Psychiatry Research 273 (2019) 296–302

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Individuals at high risk for psychosis experience more childhood trauma, life events and social support deficit in comparison to healthy controls

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ARTICLE INFO

Keywords:
High risk for psychosis
Childhood trauma
Life events
Social support

ABSTRACT

Evidence for psychological risk factors on prodromal state of psychosis remained limited and inconsistent. This study aimed to investigate childhood trauma, life events and social support in subjects with high risk for psychosis (HR), first episode psychosis with schizophrenia (FEP) and healthy control (HC). In the study, 56 FEP, 83 HR and 61 HC underwent face-to-face clinical interview and psychological assessment, including Childhood Trauma Questionnaire (CTQ), Life Events Scale (LES) and Perceived Social Support Scale (PSSS). The results showed that in univariate analysis, HR individuals had more childhood trauma, more recent life events and less social support than HC group, **and** these findings were also supported by ANCOVA analysis except for the results related to social support after taking age, education, marital and employment status as covariates. Logistic regression analysis revealed that HR group was significantly associated with more childhood trauma, poorer overall function and unmarried state than HC group after controlling the interfering factors. HR group was similar with FEP group in these assessments. In conclusion, HR individuals experienced more childhood trauma, life events and social support deficit than HC group, which may be risk factors of conversion to psychosis. Further explorations are warranted to develop optimal psychosocial interventions.

1. Introduction

In the last two decades, researchers have focused on the prodromal state of psychosis in order to offer early diagnosis and intervention (Yung and McGorry, 1996; Fusar-Poli et al., 2013; Modinos and McGuire, 2015). Abundant literature has been published to reveal this mental condition, which has been variably termed as “prodromal”, “ultra-high risk, UHR”, “clinical high risk, CHR” or “at-risk mental state, ARMS”(Schultze-Lutter et al., 2011).

Plenty of studies focused on the investigation of neurobiological, genetic and neurocognitive risk factors of the prodromal phase of psychosis(Nasrallah et al., 2011), but the exploration of psychological domain such as childhood traumatic experiences, life events, social support and so on was also of significance (Bechdolf et al., 2010; Pruessner et al., 2011; Kraan et al., 2015). Childhood trauma shaped sensitive pathological personality and was predisposing factor of mental illness (Addington et al., 2013; Mayo et al., 2017). Recent life events and social support were precipitating factor which played an intermediary role in the development of psychosis(Schuldberg et al., 1996; Sundermann et al., 2014).

Childhood trauma is the experience of a highly distressing event or situation that is usually beyond one's capacity of coping or controlling (Schmittenbecher, 2013). Traumatic experiences in childhood were considered to be associated with psychotic illness (Read et al., 2005; Shevlin et al., 2007; Krabbendam, 2008; Kapfhammer, 2012), and frequently reported in CHR people (Addington et al., 2013; Velthorst et al., 2013), and meanwhile positively associated with the severity of attenuated psychotic symptoms (Thompson et al., 2009; Bechdolf et al., 2010; Tikka et al., 2013). A meta-analysis reported that patients with psychosis were 2.72 times more likely to be exposed to childhood adversity than healthy controls, and the attributable risk of estimated population was 33% (Varese et al., 2012). Bechdolf et al. (2010)

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https://doi.org/10.1016/j.psychres.2019.01.060
Received 13 April 2018; Received in revised form 14 January 2019; Accepted 14 January 2019
Available online 15 January 2019
0165-1781/

reported that 70% subjects with UHR had a history of childhood trauma, and especially a history of sexual abuse, which was found as a risk factor of developing first episode schizophrenia. Moreover, another research (Magaud et al., 2013) showed that cyberbullying may be an issue of concern for subjects with UHR and may have long-term implications for them.

There has also been growing evidence that life events were closely concerned with the occurrence of psychosis (Kraan et al., 2015). Life events are situations or occurrences that bring about a positive or negative change in personal circumstances (Beards et al., 2013). A meta-analysis of 16 studies on the relationship between life events and onset of psychosis reported that individuals with psychotic disorders were three times more likely to experience recent life events prior to the onset of psychosis compared to healthy controls (Beards et al., 2013). Another research (Devylder et al., 2013) also implicated that declined stress tolerance on life events (especially stressful events) was related to various “prodromal” symptoms. However, there were other inconsistent findings. Mason et al. (2004)) found that experience of life events was not a predictable factor of UHR transition to psychosis. An Australian UHR cohort study also found that life events were unrelated to psychotic symptoms whereas perceived hassles were related to poor functioning and total score of BPRS (Thompson et al., 2007).

