Associations between post-traumatic stress disorders and psychotic symptom severity in adult survivors of developmental trauma: a multisite cross-sectional study in the UK and South Korea

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Lancet Psychiatry 2023; 10: 760–67

See **Comment** page 735

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Summary

Background Childhood maltreatment is a risk factor for the development of post-traumatic stress disorders and psychosis. However, the association between post-traumatic stress disorder (PTSD), including complex PTSD, and psychotic symptoms is unknown. We investigated whether the presence of PTSD and complex PTSD was associated with psychotic symptom severity within survivors of developmental trauma.

Methods As part of the Investigating Mechanisms underlying Psychosis Associated with Childhood Trauma (IMPACT) study, from Aug 20, 2020, to Jan 24, 2021, and from Sept 9, 2022, to Feb 21, 2023, using study advertisement on online platforms we recruited adult (≥18 years) participants who had experienced developmental trauma without a psychiatric diagnosis in the UK and South Korea. We measured whether participants met diagnostic thresholds for PTSD and complex PTSD using the self-reported International Trauma Questionnaire, and psychotic symptoms using the self-reported Community Assessment of Psychic Experiences. We used linear regression, adjusting for sociodemographic variables such as age, sex, ethnicity, educational attainment, and socioeconomic status, to examine whether there was an association between PTSD and complex PTSD and psychotic symptoms. The study is registered in the UK (University College London Research Ethics Committee [14317/001] and the National Health Service Research Ethics Committee [22/YH/0096]) and South Korea (Institutional Review Board of Seoul National University Bundang Hospital [B-2011-648-306]), and is ongoing.

Findings Of the 2675 participants who took part in the study, 1273 had experienced developmental trauma and were included in the study in the UK (n=475) and South Korea (n=798), comprising 422 (33%) men and 851 (67%) women with a mean age of 26·9 years (SD 6, range 18–40), mostly of White British (n=328) or South Korean (n=798) ethnicity. We found no significant association between PTSD and psychotic symptom severity (total severity β=–2·40 [SE 3·28], p=0·47), compared with participants who did not meet PTSD or complex PTSD caseness. We found a significant relationship between complex PTSD and psychotic symptom severity (total severity β=22·62 [SE 1·65], p<0·0001), including for positive (β=12·07 [SE 0·99], p<0·0001) and negative symptoms (β=10·5 [SE 0·95], p<0·0001), compared with participants who did not meet PTSD or complex PTSD caseness.

Interpretation Health systems must assess individuals with previous developmental trauma for complex PTSD and treat those affected. These individuals should also be assessed for psychotic symptoms, and if necessary, preventative measures should be taken to reduce risk of conversion. Further work should assess whether treating complex PTSD modifies the risk of conversion to psychosis.

Funding UKRI Future Leaders Fellowship, British Medical Association Margaret Temple Award for Schizophrenia Research, and the National Research Foundation of Korea—Korea Government.

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Introduction

Experiencing maltreatment during childhood or adolescence (described hereafter as developmental trauma) is a risk factor for post-traumatic stress disorders[1] and psychosis in adulthood.[2] Here we define developmental trauma as including sexual, emotional, or physical abuse, or emotional or physical neglect experienced before age 18 years. There is currently little understanding of the processes underpinning the relationship between developmental trauma and psychosis, which is a barrier to the development of targeted treatments for this at-risk group.[3] We ask within this study whether post-traumatic stress disorders are involved in this relationship.

After exposure to a traumatic event, many people experience trauma-related intrusive images across sensory modalities.[4] When these experiences do not resolve spontaneously in the weeks that follow trauma exposure,

Research in context

Evidence before this study

We conducted a systematic search of PubMed, the Cochrane Library, PsycINFO, Embase, and Google for cohort, cross-sectional, or case–control studies in English published from database inception to Jan 10, 2023, with the terms: "psychosis OR psychot*" and "PTSD OR post-traumatic stress". Risk of bias assessment found most studies to be of low quality and mainly cross-sectional in nature. Several reviews have reported a higher prevalence of childhood trauma among people with psychotic symptoms, and one review reported a relationship between post-traumatic stress disorder (PTSD) symptoms and psychotic symptoms. Previous observational studies have found PTSD symptoms to be a key predictor of psychotic symptom severity. However, little research has been conducted in people at clinical high risk for psychosis or examined ICD-11 complex PTSD prevalence in those with psychotic symptoms. One general population study of trauma-exposed individuals found a dose–response relationship, whereby experiencing increasing numbers of childhood trauma types was associated with an increased risk of diagnosis with ICD-11 PTSD, complex PTSD, complex PTSD with some psychotic symptoms, or complex PTSD with all psychotic symptoms.

