Correspondence

Letter to the Editor

Beyond childhood trauma – stressful events early and later in life in relation to psychotic experiences

Introduction

Traumatic experiences during childhood increase the risk for psychopathology later in life (Danese & Baldwin, 2016), yet the underlying mechanisms remain elusive. In the context of psychotic disorders, Reininghaus *et al.* (2016) recently found support for the notion that enhanced sensitivity and increased threat anticipation to stress are important psychological mechanisms in the pathways from childhood trauma to psychosis (as put forward by Morgan & Hutchinson, 2010). The question is whether these mechanisms are relevant to the development of psychotic symptoms with a need for care, or merely contribute to a more general vulnerability for psychotic experiences, including those without a need for care. This can be studied by comparing patients with a psychotic disorder to individuals with frequent non-clinical psychotic experiences. We previously found that both groups reported equally high rates of childhood trauma (Daalman *et al.* 2012), suggesting that traumatic experiences early in life make a person vulnerable for psychotic experiences in general rather than forming a specific risk factor for a full-blown psychotic disorder. Notably, only a minority of maltreated children eventually develop psychotic experiences, whether or not part of a psychotic disorder, whereas others do not develop such experiences. To understand these differences, we need to gain more insight into the mechanisms involved in the pathways from childhood trauma to clinical and non-clinical psychotic experiences in adulthood.

During the past years, interest has increased regarding the role of stressful events after childhood in the development of psychotic experiences or a psychotic disorder. In individuals who have experienced maltreatment as a child, the risk for trauma exposure later in life is elevated (Acierno *et al.* 1999; Kim *et al.* 2014), which could be viewed as a second hit. According to meta-analytic data, exposure to adult stressful life events is associated with a higher risk of subsequent onset of a psychotic disorder or psychotic experiences, compared with controls [odds ratio (OR)

3.19, 95% confidence interval (CI) 2.15–4.75] (Beards *et al.* 2013). However, none of the included studies adjusted for childhood trauma (Beards *et al.* 2013), while the impact of stressful events on psychotic experiences later in life may be greater in individuals with a history of maltreatment. For instance, Read *et al.* (2003) found that a combination of both child and adult abuse, rather than either one alone, best predicted psychotic symptoms in psychiatric patients. In a population-based study by Morgan *et al.* (2014), early abuse and life events combined synergistically to increase the odds of subclinical psychotic experiences. In a population-based 10-year prospective study, only the highest levels of exposure to adversity ($\geqslant 10$ recent events) was related to psychotic symptoms, and this relationship was stronger in individuals who were maltreated during childhood (Lataster *et al.* 2012).

Until recently, studies rarely considered the subjective interpretation of life events (Beards *et al.* 2013). However, as Reininghaus *et al.* (2016) demonstrated, psychological and cognitive mechanisms are important when evaluating the effects of childhood trauma and stressful events later in life. Indeed, when childhood trauma and adult trauma are related to both psychotic experiences as well as psychotic disorders, the question remains why some individuals pass the psychosis threshold while others do not.

By studying patients with a psychotic disorder, individuals with frequent non-clinical psychotic experiences and controls without psychotic experiences, we aimed to investigate:

(1) The main effects of stressful life events after childhood and accompanying subjective ratings (impact, feelings of helplessness and perceived danger), on the odds of having a psychotic disorder *v.* having non-clinical psychotic experiences *v.* having no psychotic experiences;
(2) The relative effects of childhood trauma and stressful events after childhood and their subjective ratings, by combining these factors in one model;
(3) The synergistic effect by the combination of childhood trauma and stressful life events after childhood, following past work in this area (Lataster *et al.* 2012; Morgan *et al.* 2014).

Method

Participants and procedures

We included 103 patients with a psychotic disorder, 134 individuals with non-clinical psychotic experiences

(predominantly auditory verbal hallucinations) and 125 healthy controls (procedures described in Sommer *et al.* 2010; Daalman *et al.* 2012). The Life Stressor Checklist Revised (LSC-R; Wolfe *et al.* 1996) was used to evaluate stressful life events after childhood (yes/no, 26 items); endorsed items were summed. Follow-up questions addressed the age at which the event took place and to what extent the event still had impact on the participants' life during the past year (1–5 Likert scale; total impact scores divided by the number of endorsed events provided mean impact scores). For 15 possible traumatic items, two additional questions assessed whether participants believed they had been in danger and whether they had experienced feelings of helplessness (yes/no; total number of times divided by the number of experienced events provided percentages). All participants with ⩽1 item missing were included. The Childhood Trauma Questionnaire Short Form (CTQ-SF; Bernstein *et al.* 2003) was available for 99 patients, 127 individuals with non-clinical psychotic experiences and 124 controls, evaluating childhood trauma severity (25 items, 1–5 Likert scale) on five trauma subtypes: emotional, physical, and sexual abuse, and emotional and physical neglect. Cut-off scores for moderate to severe exposure were used to classify presence or absence of (one or more subtypes of) trauma (Daalman *et al.* 2012).