Social support played a critical psychological role in the onset of psychosis. There was a sizeable literature suggesting that being integrated in intimate social relationships or perceiving that social support was available in case of need would have considerable influence on an individual's health and even survival (Holt-Lunstad et al., 2010; Ditzen and Heinrichs, 2014). Falcon et al. (2009) reported that social ties were generally protective, but may also contribute to increased psychological distress when faced with stressful life events. In order to investigate the role of social network support in alleviating psychological impact of life stressors, several studies focused on the relationship between social support and psychosis (Gayer-Anderson and Morgan, 2013; Sundermann et al., 2014; Masse and Lecomte, 2015). A meta-analysis including 38 studies implied that reduced social networks and support appeared to predate the onset of psychotic disorder (Palumbo et al., 2015). Another survey suggested that UHR group reported lower social support and lower active coping than healthy controls (Pruessner et al., 2011).

As the above studies showed, numerous studies found that subjects with first episode schizophrenia and those who were at risk for psychosis had a history of childhood trauma, but studies specifically investigating traumatic experiences in HR individuals are limited. The impact of life events on psychosis has been less consistent and only a few studies focused on stressful life events that HR individuals experienced. In addition, only a few researchers directly explored the influence of social support on psychosis and on its prodromal state. Therefore, it was necessary to carry out studies to explore the psychological characteristics of high-risk individuals and the importance of early psychosocial interventions, which was also the innovation of our study.

We hypothesized that childhood trauma and life events as well as social support deficit would be significantly more prevalent in HR group in comparison to HC group. To test the hypothesis, we aimed to explore the relationship between them by evaluating Childhood Trauma Questionnaire (CTQ), Life Events Scale (LES) and Perceived Social Support Scale (PSSS) of subjects with FEP, HR and HC groups, and provide evidence for the development of early psychosocial interventions.

2. Methods

2.1. Study design and participants

In the present study, we were mainly concerned about a more extensive crowd of high risk individuals for psychosis (HR) (Lasalvia and Tansella, 2012) so as to obtain earlier and broader detection of the prodromal state before the occurrence of psychosis. HR group was composed of high risk individuals including (1) UHR population (Yung et al., 2012; Yung and Nelson, 2013) or CHR people (Smieskova et al., 2013; Carpenter and Schiffman, 2015)who were diagnosed according to the Structured Interview for Prodromal Syndromes (SIPS) (Miller et al., 1999); (2) first degree relatives (siblings, parents or offspring) of patients with schizophrenia (FDR) (Gottesman, 1991) who didn't fulfill the criteria of UHR.

Participants were mainly recruited from five psychiatric centers in Guangdong Province, including Guangdong mental Health Center of Guangdong Provincial People's Hospital, the Third People's Hospital of Luoding, Baiyun psychological hospital, the Third People's Hospital of Foshan, and the Third People's Hospital of Xinhui. The total sample consisted of 56 first episode patients with schizophrenia (FEP), 83 subjects with high risk for psychosis (HR) and 61 healthy controls (HC).

General inclusion criteria of the three groups included being aged 15–45 years and being able to understand the research proposal. General exclusion criteria included (1) a history of significant head injury, cerebrovascular disease, seizures and other neurological disease; (2) impaired thyroid function; (3) the International Statistical Classification of Diseases and Related Problems-10th Revision (ICD-10) criteria of alcohol or substance abuse or dependence. Patients who have experienced a first episode schizophrenia within the past year according to ICD-10 and Mini-International Neuropsychiatric Interview (M.I.N.I) diagnosis were enrolled into FEP group. HR group was composed of subjects with high-risk individuals for psychosis as mentioned above. HC group was recruited from the community, consisting of volunteers without any psychiatric disorders and without positive history of psychosis.

The study protocol was approved by the Clinical Research Ethics Committee of Guangdong Provincial People's Hospital. Written informed consent was issued by each adult subject and additionally by their parents if subjects were younger than 18 years after the investigation procedures were fully explained.

2.2. Assessments

Basic socio-demographic and clinical characteristics were collected using a form designed for the study. The patients’ basic demographic and clinical characteristics as well as medication prescriptions were recorded by an electronic chart management system.