The added value of this study

This multisite study of the association between PTSD and complex PTSD symptoms and psychotic symptom severity in people who had previously experienced developmental trauma found evidence of a relationship between the presence of complex PTSD and both positive and negative psychotic symptom severity. These associations were significant in both the UK and South Korea independently. There was no significant association between PTSD (without complex symptoms) and psychotic symptom severity, suggesting that the association between post-traumatic symptoms and psychosis is specific to the complex PTSD diagnostic construct.

Implications of all the available evidence

Considering the high prevalence of complex PTSD, our results emphasise the need for health systems to assess individuals with previous developmental trauma for complex PTSD. Increased detection of people with complex PTSD would enable the provision of more tailored and effective treatments for survivors of developmental trauma. Our results also highlight the need for further work to assess whether treating complex PTSD modifies the risk of conversion to psychosis.

and when they persist beyond the immediate aftermath of the traumatic experience, these intrusive images are understood as relating to post-traumatic stress. ICD-11 introduced a distinction between post-traumatic stress disorder (PTSD) and complex PTSD. ICD-11 characterises PTSD as a clinical triad of re-experiencing memories of the traumatic events in the present, for example as nightmares and flashbacks; avoiding internal and external reminders of the event; and having a heightened perception of current threat. Individuals who go through prolonged or repeated trauma, as typically occurs with developmental trauma, are at elevated risk of complex PTSD.[1] The complex PTSD diagnosis requires that the core triad of PTSD requirements is met (ie, re-experiencing, avoidance, and threat) plus an additional triad of pervasive interpersonal difficulties, negative self-concept, and emotional dysregulation.

Clinically, there is a high degree of overlap in the symptomatology of post-traumatic stress disorders and psychosis. For example, individuals with post-traumatic stress disorders can experience auditory hallucinations, and individuals with psychosis can experience delusions and hallucinations with trauma-related content.[5] Since individuals with psychosis can experience trauma-related hallucinations as highly emotional involuntary intrusions, similar to the intrusions associated with post-traumatic stress,[6] involuntary intrusive images of traumatic memories can be a common feature across these presentations. Current treatments for PTSD show that these symptoms can be amenable to intervention.[4] It is therefore possible that post-traumatic stress disorders are modifiable risk factors for psychosis in people who have experienced developmental trauma. Post-traumatic stress disorders predict psychotic symptom development and severity but are often undetected in people with psychosis.[7] However, there is little research into whether post-traumatic stress disorders predict psychotic symptoms in individuals exposed to developmental trauma, particularly in those with at-risk mental states for psychosis who have yet to present to services.

Several psychological models of psychosis incorporate intrusive experiences. In the information processing account,[8] individuals with psychosis or psychosis proneness have a general impairment in the temporo-spatial integration of information, leading to the development of intrusive experiences. This account is consistent with models of the neurocognitive processes underpinning intrusive memories in post-traumatic stress disorders.[9] For example, using an experimental model of psychological trauma, schizotypy (ie, psychosis proneness) was associated with increased risk of developing intrusive memories.[10] More recent models of psychosis following trauma propose that at least some psychotic symptoms are likely to involve intrusive trauma memories.[11,12]

Not ascertaining whether individuals with an at-risk mental state have a diagnosis of post-traumatic stress[7] means that the presence of a more serious type of psychopathology that could affect psychotic symptoms, such as ICD-11 complex PTSD, could be overlooked. The interpersonal nature of developmental trauma makes it a risk factor for development of complex PTSD.[1] Considering the complex PTSD symptoms, individuals

who have experienced severe, prolonged trauma are more likely to have persistent difficulties in sustaining relationships, either avoiding or having little interest in relationships or having intense relationships with difficulty maintaining emotional engagement.[13] Studies have found significant associations between having an avoidant attachment style and positive psychotic symptoms.[14] Given the overlap in symptomatology, it is important to consider how PTSD and complex PTSD are related to psychotic symptom severity.