Statistics

(1) Multinomial logistic regression was used to quantify associations between stressful events after childhood (LSC-R total score and subjective ratings) and having clinical psychotic symptoms (patients) *v.* having non-clinical psychotic experiences *v.* having no psychotic experiences (controls), adjusting for age and gender. This was repeated for childhood trauma severity (CTQ-SF total score). Explorative correlations were calculated between childhood trauma and stressful events after childhood plus accompanying subjective ratings (mean impact, helplessness and danger; Spearman's ρ).

(2) To examine their relative effects, predictors were combined in a multinomial logistic regression model (age and gender as covariates).

(3) Synergistic effects of childhood trauma and stressful events after childhood were evaluated by comparing the interaction term in relation to their individual effects using a multinomial logistic regression model (Lataster *et al.* 2012; Morgan *et al.* 2014).

Ethical standards

All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2013.

Results

Main effects

Gender was equally distributed; mean age differed between the three groups as patients were younger than healthy controls (Tables 1 and 2). The number of stressful events after childhood (LSC-R total score) was associated with having a psychotic disorder (OR 1.28) and non-clinical psychotic experiences (OR 1.13) (Tables 1 and 2). For each additional life event, the odds increased with 28% for having clinical psychotic symptoms (i.e. belonging to the patient group) and with 13% for having non-clinical psychotic experiences. The number of stressful events after childhood was associated with similar odds for having a psychotic disorder or non-clinical psychotic experiences.

Higher impact of these events increased the odds for psychosis (OR 2.56) and non-clinical psychotic experiences (OR 1.65) (Tables 1 and 2). Interestingly, each point increase in mean impact score was associated with 1.55-fold greater odds for psychosis over non-clinical psychotic experiences (OR 1.55). Each percentage-point increase in helplessness score increased the odds for psychosis with 3.1% (OR 1.03) and with 1.8% for non-clinical psychotic experiences (OR 1.02). Therefore, a 50% increase in mean helplessness rating would be associated with 4.71-fold greater odds for psychosis ($e^{50 \times 0.031}$) and 2.46-fold greater odds for non-clinical psychotic experiences ($e^{50 \times 0.018}$). Moreover, this 50% increase in helplessness score would nearly double the odds for psychosis *v.* non-clinical psychotic experiences [OR 1.01; 50% increase equals $1.92(e^{50 \times 0.013})$]. Perceived danger of stressful events was associated with psychosis (OR 1.01) but not with non-clinical psychotic experiences; the odds for having a psychotic disorder or non-clinical psychotic experiences were similar.

Every point increase in childhood trauma severity (CTQ-SF total score) was associated with higher odds for a psychotic disorder (OR 1.08) as well as non-clinical psychotic experiences (OR 1.07); odds for clinical *v.* non-clinical psychotic experiences were similar. Childhood trauma correlated significantly with the number of stressful events after childhood ($\rho = 0.403$; within patients: $\rho = 0.377$; non-clinical psychotic experiences: $\rho = 0.325$; controls: $\rho = 0.348$; all *p* values < 0.001). Childhood trauma was related to higher impact scores ($\rho = 0.193$) and helplessness ratings ($\rho = 0.195$, *p* values ⩽ 0.001), but not to experienced danger ($\rho = -0.012$, $p = 0.0843$).

Table 1. *Demographic characteristics of the included patients with a psychotic disorder, individuals with non-clinical psychotic experiences and healthy controls*

Characteristics	Patients	Individuals with non-clinical PE	Healthy controls	Test statistic[a]	p-value	
n	103	134	125			
Male, n (%)	40 (39%)	40 (30%)	39 (31%)	$\chi^2 = 2.37$	p = 0.305	
Age in years, mean (S.D.)	38.14 (12.29)	42.01 (12.76)	42.89 (14.32)	$F_2 = 4.052$	**p = 0.018**	*Post-hoc:* **Pat<C (p = 0.021)** Non-clinical PE = C (p = 1.00) Pat = non-clinical PE (p = 0.08)
Life events after childhood (LSC-R)						
Number of events, mean (S.D.)	5.05 (3.01)	5.65 (3.13)	3.74 (2.59)			
Impact[b] mean (S.D.)	2.62 (1.06)	2.15 (0.99)	1.74 (0.87)			
Helplessness, % of events[c]	72.46% (34.15)	56.30% (39.07)	31.46% (36.35)			
Feeling in danger, % of events[c]	51.77% (35.89)	43.96% (37.41)	34.18% (35.66)			
Childhood trauma (CTQ-SF), mean (S.D.)	46.67 (20.05)	45.20 (15.45)	35.43 (8.18)			

PE, Psychotic experiences; LSC-R, Life Stressor Checklist Revised; CTQ-SF, Childhood Trauma Questionnaire-Short Form; Pat, patients with a psychotic disorder; non-clinical PE, non-clinical psychotic experiences; C, healthy controls.