Structured interviews with each participant were conducted by three trained psychiatrists with no less than three years of clinical and research experience. All participants received an evaluation of Mini-International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998) in order to confirm their diagnosis. Basic sociodemographic and clinical characteristics were collected by a designed form for those participants meeting the inclusion criteria of the study.

The Chinese version of the positive and negative syndrome scale (PANSS) was measured in FEP and HR groups to quantify their severity of clinical symptoms (Kay et al., 1987; He and Zhang, 2000) while SIPS was investigated in HR and HC groups to confirm their diagnosis and enrollment. The criteria of prodromal symptoms included at least one of the following three clinical criteria: (1)frankly psychotic positive symptoms that appeared too brief and too intermittent to constitute a fully psychotic syndrome, BIPS; (2)attenuated positive symptoms syndrome, APSS; (3)functional decline in the presence of genetic risk, GRDS (Miller et al., 2003).

Additionally, Global Assessment Function (GAF) (Zhang, 1984; Hall, 1995) was applied to assess the overall function. Montgomery–Asberg Depression Rating Scale (MADRS) (Montgomery and Asberg, 1979; Zhong et al., 2011) was applied to assess the depressive symptoms.

We chose Childhood Trauma Questionnaire (CTQ-SF) for the assessment of childhood trauma. CTQ-SF, 28 item Short Form (Bernstein et al., 1994) was established by clinical psychologists to

Table 1
Sociodemographic and clinical characteristics of the first-episode patients with schizophrenia, subjects with high risk for psychosis and healthy control groups.

	FEP(N = 56)		HR(N = 83)		HC(N = 61)		Statistics		
	n	%	*n*	%	*n*	%	χ^{2a}	df	*P*
Male	37	66.1	44	53.0	32	52.5	2.9	2	0.23
Han Chinese	55	98.2	82	98.8	60	98.4	–	–	0.62*
Unmarried	46	82.1	46	55.4	21	34.4	27.1	2	**<0.001**
Unemployed	21	37.5	30	36.1	8	13.1	11.3	2	**0.003**
Education									
<6 years	5	8.9	8	9.6	3	4.9	23.1	4	**<0.001**
6–12 years	44	78.6	58	69.9	28	45.9			
>12 years	7	12.5	17	20.5	30	49.2			
Antipsychotic Medication	53	94.6	1	1.2	0	0	–	–	**<0.001***
	mean	SD	mean	SD	mean	SD	t/F^{b}	df	*P*
Age (years)	26.5	8.5	28.8	8.4	31.3	7.9	4.8	199	**0.009**
PANSS Total	61.3	19.4	35.8	9.3	–	–	10.2	137	**<0.001**
PANSS Positive	15.3	6.5	8.6	2.6	–	–	8.3	137	**<0.001**
PANSS Negative	15.5	8.4	8.6	3.6	–	–	6.6	137	**<0.001**
PANSS General	30.4	8.1	18.6	3.8	–	–	11.4	137	**<0.001**
SIPS Total	–	–	5.5	9.9	0.9	1.7	3.5	142	**<0.001**
SIPS Positive	–	–	2.4	4.06	0.3	0.9	4.1	142	**<0.001**
SIPS Negative	–	–	1.7	3.6	0.2	0.6	3.02	142	**0.003**
SIPS Disorganized	–	–	0.4	0.9	0.1	0.3	2.4	142	**0.01**
SIPS General	–	–	0.9	2.1	0.2	0.6	2.5	142	**0.01**
GAF	57.1	12.2	79.9	10.5	86.4	4.5	147.4	199	**<0.001**
MADRS Total	13.7	9.06	4.8	6.2	1.3	2.3	58.8	199	**<0.001**

Bold values: $P < 0.05$; FEP: first-episode patients with schizophrenia; GAF: Global Assessment Function; HC: healthy control; HR: high risk for psychosis; MADRS: Montgomery–Asberg Depression Rating Scale; PANSS: Positive and Negative Syndrome Scale; SIPS: Structured Interview for Psychosis-Risk Syndrome.

[a] Pearson chi-square tests.

[b] independent-samples *t*-test or one-way analysis of variance.

* Fisher's Exact Test.

evaluate childhood trauma experience, which was composed of five sub-domains including emotional abuse (EA), physical abuse (PA), sexual abuse (SA), emotional neglect (EN) and physical neglect (PN). The Chinese version (Fu et al., 2005) showed that the five factor models of the scale conformed to the original scale theory. The scale consists of totally 28 items including 25 clinical items and 3 validity items. Each item rates from 1 to 5 points, representing the frequency of occurrence from never to always. The score of each subscale ranges from 5 to 25 and the total score of the scale ranges from 25 to 125.