Few studies have investigated whether the relationship between post-traumatic stress and psychosis is specific to positive symptoms or also affects negative symptoms. Negative symptoms include affective flattening, avolition, and social withdrawal, and could develop in response to a traumatic event.[15] Studies have shown contrasting findings, with some reporting post-traumatic stress disorders to increase incidence of negative symptoms[16] and others reporting a decrease.[17] These contrasting findings might be due to studies failing to consider whether negative symptoms are primary (due to the disease process itself) or secondary (arising from factors after disease progression, such as anxiety, depression, or medication effects).[18] For example, one study reported an elevation of negative symptoms only in patients with secondary negative symptoms.[19]

The present study was conducted in two sites (the UK and South Korea) to obtain a culturally and geographically diverse sample. We hypothesised that at both sites, the probability of meeting the threshold for PTSD or complex PTSD would be associated with total psychotic symptom severity in survivors of developmental trauma. Secondary analysis examined whether the effect of PTSD symptoms was specific to positive or negative psychotic symptoms.

Methods

Study design and participants

As part of the Investigating Mechanisms underlying Psychosis Associated with Childhood Trauma (IMPACT) study, we recruited adult (age ≥18 years) participants from two separate sites, one in the UK and another in South Korea, using social media platforms (Facebook, Twitter, and Reddit). The study advertisement mentioned childhood trauma as a measure of interest but stated that someone would not need to have experienced trauma in childhood or adulthood to be able to participate. Recruitment was conducted during two time periods (Aug 20, 2020, to Jan 24, 2021, and Sept 9, 2022, to Feb 21, 2023). During the time in between, the recruitment strategy was revised (ie, targetting Facebook advertisements to improve recruitment of specific sociodemographic groups including males). Conducting the study during the COVID-19 pandemic precluded the use of clinical interviews. Participants clicked a link to complete the questionnaires online using Gorilla. These participants reported whether they were not currently known to mental health services and had not received a currrent formal psychiatric diagnoses. Participants were selected if they had experienced developmental trauma. We verified that participants met threshold for experiencing psychological trauma using the self-reported Childhood Trauma Questionnaire (CTQ).[19] This questionnaire measures five types of traumas: emotional, physical, and sexual abuse, and emotional and physical neglect. Established thresholds were used to categorise the severity of trauma experienced as none, low, moderate, and severe.[19] For this study, participants were included if they scored higher than moderate for at least two trauma types or severe on one of the trauma types within the CTQ.[19]

This study has ethical approval from the University College London Research Ethics Committee (reference 17495/001), the UK National Health Service Research Ethics Committee (22/YH/0096), and the Institutional Review Board of Seoul National University Bundang Hospital (reference B-2011-648-306). All participants provided written informed consent.

Measures

English and Korean versions of all measures (CTQ, International Trauma Questionnaire [ITQ], and Community Assessment of Psychic Experiences [CAPE]) were used in the two sites. The CTQ, ITQ, and short form of the CAPE[20–22] and the 42-item version of CAPE[23] have been validated in Korean. The CAPE was translated and validated by PJ, HS, and EK.

We chose the ITQ as a self-reported diagnostic measure of ICD-11 PTSD and complex PTSD.[24] The ITQ was developed to maximise clinical use and ensure international applicability by focusing on core symptoms of PTSD using principles of the ICD-11.[24] The ITQ has been validated for clinical use in identifying individuals with a potential PTSD or complex PTSD diagnosis, and it has been translated into 25 languages. We used the ITQ as a categorical variable to determine whether individuals met PTSD or complex PTSD thresholds. For PTSD, participants had to score at least 2 points on one item from each of three separate subscales (re-experiencing, avoidance behaviour, and feeling a sense of current threat) and 2 points on at least one item relating to functional impairment. To meet the complex PTSD threshold, participants needed to meet the requirements for PTSD, score at least 2 points on an item from each of three specific subscales (affective dysregulation, negative self-concept, or disturbances in relationships), and score at least 2 points on an item from the complex PTSD subscale relating to functional impairment. After endorsing exposure to developmental trauma using the CTQ, participants were classified using the ITQ as either not meeting PTSD or complex PTSD caseness, meeting PTSD caseness, or meeting complex PTSD caseness. Participants who met complex PTSD caseness were no longer categorised as meeting PTSD caseness.

