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The Association Between Childhood Trauma and Memory Functioning in Schizophrenia

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Objective: **Both neurocognitive impairments and a history of childhood abuse are highly prevalent in patients with schizophrenia. Childhood trauma has been associated with memory impairment as well as hippocampal volume reduction in adult survivors. The aim of the following study was to examine the contribution of childhood adversity to verbal memory functioning in people with schizophrenia.** ***Methods:*** **Eighty-five outpatients with a *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) diagnosis of chronic schizophrenia were separated into 2 groups on the basis of self-reports of childhood trauma. Performance on measures of episodic narrative memory, list learning, and working memory was then compared using multivariate analysis of covariance.** ***Results:*** **Thirty-eight (45%) participants reported moderate to severe levels of childhood adversity, while 47 (55%) reported no or low levels of childhood adversity. After controlling for premorbid IQ and current depressive symptoms, the childhood trauma group had significantly poorer working memory and episodic narrative memory. However, list learning was similar between groups.** ***Conclusion:*** **Childhood trauma is an important variable that can contribute to specific ongoing memory impairments in schizophrenia.**

Key words: abuse/memory/psychosis/trauma/schizophrenia

Introduction

A high proportion of people with severe mental health problems report traumatic childhood experiences including sexual and physical abuse.[1,2] Read et al[3] review the prevalence rates of sexual and physical abuse in female and male psychiatric inpatients. The majority of female inpatients 69% (weighted average of 39 studies) report either childhood sexual abuse or childhood physical abuse (69%). The majority of male psychiatric inpatients 59% (weighted average from 31 studies) also report either childhood sexual abuse or childhood physical abuse (59%).

The experience of trauma can negatively affect the clinical course of the major psychiatric disorders.[4,5] Childhood exposure to trauma in particular has been associated with higher symptom levels, poorer quality of life, greater service utilization,[6] poorer work performance in a rehabilitation program,[7] intercommunication functioning, increased social withdrawal,[8] a deteriorating course of psychosocial functioning,[9] and suicidality[10] in people with schizophrenia.

Various lines of indirect evidence suggest that childhood trauma may also contribute to some of the neuropsychological impairments observed in schizophrenia. Short-term memory functioning has been found to be poorer in adult survivors of childhood physical and sexual abuse.[11] Findings suggested that this stressor is associated with ongoing deficits in verbal short-term memory, with overall severity of abuse being related to the degree of memory impairment. Childhood trauma may have long-lasting effects on brain areas underpinning the explicit memory system. While not all studies have reported significant findings,[12] others[13,14] have reported a reduction in the volume of the left hippocampus in adult survivors of childhood sexual abuse: This may be particularly evident in individuals with a diagnosis of posttraumatic stress disorder (PTSD).[15] Notably, hippocampal volume reduction is also a common finding in first-episode and chronic schizophrenia.[16]

Only 2 studies have specifically examined the effect of childhood trauma histories on neuropsychological functioning in people with schizophrenia. One study[17] examined the effect of child sexual abuse in 43 patients with a schizophrenia-spectrum disorder. The sexual abuse group ($n = 15$) performed more poorly on tests of working memory and information processing speed. However, another small study[18] found no relationship between childhood maltreatment and measures of executive

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functioning, verbal fluency, or verbal processing speed in this patient group but did found some evidence of an association between childhood abuse and deficits on a contour integration task. In the following study, we attempted to examine this issue further in a larger sample of patients with chronic schizophrenia: On the basis of research conducted to date, we hypothesized that a history of childhood adversity would have a negative impact on memory functioning in these individuals.

Methods

Participants

Ethical approval for the study was granted by a local research ethics committee regulated by a statutory research governance framework. Participants were community outpatients with a *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) (*DSM-IV*) diagnosis of chronic schizophrenia. Participants were living in the town of Newtownabbey (population approximately 60 000) on the northern outskirts of Belfast and were under the care of one consultant psychiatrist (C.Mu.). *DSM-IV* diagnoses were reached by consensus after case note review and discussion between the responsible psychiatrist and his colleagues. A total of 90 patients fulfilling diagnostic criteria were approached, and 85 people gave written consent to participate after a complete description of the study was provided. Of those 85, 67 were male and 18 were female. The mean age was 41.1 years (SD = 11.7). The mean number of admissions was 5.6 (SD = 8.1), and the mean age of first admission was 25.7 years (SD = 10). Fifty-five people in the sample were single, 10 were married or cohabiting, and 20 were separated or divorced. Only 4 were in full-time open employment. Twenty were living in supported accommodation, 37 living with their spouse or family or origin, and 28 living independently.