Life Events Scale was applied to assess life events. There are great quantity type of scales for life events' measurement, using extremely different items, as well as various data collection tools and scoring method (Schuldberg et al., 1996;Fallon, 2008). It's hard to find one identical scale which could completely fulfill the actual requirement of this study. Therefore, we designed a 45-item life events scale to assess life events which occurred within the past year. Both positive and negative events were included in the scale. Item 1–26 and 45 are the same as Adolescent Self-Rating Life Events Checklist (ASLEC) (Liu, 1997a,b), with good reliability and validity proved by many studies (Cheng, 1997; Liu, 1997a,b; Xin, 2015). In addition, item 27–44 were elaborately selected from Life Event Scale (LES), which was designed in 1986 (Zhang and Yang, 2001), also with good reliability and validity (Zhang and Yang, 1988; Li and Yang, 1990). Each item ranks from 0 to 5 points, representing never happen, no influencing, mildly influencing, moderately influencing, severely influencing and extremely severely influencing respectively. Since the scoring criteria of these two referential scales were totally different, we designed a unified scoring method for this new scale. Take Ya-Lin Zhang's Life Event Scale as reference, we split all items into three sub-domains, including Family Life domain (FL), Social & Other domain (S&O) and Work & Study domain (W&S). The score of each sub-domain was the sum of relevant items, while the total score of the scale was the sum of the above three sub-domains.

We selected a brief self-rating scale called Perceived Social Support Scale (PSSS) to evaluate social related support which individuals perceived from various interpersonal resources such as family, friends and others. The scale was originally drawn up by Zimet et al. (1990) and its Chinese version (Chen, 2016) was proved to have good reliability and validity. The rating of 12 items was made on a 7-point Likert-type scale, which ranged from 1 to 7 points, representing from very strongly disagree to very strongly agree. The scale was consisted of family support and out of family support according to the factor analysis applied into Chinese version.

The three interviewers underwent an interrater reliability exercise on the use of the assessment scales in 10 patients with schizophrenia prior to the main study. The interrater reliability of the rating instruments yielded excellent agreement (intraclass correlation coefficients and kappa values >0.90).

2.3. Statistical analysis

Data was analyzed by SPSS 20.0 for Windows. Initially, raw data were screened to determine the departure from normality and heterogeneity of variance. Comparisons among FEP, HR and HC groups in the aspect of social-demographic characteristic, clinical features and psychological traits were performed by Pearson chi-square tests and independent-samples *t*-test as well as one-way analysis of variance (ANOVA) as appropriate. Clinical and psychological characteristics were compared again by analysis of covariance (ANCOVA), after controlling for the potentially confounding effects of variables that significantly differed among the three groups in univariate analysis (including age, education, marital and employment status). Otherwise, spearman correlation was employed to explore the correlation between SIPS, PANSS, GAF scores and childhood trauma, life events, social support in HR and FEP groups separately. Lastly, two binary logistic regression analysis were applied to explore risk factors of developing prodromal psychosis or psychosis, in which FEP, HR and HC groups were the dependent variable, while social-demographic, clinical and psychological characteristics that significantly differed in univariate analysis were entered as covariates (including education, marital and employment status, PANSS Total, SIPS Positive, MADRS Total, GAF,

CTQ Total, LES Total, and PSSS Total). The level of significance was established at 0.05 (two-tailed).

3. Results

Table 1 shows the sociodemographic and clinical characteristics of FEP, HR and HC

Totally, 56 FEP, 83 HR and 61 HC participated in the study. The mean age of FEP participants was 26.5, and 28.8 for HR group while 31.3 for HC individuals (F = 4.8, $P = 0.009$). Among the three groups, gender and nationality characteristics were similar, but there were significant differences in marital status, employment status and education level. It showed a descending trend in FEP, HR and HC groups on unmarried percentage ($\chi^2 = 27.1$, $P<0.001$) and unemployed percentage ($\chi^2 = 11.3$, $P = 0.003$) as well as low education($\leq$12 years) ($\chi^2 = 23.1$, $P<0.001$).

There were significant differences between FEP and HR groups in terms of PANSS Total and all PANSS subscales (all p values <0.05). Otherwise, we found that FEP group obtained lowest GAF score and highest MADRS score, followed by HR subjects and then healthy controls.