We also measured demographic variables, including age, sex, ethnicity, highest educational attainment,

socioeconomic status, and COVID-19-associated stress. Socioeconomic status was measured using a family affluence scale (consisting of multiple questions; ie, annual disposable household income, how many people live in household, of these how many children are younger than 14 years, does your family own a car, truck, or van, do you have a bedroom to yourself, in the last 12 months how many times have you travelled on holiday with your family, how many computers does your family own, which option describes the occupation of the highest earning guardian or parent, were you eligible for free school meals at any point during school years). Participants were asked to rate (out of 100) how stressed or burdened they felt in the past 2 weeks due to the COVID-19 pandemic compared with before the pandemic. The measure is as described: stress associated with COVID-19 out of 100, 0 no stress and 100 most stressed due to COVID-19.

Choice of primary measure

The CAPE is a widely used, open-access, self-reported screening tool for individuals at increased risk for developing psychosis in the general population. It has been reported to have been used in 111 published studies across 15 countries, and it is available in eight languages.[25,26] The CAPE consists of 42 items that include positive symptoms (20 items), negative symptoms (14 items), and depressive symptoms (eight items). Each response is recorded using a 4-point Likert scale from 1 to 4, measuring both frequency (never, sometimes, often, and nearly always) and distress (not distressed, a bit distressed, quite distressed, and very distressed). If answering never for frequency, distress is reported as not distressed. For our primary question about psychotic symptom severity, we combined the CAPE scores for the frequency and distress of positive and negative symptoms, to measure the severity of positive and negative psychotic experiences. We combined the severity of positive and negative experiences to measure total psychotic experience severity.

Statistical analysis

We used descriptive statistics for the demographic variables (age, sex, ethnicity, site, highest educational attainment, socioeconomic status, and COVID-19-associated stress) and clinical variables (CTQ subtype scores, psychotic symptom severity, and meeting PTSD and complex PTSD thresholds). To test the main hypothesis, we conducted linear regressions to determine whether meeting PTSD and complex PTSD thresholds were independently associated with the severity of total psychotic symptoms. All regressions controlled for age, sex, ethnicity, educational attainment, COVID-19-associated stress, CTQ total score, socioeconomic status, and site. Additional regressions were conducted with site included as an interaction variable and independent variable. Ethnicity was collapsed into two levels due to the low frequency of participants not belonging in the main ethnic groups. A linear regression was conducted to determine whether there was an association between meeting complex PTSD threshold (as distinct from meeting PTSD threshold) with the severity of total psychotic symptoms. Further regressions were conducted to measure whether the associations between PTSD and complex PTSD and psychotic symptoms were specific to positive or negative psychotic symptom severity, and to measure which specific PTSD dimensions were associated with psychotic symptoms. All regression analyses used Bonferroni corrected p values to account for multiple comparisons.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Of the 2675 participants recruited, 2608 had complete data and 1273 had experienced developmental trauma and were included in this study (figure). 328 (69%) of 475 participants in the UK site were White British, and all 798 participants from the South Korea site were Asian Korean (table 1). 592 (47%) of 1273 participants met caseness for either PTSD or complex PTSD, including 64 (5%) for PTSD and 528 (41%) for complex PTSD. The whole group had lower severity for positive (48·92 [SD 17·86]) than negative symptoms (53·25 [SD 16·54]; table 1).

In the sample of participants meeting PTSD caseness (n=64), compared with those who did not meet PTSD or complex PTSD caseness (n=681), PTSD was not associated with total psychotic symptom severity

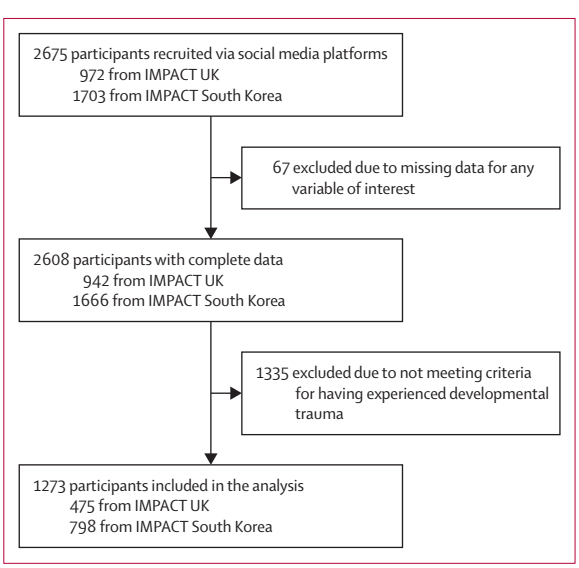

Figure: **Study profile**
IMPACT=Investigating Mechanisms underlying Psychosis Associated with Childhood Trauma.