Measures

Patients were interviewed using the 28-item Childhood Trauma Questionnaire (CTQ)[19] that inquires about 5 types of maltreatment: emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. The Posttraumatic Diagnostic Scale (PDS),[20] a 49-item self-report instrument, provided the information necessary to arrive at a comorbid *DSM-IV* diagnosis of PTSD. Depressed mood was measured using the 21-item self-report Beck Depression Inventory (BDI)-II.[21]

The National Adult Reading Test (NART)[22] was administered to obtain an estimate of premorbid intellectual functioning: NART scores were converted to the Wechsler Adult Intelligence Scale-Revised IQ using published regression equations.[22] All participants then completed 3 subtests of the Wechsler Memory Scale-Third Edition (WMS-III)[23] to assess verbal memory functioning: (1) logical memory, (2) word lists, and (3) letter-number sequencing.

"Logical memory" tests the free recall of 2 story narratives. It is a measure of episodic memory and assesses for the type of deficits expected following hippocampal damage.[11,24] The logical memory subtest may also be sensitive to temporal lobe dysfunction: The delayed recall and percentage retention scores have been reported to detect right and left temporal lobectomies.[25,26] Immediate recall, delayed recall, and recognition subtests were administered.

"Word lists" measure immediate and delayed rote learning. Twelve semantically unrelated words are read aloud, and the examinee is requested to recall as many words as possible over 4 trials. The examiner subsequently reads a new list of 12 words and asks the examinee to recall these. Finally, the examinee is asked to recall and then recognize as many of the first list of words as possible. The test produces indices of immediate recall, delayed recall, delayed recognition, and percentage retention. There is evidence that tests of list learning are more specifically sensitive to left-sided damage to temporal and hippocampal structures than tests of narrative recall.[26,27]

"Letter-number sequencing" is a measure of auditory working memory and mental control. The examinee is presented with a string of alternating letters and numbers and is asked to repeat the letters and numbers in alphabetical and numerically ascending order. The lengths of the letter-number strings are gradually increased from 2 to 8 elements, thus demanding that participants simultaneously store and manipulate information. Letter-number sequencing tests are sensitive to the working memory deficits found in schizophrenia.[28]

In addition to the above scales, we collected information of demographics—age, gender, employment, relationships, and accommodation. Information related to electro-convulsive therapy (ECT) history and admission history was gathered from patients' notes.

Data Analysis

Participants were separated into 2 independent groups (child trauma positive and child trauma negative) for comparative purposes on the basis of information gathered using the CTQ: The child trauma–positive group was comprised of individuals who had one or more scaled scores reaching moderate or severe levels of maltreatment on the CTQ. The child trauma-negative group was comprised of individuals who either scored in the low or no category on the CTQ. Data from this cross-sectional between-group study were analyzed using the Statistical Package for Social Sciences/PC15 for Windows (SPSS Inc, Chicago, IL). Sociodemographic and clinical data were compared between groups using analysis of variance (ANOVA) and the Pearson chi-square test. Group comparisons for indices of memory were conducted using MANCOVA (multivariate analysis of covariance

Table 1. Participant Child Trauma Characteristics (CTQ)

Score	Emotional Abuse	Physical Abuse	Sexual Abuse	Emotional Neglect	Physical Neglect
None	57 (67%)	64 (75%)	66 (78.7%)	39 (46%)	57 (67%)
Low	16 (19%)	12 (14%)	4 (5%)	30 (35%)	14 (17%)
Moderate	6 (7%)	6 (7%)	9 (11%)	10 (12%)	7 (8%)
Severe	6 (7%)	3 (4%)	6 (7%)	6 (7%)	7 (8%)

Note: CTQ, Childhood Trauma Questionnaire.

[MANCOVA]), covarying for depression levels and estimates of premorbid IQ. WSM-III age-scaled scores were utilized where possible. Statistical significance for all tests was defined as $P < .05$.