After controlling for the socio-demographic variables that were significantly different among the three groups in the above univariate analysis (including age, education, marital and employment status), in ANCOVA analysis, there were still significant differences in PANSS Total (F = 96.6, $P<0.001$), SIPS Positive (F = 11.9, $P = 0.001$), GAF (F = 120.5, $P<0.001$), MADRS Total (F = 46.6, $P<0.001$) among FEP, HR and HC groups.

Table 2 shows psychological assessment of FEP, HR and HC Childhood Trauma Questionnaire

In terms of CTQ Total, there were no significant differences between FEP and HR groups, but both groups scored obviously higher than HC group ($P = 0.002$ and $P<0.001$ respectively). In Emotional Neglect (EN) sub-domain, HR group scored highest, followed by FEP participants and then HC individuals (F = 22.2, $P<0.001$). The score of Emotional Abuse (EA) resembled between HR and HC groups, whereas apparently higher in FEP participants ($P = 0.008$ and $P<0.001$ respectively). Besides, compared with HC group, HR group scored higher on Physical Neglect (PN) ($P = 0.009$).

3.1. Life events scale

HR group experienced a significantly more total life events compared with HC individuals ($P = 0.004$). In Family Life (FL) sub-domain, HR group scored higher than FEP and HC group ($P = 0.009$ and $P = 0.003$ respectively). Moreover, HR group scored higher than HC group on Social and Other(S&O) sub-domain ($P = 0.002$).

3.2. Perceived social support scale

FEP and HR groups scored lower on PSSS Total than HC group ($P = 0.03$ and $P = 0.01$ respectively). In Family Support (FS) sub-domain, HR people possessed poorer family support than HC individuals ($P = 0.03$).

The ANCOVA analysis showed that after controlling for the socio-demographic variables that were significantly different among the three groups in the above univariate analysis (including age, education, marital and employment status), HR individuals scored higher on CTQ Total ($P = 0.001$) and LES Total ($P = 0.035$) than HC group while scored similarly with FEP group, and there was no more significant difference in PSSS Total among the three groups.

Table 3 Correlations between psychological traits and clinical characteristics in HR and FEP groups respectively

In HR group, CTQ Total showed positive correlation with SIPS Total ($P<0.05$), while LES Total showed positive correlation with SIPS Positive ($P<0.05$), SIPS Total ($P<0.01$) and GAF ($P<0.05$). In FEP group, CTQ Total showed positive correlation with PANSS Total ($P<0.01$) and negative correlation with GAF ($P<0.01$), and LES Total showed positive correlation with PANSS Total ($P<0.05$), while PSSS Total showed negative correlation with PANSS Total ($P<0.01$) and positive correlation with GAF ($P<0.01$).

Table 4 shows sociodemographic, clinical and psychological risk factors of developing into FEP and HR groups (two binary logistic regression analysis)

As SIPS should only assessed in HR and HC groups, while PANSS should only assessed in FEP and HR groups, there were many missing values when we conducted a single multinomial logistic regression analysis. Thus, we conducted two independent binary logistic regression analysis (taking education, marital and employment status, PANSS Total, SIPS Positive, MADRS Total, GAF, CTQ Total, LES Total, and PSSS Total as covariates as appropriate). The results revealed that compared with HC group, HR group was significantly associated with higher CTQ Total, lower GAF and unmarried state. Besides, compared with HR group, FEP group was significantly associated with lower LES Total, lower GAF, higher PANSS Total and unmarried state.

4. Discussion

In this study, there were important findings. In univariate analysis, HR individuals had more childhood trauma, more recent life events and less social support than HC group, meanwhile these findings were also supported by ANCOVA analysis except for the results related to social support. Logistic regression analysis revealed that HR group was significantly associated with more childhood trauma, poorer overall function and unmarried state than HC group. Besides, there was no significant difference on childhood trauma, life events and social support between HR and FEP groups in both univariate analysis and ANCOVA analysis, while in logistic regression analysis, FEP group was significantly associated with less recent life events, poorer overall function, severer clinical symptoms and unmarried state than HR group.