	All participants (n=1273)	Participants in IMPACT UK (n=475)	Participants IMPACT South Korea (n=798)	χ^2 or t	p value
Age, years	26·92 (5·97)	28·57 (6·05)	25·94 (5·70)	7·77	<0·0001
Sex					
Female	851 (67%)	330 (69%)	521 (65%)	2·17	0·14
Male	422 (33%)	145 (31%)	277 (35%)	..	..
Ethnicity	..	..	..	1273	<0·0001
White British	328 (26%)	328 (69%)	0	..	..
Black	3	3	0	..	..
Mixed	18 (1%)	18 (4%)	0	..	..
Asian Korean	798 (63%)	0	798 (100%)	..	..
Asian other	20 (2%)	20 (4%)	0	..	..
Other	106 (8%)	106 (22%)	0	..	..
Highest educational attainment	..	..	..	191·80	<0·0001
Doctoral level (ie, PhD)	111 (9%)	31 (7%)	80 (10%)	..	..
Bachelors and Masters level	857 (67%)	271 (57%)	586 (73%)	..	..
Other higher education	175 (14%)	63 (13%)	112 (14%)	..	..
A level or equivalent	51 (4%)	51 (11%)	0	..	..
GCSE grades A* to C or equivalent	41 (3%)	41 (9%)	0	..	..
No qualifications	13 (1%)	13 (3%)	0	..	..
Other	25 (2%)	5 (1%)	20 (3%)	..	..
Socioeconomic status	4·42 (1·75)	4·22 (1·68)	4·54 (1·78)	–3·11	0·0020
COVID-19-associated stress	46·42 (33·70)	49·83 (32·76)	44·39 (34·11)	102·20	0·42
Developmental trauma exposure					
CTQ total	64·08 (15·13)	65·59 (16·47)	63·18 (14·20)	2·76	0·0060
Emotional abuse on CTQ	15·81 (5·02)	17·70 (5·01)	14·68 (4·68)	10·88	<0·0001
Physical abuse on CTQ	11·85 (5·29)	9·64 (4·89)	13·17 (5·08)	–12·16	<0·0001
Sexual abuse on CTQ	8·86 (5·15)	10·46 (6·42)	7·91 (3·91)	8·82	<0·0001
Emotional neglect on CTQ	17·13 (4·69)	16·93 (4·66)	17·25 (4·71)	–1·18	0·25
Physical neglect on CTQ	10·44 (3·97)	10·86 (4·38)	10·18 (3·68)	2·97	0·0031
International Trauma Questionnaire					
PTSD	64 (5%)	21 (4%)	43 (5%)	0·40	0·53
Complex PTSD	528 (42%)	257 (54%)	271 (34%)	48·96	<0·0001
Psychotic symptoms†					
Total	102·17(30·32)	108·22 (31·69)	98·57 (28·90)	5·56	<0·0001
Positive	48·92 (17·86)	51·57 (19·00)	47·34 (16·96)	4·11	<0·0001
Negative	53·25 (16·54)	56·65 (17·55)	51·23 (15·57)	5·73	<0·0001

Data are mean (SD) or n (%). At the time the study participants completed GCSEs, GCSEs in the UK were graded A* to U. CTQ=Childhood Trauma Questionnaire. PTSD=post-traumatic stress disorder. †Scored on the 42-item Community Assessment of Psychic Experiences. GCSE=General Certificate of Secondary Education.

Table 1: **Demographic variables of participants within each subgroup**

(β=–2·40 [SE 3·28], p=0·47; table 2). There was no interaction effect between PTSD and site (β=–4·75 [SE 5·71], p=0·41; appendix p 1).