Results

Thirty-eight (45%) participants had experienced at least one moderate to severe childhood adversity according to criteria and were categorized as the childhood trauma–positive group. Table 1 depicts the prevalence of childhood trauma across the categories of emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. Twenty-five participants had reported moderate or severe trauma levels in 1 category, and 13 participants reported moderate or several levels in 2 or more categories.

Fifteen percent of the total sample ($n = 13$) met the criteria for PTSD. Just under half of these ($n = 5$) identified childhood adversity (predominant type/severity) as the event that caused their symptoms. The others identified adult events. A further 15 people refused or were judged to be too distressed at the time to complete the PDS.

No significant differences were found between groups on age ($F_{1,80}$ =1.12, $P = .29$, partial $\eta^2 = 0.01$). A significant difference between the groups was found on estimated premorbid IQ using the NART ($F_{1,80} = 8.05$, $P < .01$, partial $\eta^2 = 0.09$). Those reporting childhood trauma had slightly higher mean scores ($M = 104.4$, SD = 14.37) than those who did not report childhood trauma ($M = 98.24$, SD = 12.64). A significant difference between the groups was found on BDI scores ($F_{1,80} = 3.95$, $P = .05$, partial $\eta^2 = 0.05$). Those reporting childhood trauma had slightly higher mean scores ($M = 14.08$, SD = 9.32) than those who did not report childhood trauma ($M = 10.05$, SD = 8.94).

No significant differences were found between the groups on gender (Pearson $\chi^2 = 0.31$, $df = 1$, $P = .58$), marital status (Pearson $\chi^2 = 0.1$, $df = 1$, $P = .75$), history of ECT (Pearson $\chi^2 = 0.35$, $df = 1$, $P = .56$), problematic alcohol use (Pearson $\chi^2 = 0.01$,$df = 1$, $P = .91$), or employment status (Pearson $\chi^2 = 0.05$, $df = 1$, $P = .83$).

Between-group analyses, conducted using MANCOVA and covarying for estimates of premorbid IQ and for depression levels, revealed significant group differences on logical memory subtests—immediate and delayed recall—suggesting that those who reported childhood trauma scored worse on these tasks when compared with a group that did not report childhood trauma. No significant differences were found between the groups on recognition scores and percentage retention scores of the logical memory task (see table 2).

No significant differences were found between the groups on immediate or delayed recall of word lists. Significant differences were also found on recognition of these word lists, with those who report childhood trauma scoring better on recognition of previously presented word lists (see table 2).

Scores on the letter-number sequencing subtest of the WMS-III also revealed significant differences between the 2 groups, suggesting that those who reported childhood trauma scored worse on these tasks when compared with a group that did not report childhood trauma (see table 2).

Discussion

Similar to the 1 of the 2 published studies investigating the effects of childhood trauma on neurocognitive functioning in schizophrenia,[17] we found clear evidence of deficits on several subtests of the WSM-III in those people who had a diagnosis of schizophrenia and who reported childhood trauma when compared with those with a similar diagnosis but with no reported history of childhood adversity. After controlling for premorbid IQ and depressive symptoms, the childhood trauma group had significantly poorer retrieval (immediate and delayed recall) on tasks of episodic narrative memory but scored similarly on recognition and retention of this information. The opposite effect was found for verbal rote memory (word lists). The trauma group scored better on recognition but similarly on retrieval of stimuli presented in a task of immediate and delayed rote learning. The trauma group also scored poorer on a measure of auditory working memory (letter-number sequencing).

The results clearly suggest that those with a diagnosis of schizophrenia and a childhood trauma history have greater difficulty with working memory. The discrepancy between results of the 2 tasks that measure episodic memory (logical memory and word lists) makes conclusions regarding episodic memory more difficult to make.