Significant findings are indicated in bold.

[a] Group differences were explored using χ^2 and analysis of variance.

[b] Impact scores were summed and divided by the LSC-R total score.

[c] For potentially traumatic items, the number of times that people had felt helpless or had felt that they were in danger during the event were summed and divided by the number of experienced events (maximum of 15) to provide percentages.

Relative effects

When all factors were combined in multinomial regression (age and gender as covariates), the model was significant ($\chi^2_{14} = 103.20$, $p < 0.001$) and showed a good fit to the data (Pearson $\chi^2_{588} = 601.21$, $p = 0.302$), with a moderate predictive value of 32.8% (Nagelkerke pseudo $R^2 = 0.328$; no multicollinearity problems were found). While the associations with stressful events after childhood and perceived danger were weakened, perceived impact was associated with higher odds for having a psychotic disorder *v.* controls (OR 1.98) (see Tables 1 and 2). Helplessness remained associated with increased odds for having a psychotic disorder (OR 1.02) and for non-clinical psychotic experiences (OR 1.01) and, notably, with higher odds for clinical *v.* non-clinical psychotic experiences (OR 1.01). Childhood trauma remained associated with increased odds for clinical psychotic symptoms (OR 1.06) as well as non-clinical psychotic experiences (OR 1.05).

Synergic effect

A history of childhood trauma was reported in 51.5% of the patients, compared with 53.5% of the individuals with non-clinical psychotic experiences and 28.2% of the controls. A history of childhood trauma increased the odds for psychosis (OR 2.06, 95% CI 0.65–6.61, $p = 0.001$), as did stressful events after childhood (OR 1.20, 95% CI 1.03–1.40, $p = 0.021$). However, the interaction effect of both factors was not significant (OR 1.05, 95% CI 0.84–1.30, $p = 0.667$). The higher odds for non-clinical psychotic experiences after a history of childhood trauma bordered on significance (OR 3.05, 95% CI 0.99–9.36, $p = 0.051$), while every additional life event after childhood increased the odds by 31% (OR 1.31, 95% CI 1.14–1.51, $p < 0.001$). Again, the combined effect was not significant (OR 0.95, 95% CI 0.78–1.17, $p = 0.635$). Childhood trauma and stressful events after childhood were both associated with similar odds for having a psychotic disorder *v.* non-clinical psychotic experiences (OR 0.67, 95% CI 0.22–2.05, $p = 0.490$ and OR 0.92, 95% CI 0.79–1.06, $p < 0.240$, respectively), with no interaction effect (OR 1.10, 95% CI 0.91–1.33, $p < 0.314$).

Discussion

This study confirms and extends previous findings showing that childhood trauma and stressful life events after childhood are both related to psychosis as well as non-clinical psychotic experiences. Childhood trauma was also associated with increased exposure to stressful events after childhood. However, contrary to a population-based study (Morgan *et al.* 2014), these factors did not combine synergistically

Table 2. *Associations between childhood trauma and stressful events after childhood in patients, individuals with non-clinical psychotic experiences and healthy controls*

Main effects Multinomial logistic regression analysis[a]	Patients *v.* controls		Non-clinical PE *v.* controls		Patients *v.* non-clinical PE	
	OR[a] (95% CI)	*p*-value	OR[a] (95% CI)	*p*-value	OR[a] (95% CI)	*p*-value
Life events after childhood (LSC-R)						
Number of events	**1.28 (1.15–1.43)**	***p* < 0.001**	**1.13 (1.19–1.45)**	***p* < 0.001**	0.97 (0.89–1.07)	*p* = 0.559
Impact[b]	**2.56 (1.85–3.53)**	***p* < 0.001**	**1.65 (1.22–2.22)**	***p* = 0.001**	**1.55 (1.19–2.03)**	***p* = 0.001**
Helplessness (% of events)[c]	**1.03 (1.02–1.04)**	***p* < 0.001**	**1.02 (1.01–1.03)**	***p* < 0.001**	**1.01 (1.01–1.02)**	***p* = 0.001**
Feeling in danger (% of events)[c]	**1.01 (1.01–1.02)**	***p* = 0.003**	1.01 (1.00–1.02)	*p* = 0.060	1.01 (1.00–1.01)	*p* = 0.180
Childhood trauma (CTQ-SF)	**1.08 (1.05–1.10)**	***p* < 0.001**	**1.07 (1.04–1.09)**	***p* < 0.001**	1.01 (0.99–1.03)	*p* = 0.219