Compared to Zimbrón' study (Zimbrón et al., 2013), which showed that FEP and HR groups had similar sociodemographic characteristics such as employment history and marital status, our research found that the proportion of unmarried status presented a decreasing tendency in FEP, HR and HC groups (see Table 4). Different sample size and control of confounding factors may account for the inconsistent results. Besides, our research indicated that GAF score in HR group was poorer than HC group but better than FEP group and other studies also supported that HR individuals possessed poorer social function than healthy people (Grano et al., 2011; Cornblatt et al., 2012; Alderman et al., 2015). Poor working or studying status and lower education were associated with poor overall outcome (Salokangas et al., 2013), which reminded us to focus more on the working and educational status in high risk individuals for psychosis.

Our results showed that total childhood trauma in HR individuals was similar with FEP group but significantly severer than heathy controls. We also found that emotional and physical neglect were more frequently prevalent in HR group than HC group. Some other studies showed similar results (Magaud et al., 2013; Tikka et al., 2013; Ucok et al., 2015). In Sahin's study (Sahin et al., 2013), they reported that UHR individuals had higher total CTQ scores and also higher subdomain scores including emotional and physical abuse, as well as physical and emotional neglect than HC group. The research of Russo et al. (2014) mainly focused on characteristics of trauma history and found that CHR individuals experienced their first trauma at earlier ages, then continued to experience trauma at younger developmental stages, especially during early or mid-adolescence and were exposed to a high number of traumas. A meta-analysis was performed on 6 studies about childhood trauma in UHR populations, which resulted in a mean prevalence rate of 86.8%, and UHR subjects experienced markedly more childhood trauma than healthy controls (Kraan et al., 2015).

Table 2
Psychological assessment in the first-episode patients with schizophrenia, subjects with high risk for psychosis and healthy control groups.

	FEP (N = 56)		HR (N = 83)		HC (N = 61)		Analysis of variance			Pairwise comparison		
	mean	SD	mean	SD	mean	SD	F	df	P		MD	P
CTQ Total*	42.06	9.6	44.2	9.9	36.5	7.5	12.5	199	**< 0.001**	HR vs FEP	2.15	0.49
										HR vs HC	7.702	**< 0.001**
										FEP vs HC	5.54	**0.002**
CTQ EN*	12.6	4.8	15.9	6.1	10.2	3.7	22.2	199	**< 0.001**	HR vs FEP	3.36	**0.001**
										HR vs HC	5.72	**< 0.001**
										FEP vs HC	2.36	**0.01**
CTQ SA*	6.05	2.4	5.4	1.6	5.2	0.8	3.4	199	0.05	HR vs FEP	−0.608	0.29
										HR vs HC	0.21	0.67
										FEP vs HC	0.82	0.06
CTQ PA**	5.9	1.4	5.8	2.2	5.6	1.2	0.3	199	0.71	HR vs FEP	−0.06	0.84
										HR vs HC	0.19	0.51
										FEP vs HC	0.25	0.43
CTQ EA*	7.9	2.9	6.4	2.5	6.1	1.5	8.9	199	**< 0.001**	HR vs FEP	−1.47	**0.008**
										HR vs HC	0.25	0.83
										FEP vs HC	1.73	**< 0.001**
CTQ PN**	9.5	2.9	10.5	2.8	9.2	2.9	3.8	199	**0.02**	HR vs FEP	0.93	0.06
										HR vs HC	1.29	**0.009**
										FEP vs HC	0.35	0.507
LES Total*	32.7	25.7	43.3	30.2	29.8	19.5	5.4	199	**0.005**	HR vs FEP	10.57	0.08
										HR vs HC	13.52	**0.004**
										FEP vs HC	2.95	0.86
LES FL*	11.7	9.4	17.2	11.9	11.1	9.4	7.3	199	**0.001**	HR vs FEP	5.51	**0.009**
										HR vs HC	6.03	**0.003**
										FEP vs HC	0.52	0.98
LES W&S*	9.3	8.2	11.5	8.9	9.05	6.1	2.06	199	0.12	HR vs FEP	2.17	0.36
										HR vs HC	2.44	0.15
										FEP vs HC	0.26	0.99
LES S&O*	11.7	10.5	14.6	10.7	9.5	6.6	4.9	199	**0.008**	HR vs FEP	2.88	0.31
										HR vs HC	5.05	**0.002**
										FEP vs HC	2.95	0.86
PSSS Total**	51.2	10.6	51.05	8.6	54.9	10.1	3.3	199	**0.03**	HR vs FEP	−0.19	0.906
										HR vs HC	−3.93	**0.01**
										FEP vs HC	−3.73	**0.03**
PSSS FS*	20.7	5.4	20.4	4.3	22.4	4.6	3.3	199	**0.03**	HR vs FEP	−0.28	0.98
										HR vs HC	−1.99	**0.03**
										FEP vs HC	−1.71	0.202
PSSS OS**	40.3	8.4	40.9	7.3	43.2	8.4	2.2	199	0.103	HR vs FEP	0.55	0.68
										HR vs HC	−2.35	0.08
										FEP vs HC	−2.91	0.05