Table 2. WMS-III Verbal Memory Task Scores of Participants in the Childhood Trauma Group and the No Childhood Trauma Group

	Trauma Group, n = 38, Mean (SD)	No Trauma Group, n = 47, Mean (SD)	F	P	η^2
WMS-III logical memory					
Immediate recall	6.41 (3.33)	7.44 (3.66)	2.832	.044*	0.099
Delayed recall	6.27 (2.75)	7.64 (3.34)	2.85	.043*	0.1
Recognition	20.43 (4.05)	22.02 (4.48)	1.23	.304	0.046
% Retention	7.62 (3.61)	8.47 (3.51)	1.137	.326	0.028
WMS-III word lists					
Immediate recall	6.46 (3.06)	6.22 (4.18)	2.223	.092	0.08
Delayed recall	9.22 (2.94)	8.96 (3.44)	0.339	.797	0.013
Recognition	8.95 (3.04)	8.51 (4.03)	3.295	.025*	0.114
% Retention	10.14 (3.37)	9.56 (3.96)	0.185	.906	0.007
WMS-III letter-number sequencing					
Total score	7.92 (2.19)	8.58 (3.34)	6.000	.001**	0.189

Note: All results are shown as a multivariate analysis of covariance (covarying for IQ and current levels of depression). WMS-III, Wechsler Memory Scale-Third Edition.
*Significant at $P < .05$; **significant at $P < .001$.

Explanation may lie with the differences between the 2 tasks. It could be argued that the executive aspects of episodic memory are tapped to a greater extent in the logical memory subtest. These aspects would be those involved in the organization and retrieval of propositionally related material and hypothesized by contemporary neurobiological theories to be supported by frontothalamic and/or frontotemporal circuitry.[29–31] Meanwhile, long-term memory encoding and storage processes are similar to, or better than, patients who have not experienced trauma.

A further difference between these 2 subtests is the social aspects of the information involved. Results may suggest that patients who have experienced trauma may have a reduced capacity to retrieve, construct, and communicate social narratives. This would be in keeping with studies that have found poorer social functioning associated with trauma in a population with a diagnosis of schizophrenia.[8,9,32] It would also be in keeping with several studies that found that logical memory subtests are good predictors of psychosocial functioning in schizophrenia[33] and of improvement in vocational rehabilitation programs.[34]

Another possible explanation of these results of episodic memory functioning may be measurement error. The effect size is small. While we did statistically control for general cognitive ability, it may be that these results may be due to other aspects of cognitive functioning that this study did not measure. Utilizing a wider battery of neuropsychological tests is clearly an area for further research to focus on.

One advantage of this study is that the population studied had a clear diagnosis of schizophrenia. The 2 previous studies in the area of neuropsychological effects of childhood adversity have used severe mental illness (SMI) populations, which included patients with diagnoses such as schizophrenia and schizoaffective disorder.[13,14] This study also included a range of abuse experience and asking patients directly about this experience. One of the studies[13] has only looked at the effect of childhood sexual abuse in particular and not the broad range of childhood adversity that this study has measured. The other study[14] assessed for childhood neglect, physical abuse, and sexual abuse by conducting a chart review in which a detailed social history was present. The accurate reporting of trauma was reliant on abuse being properly assessed by other mental health professionals in their routine clinical work. This may have led to an underreporting of trauma prevalence.[35]

These results have a number of important theoretical implications. Firstly, it establishes childhood adversity as an important variable in understanding the neuropsychology of schizophrenia. A proposed traumagenic neurodevelopmental model of schizophrenia[16] draws heavily from the similarities between the effects of traumatic events on the developing brain and the biological abnormalities found in people diagnosed with schizophrenia, including the overreactivity of the hypothalamic-pituitary-adrenal axis. The model raised the idea that there is a need for trauma to be integrated in neuropsychological research design. The results of this study are consistent with this view.

Secondly, the heterogeneity of schizophrenia as a research entity has long been debated in the literature.[36,37] Some have argued[37] that most schizophrenia studies ignore the etiopathophysiological heterogeneity within the syndrome and argue that study designs could be substantially strengthened by addressing heterogeneity at the level of clinical phenomena. These authors propose the study of a deficit syndrome (defined by the presence of deficits symptoms). Other authors have proposed the existence of a traumagenic dissociative subtype of schizophrenia.[3] Ross and Joshi[38(p272)] note "it will be of

interest in future studies to determine whether the traumatized subgroup of various psychiatric disorders, including schizophrenia, exhibits a distinct phenomenology, family history, psychobiology, course, response to psychotherapy and medication and prognosis.'' The results of this study lend weight to this proposition by finding neuropsychological differences between those people who have a diagnosis of schizophrenia and who report childhood adversity and those who do not report such adversity.