See Online for appendix

In the sample of participants meeting complex PTSD caseness (n=528) compared with those who did not meet PTSD or complex PTSD caseness (n=681), complex PTSD was significantly associated with increased total psychotic symptom severity (β=22·62 [SE 1·65], p<0·0001; table 3). There was no interaction effect between complex PTSD and site (β=1·64 [SE 3·19], p=0·61; appendix p 1). When all three additional symptom domains were input as separate regressors into one regression analysis, all three domains (affective dysregulation [β=9·03, SE 3·34, p=0·01], negative self-concept [β=18·95, 2·47, p<0·0001], and relationship disturbance [β=17·11, 2·75, p<0·0001]) were significantly associated with total symptom severity (appendix p 2).

Compared with participants not meeting PTSD or complex PTSD caseness, PTSD was not associated with positive psychotic symptom severity (β=0·55 [SE 1·90], p=0·77; appendix p 3) whereas complex PTSD was significantly associated with increased positive psychotic symptom severity overall (β=12·07 [SE 0·99], p<0·0001; appendix p 4). There was no interaction effect between PTSD and site (β=1·43 [SE 4·00],

	Estimate (SE)	t	p value
PTSD			
No PTSD or complex PTSD	(ref 1)	(ref 1)	(ref 1)
PTSD	–2·40 (3·28)	–0·73	0·47
Site			
IMPACT UK	(ref 1)	(ref 1)	(ref 1)
IMPACT South Korea	–5·22 (3·23)	–1·62	0·11
CTQ total	0·39 (0·07)	5·60	<0·0001
Age	–0·84 (0·17)	–4·89	<0·0001
Sex			
Female	(ref 1)	..	..
Male	3·87 (1·92)	2·02	0·040
Highest educational attainment			
Doctoral level (ie, PhD)	(ref 1)	(ref 1)	(ref 1)
Bachelors and Masters	–3·93 (3·17)	–1·24	0·22
Other higher education	0·74 (4·09)	0·18	0·86
A level or equivalent	3·55 (6·79)	0·52	0·60
GCSEs grades A* to C or equivalent	6·34 (6·29)	1·01	0·32
Other	6·96 (7·25)	0·96	0·34
No qualifications	10·81 (11·63)	0·93	0·35
Socioeconomic status	0·47 (0·52)	0·96	0·36
COVID-19-associated stress	0·14 (0·03)	5·16	<0·0001
Ethnicity			
White British	(ref 1)	(ref 1)	(ref 1)
Non-White British†	–0·21 (3·71)	–0·06	0·96

Associations control for age, sex, ethnicity, education, CTQ total, socioeconomic status, COVID-19-associated stress, and site measure by linear regression. All significant p values are after Bonferroni correction (p=0·003). At the time the study participants completed GCSEs, the UK GCSEs were graded A* to U. GCSE=General Certificate of Secondary Education. CTQ=Childhood Trauma Questionnaire. PTSD=post-traumatic stress disorder. †The non-White British category takes into account Black, mixed, Asian other, and other ethnicity categories as well as the Asian Korean category.

Table 2: **Examining whether meeting PTSD threshold predicts total psychotic symptom severity**

	Estimate (SE)	t	p value
Complex PTSD			
No complex PTSD or PTSD	(ref 1)	(ref 1)	(ref 1)
Complex PTSD	22·62 (1·65)	13·71	<0·0001
Site			
IMPACT UK	(ref 1)	(ref 1)	(ref 1)
IMPACT South Korea	–5·99 (2·46)	–2·43	0·020
CTQ total	0·39 (0·05)	7·20	<0·0001
Age	–0·58 (0·14)	–4·27	<0·0001
Sex			
Female	(ref 1)	(ref 1)	(ref 1)
Male	5·02 (1·63)	3·10	0·010
Highest educational attainment			
Doctoral level (ie, PhD)	(ref 1)	(ref 1)	(ref 1)
Bachelors and Masters	–0·71 (2·78)	–0·26	0·80
Other higher education	4·38 (3·40)	1·29	0·20
A level or equivalent	3·78 (4·75)	0·80	0·43
GCSEs grades A* to C or equivalent	10·89 (5·17)	2·11	0·040
Other	4·70 (5·86)	0·80	0·43
No qualifications	18·93 (7·84)	2·41	0·020
Socioeconomic status	0·26 (0·44)	0·59	0·55
COVID-19-associated stress	0·09 (0·02)	4·14	<0·0001
Ethnicity			
White British	(ref 1)	(ref 1)	(ref 1)
Non-White British†	3·27 (2·68)	1·22	0·22