Bold values: $P < 0.05$; CTQ: Childhood trauma questionnaire; EA: Emotional abuse; EN: Emotional neglect; FEP: First-episode patients with schizophrenia; FL: Family life; FS: Family support; HC: Healthy control; HR: High risk for psychosis; LES: Life events scale; OS: Other support; PSSS: Perceived social support scale; PA: Physical abuse; PN: Physical neglect; SA: Sexual abuse; S&O: Social &other; W&S: Work &study.

* use Dunnett T3 for multiple comparisons when equal variance not assumed.

** use LSD for multiple comparisons when equal variance assumed.

Table 3
Spearman correlations (rho) between psychological traits and clinical characteristics in HR and FEP group respectively.

	HR group			FEP group	
	SIPS positive	SIPS total	GAF	PANSS total	GAF
CTQ Total	0.18	**0.26***	−0.05	**0.35****	**−0.34****
LES Total	**0.24***	**0.29****	**−0.27***	**0.26***	−0.25
PSSS Total	−0.11	−0.14	0.17	**−0.44****	**0.47****

CTQ: Childhood trauma questionnaire; FEP: First-episode patients with schizophrenia; GAF: Global assessment function; HR: High risk for psychosis; LES: Life events scale; PSSS: Perceived social support scale; PANSS: Positive and negative syndrome scale; SIPS: Structured interview for psychosis-risk syndrome.

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

However, studies regarding childhood trauma and psychosis had some methodological problems, involving numerous definitions of childhood trauma and measurement tools, which lead to interpretational pitfalls and difficulty in comparing results from different studies (Ucok and Bikmaz, 2007). The above findings strongly illustrated the salience of traumatic childhood experiences for high risk individuals (including

Table 4
Sociodemographic, clinical and psychological risk factors of developing into FEP and HR groups (two binary logistic regression analysis).

	HR vs. HC[a]			FEP vs. HR[b]		
	P	OR	95%C.I.	P	OR	95%C.I.
Married	**0.01**	**0.29**	**0.11–0.75**	**0.04**	**0.14**	**0.02–0.92**
Employed	0.13	0.43	0.14–1.28	\	\	\
Education years > 12	0.06	0.18	0.03–1.08	\	\	\
PANSS total	–	–	–	**0.01**	**1.15**	**1.02–1.28**
SIPS positive	0.26	1.301	0.81–2.06	–	–	–
MADRS total	0.88	1.01	0.81–1.26	0.51	0.94	0.79–1.12
GAF	**0.02**	**0.901**	**0.82–0.98**	**0.001**	**0.86**	**0.79–0.93**
CTQ total	**0.005**	**1.09**	**1.02–1.16**	0.11	0.93	0.85–1.01
LES total	0.68	1.004	0.98–1.02	**0.002**	**0.94**	**0.909–0.98**
PSSS total	0.13	1.04	0.98–1.10	0.15	1.06	0.97–1.16

Bold values: $P < 0.05$; 95%C.I.: 95% confidence interval; CTQ: Childhood trauma questionnaire; FEP: First-episode patients with schizophrenia; GAF: Global assessment function; HC: Healthy control; HR: High risk for psychosis; LES: Life events scale; MADRS: Montgomery–Asberg depression rating scale; OR: Odds ratio; PANSS: Positive and negative syndrome scale; PSSS: Perceived social support scale; SIPS: Structured interview for psychosis-risk syndrome;

[a] HC group as the reference group, Likelihood ratio:133.02, R^2 = 0.478;

[b] HR group as the reference group, Likelihood ratio:55.38, R^2 = 0.82.

those who didn't meet UHR criteria) and their potential impact on the later transition to psychosis. Therefore, disposing childhood traumatic experiences would possibly reduce the manifestation of HR individuals and their conversion to psychosis. For example, concern of children's mental health and prevention of traumatic events in childhood are necessary, and provision of timely assessment and psychological intervention to children who experienced traumatic events are also essential.