Relative effects Multinomial logistic regression analysis[a]	Patients *v.* controls		Non-clinical PE *v.* controls		Patients *v.* non-clinical PE	
	OR[a] (95% CI)	*p*-value	OR[a] (95% CI)	*p*-value	OR[a] (95% CI)	*p*-value
Gender (Ref: male)						
Female	**2.79 (1.29–6.01)**	***p* = 0.009**	1.91 (0.97–3.76)	*p* = 0.060	1.46 (0.76–2.79)	*p* = 0.256
Age	**0.96 (0.94–0.99)**	***p* = 0.010**	0.89 (0.96–1.01)	*p* = 0.109	0.98 (0.96–1.01)	*p* = 0.159
Life events after childhood (LSC-R)						
Number of events	1.04 (0.90–1.19)	*p* = 0.636	1.12 (0.98–1.27)	*p* = 0.090	0.93 (0.83–1.04)	*p* = 0.179
Impact[b]	**1.98 (1.31–3.01)**	***p* = 0.001**	1.44 (0.98–2.12)	*p* = 0.067	1.38 (0.99–1.90)	*p* = 0.051
Helplessness (% of events)[c]	**1.02 (1.01–1.03)**	***p* < 0.001**	**1.01 (1.00–1.02)**	***p* = 0.005**	**1.01 (1.00–1.02)**	***p* = 0.025**
Feeling in danger (% of events)[c]	1.01 (0.99–1.02)	*p* = 0.289	1.00 (0.98–2.12)	*p* = 0.490	1.00 (0.99–1.01)	*p* = 0.608
Childhood trauma (CTQ-SF)	**1.06 (1.03–1.09)**	***p* < 0.001**	**1.05 (1.02–1.08)**	***p* = 0.001**	1.01 (0.99–1.03)	*p* = 0.375

PE, Psychotic experiences; LSC-R, Life Stressor Checklist Revised; CTQ-SF, Childhood Trauma Questionnaire-Short Form.

Significant findings are indicated in bold.

[a] Adjusted for age and gender, OR = regression coefficient per each unit increase of the predictor variable (e^{β}).

[b] Impact scores were summed and divided by the LSC-R total score.

[c] For potentially traumatic items, the number of times that people had felt helpless or had felt that they were in danger during the event were summed and divided by the number of experienced events (maximum of 15) to provide percentages, OR = regression coefficient per each percentage-point increase (e^{β}; 50% increase = $e^{50 \times \beta}$).

in relation to psychotic experiences. In another population-based study, a synergistic effect between childhood and recent adversity was observed only in case of ⩾10 recent stressors (Lataster *et al.* 2012). Thus, the interaction between childhood and later adversity in relation to psychotic experiences remains unclear.

Furthermore, subjective ratings of stressors after childhood were related to psychosis (impact, helplessness and perceived danger) and non-clinical psychotic experiences (impact and helplessness). Previous work found that recent-onset schizophrenia patients appraise stressors as less controllable and their coping as less effective (Horan *et al.* 2005) and that individuals at ultra-high risk for psychosis are more distressed by events and feel that they cope more poorly (Phillips *et al.* 2012). Notably, our results show that impact and helplessness both increased the odds for psychosis over non-clinical psychotic experiences.

As suggested by Reininghaus *et al.* (2016), early trauma may have an impact on these subjective reactions to later stressors. Indeed, we found that childhood trauma severity correlated with impact, helplessness and perceived danger of later stressful events. After adjusting for childhood trauma, helplessness remained associated with psychosis and with non-clinical psychotic experiences. Feelings of helplessness remained associated with increased odds for psychosis over non-clinical psychotic experiences. This implies that individuals with frequent non-clinical psychotic experiences are able to cope more adaptively with childhood trauma and stressful events, which they experience at equally high rates as patients with a psychotic disorder.

In conclusion, our findings support the hypothesis that both childhood trauma and stressful events later in life contribute to a general vulnerability for psychotic experiences that may or may not be part of a psychotic disorder. Maladaptive reactions to stressors later in life may be implicated in the pathways from adverse experiences to psychosis. This is important, as youngsters with childhood trauma may benefit from training to improve coping skills to deal with later life events. Even though such skills may not prevent the development of psychotic signs, full-blown psychotic disorders may be prevented this way.

Acknowledgements

Declaration of Interest

None.

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