Associations control for age, sex, ethnicity, education, CTQ total, socioeconomic status, COVID-19-associated stress, and site measure by linear regression. All significant p values are after Bonferroni correction (p=0·003). At the time the study participants completed GCSEs, the UK GCSEs were graded A* to U. GCSE=General Certificate of Secondary Education. CTQ=Childhood Trauma Questionnaire. PTSD=post-traumatic stress disorder. †The non-White British category takes into account Black, mixed, Asian other, and other ethnicity categories as well as the Asian Korean category.

Table 3: **Examining whether meeting complex PTSD threshold predicts total psychotic symptom severity**

p=0·72) or complex PTSD and site (β=0·42 [SE 1·92], p=0·83; appendix p 1).

Compared with participants not meeting PTSD or complex PTSD caseness, PTSD was not associated with reduced negative psychotic symptom severity (β=–2·94 [SE 1·94], p=0·13; appendix p 5) whereas complex PTSD was significantly associated with increased negative psychotic symptom severity overall (β=10·55 [SE 0·95], p<0·0001; appendix p 6). There was no interaction effect between PTSD and site (β=2·06 [SE4·09], p=0·62) or complex PTSD and site (β=1·02 [SE1·82], p=0·51; appendix p 1). Complex PTSD was significantly associated with total (β=28·73 [SE 6·25], p<0·0001; appendix p 7), positive (β=13·06 [SE 3·93], p<0·001; appendix p 8), and negative (β=15·67 [SE 3·63], p<0·0001; appendix p 9) psychotic symptom severity when compared to individuals meeting threshold for PTSD. There was no interaction effect between complex PTSD and site for any of these regressions (appendix p 1).

Discussion

Our study is, to our knowledge, the first to measure the associations between meeting ICD-11 PTSD and complex PTSD thresholds and psychotic symptoms in people exposed to developmental trauma. In two samples from different countries, fulfilling the criteria for ICD-11 complex PTSD had a significant positive relationship with total psychotic symptom severity and positive and negative symptoms in individuals who had experienced developmental trauma. This association was driven by all three additional complex PTSD symptoms (affective dysregulation, negative self-concept, and relationship disturbance.

There was no association between ICD-11 PTSD (without complex PTSD) and psychotic symptoms. Given that previous research found PTSD symptoms to be a significant predictor of psychotic symptom development,[27] this finding suggests that the association

between PTSD and psychosis is specific to the diagnostic construct of complex PTSD. Multiple mechanisms have been suggested to underpin the link between PTSD and psychosis, including the deleterious effects of trauma on hypothalamic pituitary adrenal systems, memory processing, neural structures, and neurotransmitter regulation, which increase vulnerability to both disorders.[9] Other theories have suggested that individuals with PTSD who are vulnerable to psychosis development might experience intrusive memories that present as hallucinations or take on delusional proportions due to hypervigilance increasing their paranoia.[6] Therefore, it is important for future studies to recruit large samples of participants who meet diagnostic criteria for PTSD, to investigate whether ICD-11 PTSD symptoms specifically, or additional symptoms interacting with core PTSD symptoms, affect psychotic symptom severity. Our findings suggest a potential pathway linking complex PTSD to psychosis development, depending on the severity of trauma experienced. It is therefore important to consider whether having complex PTSD with psychotic symptoms is an additional level to the spectrum of post-traumatic stress reactions (from no PTSD, PTSD, and complex PTSD to complex PTSD with psychotic symptoms). To examine this idea, it is first important to decipher whether there is comorbidity between complex PTSD and psychotic symptoms, or whether they exist as separate disorders with shared risk factors.