A number of clinical implications arising from the present findings merit discussion. Despite the high trauma prevalence rate in schizophrenia reported here and in other studies, there remains reluctance on the part of mental health services to routinely inquire about trauma.[39] There may be barriers to inquiring about childhood trauma, including concerns about offending or distressing, fear of vicarious traumatization, and fear of inducing false memories.[40] This accentuates the need for mandatory training for mental health professionals in the routine assessment of trauma in SMI populations. Read, eg, outlines a 1-day training program for mental health professionals on how to inquire and respond to trauma.[39,41] A further clinical implication of the present findings is the need to further develop and offer trauma-focused psychological interventions for individuals with schizophrenia, who present with a history of psychosocial adversity, as part of any agreed treatment plan.[42] One study utilizing a manualized form of CBT for people with PTSD and a comorbid serious mental illness (including schizophrenia) has already been published.[43]

An important caveat in interpreting these results needs mention. While the study does show clear neuropsychological differences between traumatized and nontraumatized groups, it cannot be assumed that these results are related to actual structural brain changes. The precise role of the hippocampus in memory has been the focus of much debate, and the evidence suggests a very uncertain relationship between demonstrated hippocampal volume reductions and memory performance.[44] An issue for future research would be to include memory functioning tests together with imaging technology in studies of traumatized and nontraumatized people with schizophrenia.

There are a number of limitations to this study. Firstly, it has a cross-sectional retrospective design. It relies heavily on the accurate reporting of childhood trauma by participants. The issue of the accuracy of the reporting of trauma is a controversial one. There may be underreporting due to the nature of the information. One of the main difficulties in eliciting trauma histories is that those who have experienced trauma, especially in childhood, may be more likely to be mistrusting of others. A research interview may not be the ideal setting for sufficient trust to be established. There may also be overreporting of trauma due to a participant's mental state. For example, a participant might report a ''traumatic event'' that is based on a delusional memory.

However, in an outpatient study that found some form of supporting evidence in 82% of child sexual abuse cases, there was no difference in the frequency of such evidence between those with and without psychotic symptoms or between those with and without a diagnosis of schizophrenia.[45] Another study found that ''The problem of incorrect allegations of sexual assaults was no different for schizophrenics than the general population.''[46(p82)] It has been reported that 74% of their outpatient psychiatric sample receiving treatment in a group setting for incest survivors were able to validate their memories by obtaining corroborating evidence.[46] Fair to moderate test-retest reliability of trauma reports in a SMI population have been found.[47,48] Meyer et al[49] report reliability and validity of an instrument tapping sexual and physical abuse among women with a serious mental illness. Test-retest reliability yielded a κ of 0.63 for the measure of physical abuse and 0.82 for the measure of sexual abuse. Validity, assessed as consistency with an independent clinical assessment, showed 75% agreement for reports of physical abuse and 93% agreement for reports of sexual abuse. Similar high test-retest scores have been found in a population with schizophrenia in the same geographical area as this study over an 18-month time period.[50]

Another limitation of a retrospective cross-sectional design is that it has limited ability to infer causality. We can assert an association between memory function and childhood adversity in schizophrenia, but we cannot definitively assert causality. Some evidence from the PTSD literature would suggest that hippocampal volume is a risk factor for developing PTSD but not a casual factor.[51] It may well be that hippocampal damage is a risk factor to the development of psychosis following environmental stressors.

A further limitation of the study is that our ability to investigate the effect of PTSD on memory functioning was impaired by many subjects not completing the PDS and the fact that few subjects identified a childhood traumatic event as the event that caused their PTSD symptoms. Similarly, we do not have information on current psychotic symptoms that may have affected memory functioning.

The study has several implications for further research. Despite being considerably larger than the 2 published studies in the area, it still has a relatively small sample size. In particular, the sample includes a small number of females, and as a result no gender effects were explored. Low rates of abuse were reported in comparison to other studies[1,2] (possibly due to the low number of females in the sample). In addition, further research would benefit from including PTSD in the analysis and including a wider battery of neuropsychological measures than has been used in this study.

In conclusion, the results of this study pose many questions and many issues for the development of neuropsychological models of schizophrenia. The results have the

clear implication that the experience of trauma should be seen as a significant variable in neuropsychological, causal, and outcome research into this disorder.

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