In this study, HR individuals experienced obviously larger numbers of life events in comparison to healthy controls, especially in the subdomain of family life (FL) and social & other (S&O). There was some evidence reported that exposure to life events was associated with increased risk of psychotic disorder and subclinical psychotic experiences (Beards et al., 2013). Yet in contrast to our findings, a meta-analysis which included 4 relevant studies showed that life-event rates were significantly lower in UHR subjects compared to healthy controls, which was also contrary to the researchers' initial hypothesis (Kraan et al., 2015). Similar to the above result, Phillips's study also showed that UHR group experienced distinctly fewer life events over a 12-month period follow up in comparison to HC group, but there was no difference in the experience of minor events or "hassles" (Phillips et al., 2012). However, most previous investigations simply rated the number of life events that an individual experienced, rather than considering an individual's appraisal of the meaning of those life events (Phillips et al., 2012), which would greatly reduce the persuasive power of clarifying the potential impact of life events on psychosis. To date, literature on the influence of life events on high risk individuals was limited and remained inconclusive, additionally the methodological quality of many studies was not very high, which all urged researchers to make more and further exploration (Mayo et al., 2017) and to find out whether life events play an important role in early diagnosis and early intervention of high risk individuals for psychosis. Moreover, it's crucial to offer supportive psychotherapy or interpersonal psychotherapy to people with troubles of life events, so that diminishing negative effect of those stressful life events.

In terms of the association between social support and psychosis, our findings suggested that both FEP and HR individuals owed obviously less social support than HC group in univariate analysis, although these findings were not supported by ANCOVA analysis and logistic regression analysis. One study stated that poor perceived social support and loneliness were strongly associated with psychosis and depressive symptoms (Sundermann et al., 2014). Also, another research found that lack of perceived support, especially from peers, may be important in the development of psychosis, and those individuals with more adversities may represent a vulnerable subgroup who needs more assistance to increase and maintain supportive networks (Trauelsen et al., 2016). As a matter of fact, declined social support not only played a critical role in the progression of psychosis, but also had huge influence even on the care givers of FEP patients, who as well experienced high level of perceived stress and poor social support (Sadath et al., 2017). However, current available results in the influence of social support on high-risk individuals were limited and inconsistent, which may due to different controlling methods of confounding variables, lack of uniform and mature enrolling criteria of high-risk individuals, and small sample size of most studies. Thus, a great size of studies should be done in the future to determine whether social networks and social support diminished before or at the time of disease onset and whether the absence of social supports will contribute to the risk of transformation to psychosis, either directly or indirectly. Lastly, enhancing support from various social resources also makes great difference to the prevention of mental illness.

The major strength of this research was as below. First, all participants have received a comprehensive evaluation of MINI by three well-trained psychiatrists after being recommended to the present study, which tremendously improved the accuracy of diagnosis and homogeneity of each group. Second, duration of disease of all FEP individuals was limited to one year, which greatly overcame difficulties related to the effect of chronicity and problems with memory and additionally, enhanced homogeneity within the group as well.

However, the results of this study needed to be interpreted with cautions due to several limitations. First, due to the cross-sectional nature of this study, the conversion rate of high-risk individuals to frank psychosis couldn't be identified and we were unable to examine the potentially predictive value of the above three concerned psychological factors for future frank psychosis in HR individuals. Second, our sample size was relatively small for the application of logistic regression analysis, which limits the power to detect relative weak effects such as recent life events and social support, and a larger sample size would be desirable for assessing the above two psychological characteristics in HR individuals in future researches. Third, all psychological scales were retrospective design, which inevitably generated recall bias especially in CTQ and LES scales.

In conclusion, our research indicated that in comparison to healthy controls, high-risk individuals experienced severer childhood trauma and significantly more life events meanwhile perceived poorer social support, which may be the risk factors of conversion to psychosis and may possibly bring about deterioration in overall function. Thus, this study greatly called for attention to further exploration to develop optimal psychosocial interventions, which may be beneficial in improving symptoms of high-risk individuals and may therefore help to delay and reduce conversion to psychosis.

Conflicts of interest

The authors had no conflicts of interest in conducting this study or preparing the manuscript.

Funding

The study was supported by Guangdong Provincial Department of Science and Technology (grant number: 2016A020215192) and Guangdong Provincial Administration of traditional Chinese Medicine (grant number: 20171007).

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.01.060.

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