More research is needed to explore this relationship when considering how complex PTSD might increase the severity of positive and negative symptoms independently. One potential avenue would be to focus on how the additional symptoms of complex PTSD (difficulties in emotion regulation, negative self-concept, interpersonal difficulties) affect specific psychotic symptoms. Previous research has found each of these symptoms to mediate the relationship between developmental trauma and psychotic symptoms.[11,12] Namely, mood dysregulation creates a mental environment in which psychotic experiences and delusional beliefs can emerge. This dysregulation has been reported to predict hallucinations following childhood sexual abuse, mediating a quarter of the association.[28] Negative beliefs influence delusional beliefs and the content of hallucinations, significantly mediating the relationship between developmental trauma and paranoia.[28] Combined, the effects of these symptoms can result in social isolation, increasing paranoid thinking and affecting interpersonal relationships.[29] Currently, little research has investigated the relationship between complex PTSD and negative psychotic symptoms, there is a need for studies to examine this relationship between complex PTSD and psychosis. Future research should also investigate the distinction between clinical and subclinical psychotic symptoms in association with post-traumatic stress symptoms.

This study has some limitations. One limitation is the low prevalence of PTSD found in the sample compared with that of complex PTSD. It is possible that the lack of statistical power explains the absence of an association between meeting PTSD threshold and psychotic symptom severity. Second, our study had participants with higher average educational attainment than general populations in both the UK and South Korea. Third, the study used a self-reported measure to identify PTSD and complex PTSD caseness and for experiencing developmental trauma. However, the ITQ has high factorial and discriminant validity for the ICD-11 PTSD and complex PTSD diagnoses,[1] and the CTQ has high test–retest reliability on the total score and specific abuse scores in participants with psychosis (total score >75%).[30] Our study's cross-sectional nature is a fourth limitation as causation cannot be inferred from the results. Future longitudinal studies are needed to investigate the temporal relationships between PTSD and complex PTSD and psychotic symptoms. Within these studies, it is also important to consider whether additional trauma experienced during adulthood affects the association, and how this might differ in those who have experienced developmental versus adult trauma only. Lastly, the sample was predominantly female. This could be due to the higher prevalence of childhood trauma in females than in males.[31] Given higher incidences of psychotic disorders in men, future research would benefit from recruiting more men to increase the generalisability of findings.

Despite the significant relationships reported between complex PTSD and psychotic symptoms, individuals with psychosis are not frequently asked about the experiences of developmental trauma, with low referral rates for trauma-related interventions.[12] Individuals with an at-risk mental state (ie, a preclinical state suggesting a higher likelihood of conversion to psychosis) should be assessed for experiences of developmental trauma. Assessment should occur early, as evidence suggests that an inability to access treatment at a young age after the experienced trauma could lead to worsened clinical outcomes, with psychosis and PTSD reactions evolving over time.[11] Further investment should be provided in services for children and young people to prevent transition to psychosis and increased symptom severity. People who have had previous experiences of trauma should be provided with targeted assessment for PTSD using appropriate measures, with those who meet caseness being given a thorough clinical assessment for PTSD and complex PTSD, and access to appropriate support and treatment.

We found a significant positive association between ICD-11 complex PTSD and psychotic symptoms (positive and negative) in participants who had experienced developmental trauma. These results support the post-hoc notion that increased burden and complexity of symptoms on the PTSD continuum are associated with increased severity of psychotic symptoms, and that

complex PTSD is a potential risk marker for psychotic symptoms. Survivors of developmental trauma should be assessed for complex PTSD and psychotic symptoms and offered treatment as needed.

Contributors

MB, AM, and EK were involved in the study's conceptualisation. AM was responsible for the analysis and write up of the manuscript, including revisions, with underlying data also verified by MB and PJ. AM, PJ, SK, and HS were involved in data collection. MB, EK, TG, AM, and CRB were involved in proposing and conceptualising the analysis plan. All authors had access to all the data, reviewed the written manuscript, provided comments, and were responsible for the decision to submit for publication.

Declaration of interests

EK has participated in advisory or speaker meetings organized by Janssen Korea, Otsuka Korea, Boehringer Ingelheim, and Bukwang Pharm Company and was the principal investigator of research projects from Otsuka company. All other authors declare no competing interest.

Data sharing

Deidentified participant data and study protocol can be made available on request to the corresponding author for academic purposes.

Acknowledgments

The study was supported by the National Institute for Health Research University College London Hospitals Biomedical Research Centre and funded by a UKRI Future Leaders Fellowship to MB and a British Medical Association Margaret Temple Award for Schizophrenia Research to MB and JB. PJ was supported by a donation from the Astor family. The study conducted in South Korea was supported by the National Research Foundation of Korea (NRF) grants funded by the Korea Government (NRF-2019M3C7A1032472 and NRF-2022R1A2B5B02002400).

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