Childhood trauma, social cognition and schizophrenia: Specific association between physical neglect and cognitive theory of mind in homicide offenders

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ABSTRACT

Schizophrenia is associated with a small, but increased risk of violent behavior, including homicide. Violent individuals with schizophrenia have elevated rates of childhood trauma and substantial social cognitive impairments. The aim of this study was to examine if childhood trauma is related to social cognition in homicide offenders with schizophrenia. We recruited 26 individuals with schizophrenia sentenced to compulsory mental care for homicide/attempted homicide and 28 non-violent schizophrenia controls. They filled out the Childhood Trauma Questionnaire (CTQ), providing scores for physical abuse, sexual abuse, emotional abuse, physical neglect and emotional neglect. Social cognition was assessed with two measures of emotion processing (Emotion in Biological Motion, Pictures of Facial Affect) and two theory of mind (ToM) tests (Hinting Task, Movie for the Assessment of Social Cognition: MASC). Spearman’s rho correlation coefficients were computed, and significant results followed up with partial correlation analyses controlling for IQ. Three associations were statistically significant, all in the homicide group; between CTQ physical neglect and cognitive ToM assessed with Hinting Task and with MASC, and between CTQ emotional neglect and Hinting Task. Only the first remained significant after controlling for IQ, indicating a specific association between physical neglect and cognitive ToM in homicide offenders with schizophrenia.

1. Introduction

Although it is more common for someone with schizophrenia to be a victim of violence than a perpetrator (de Vries et al., 2019), a subgroup of individuals with schizophrenia are at increased risk of violent interpersonal behavior. Among identified risk factors for violent behavior in schizophrenia are dynamic factors such as substance abuse, non-adherence to treatment and persecutory delusions, and static factors such as antisocial personality traits, and a history of criminal behavior (Fazel et al., 2009; Witt et al., 2013; Silverstein et al., 2015; Rund, 2018).

Risk assessment tools covering these known risk factors have had somewhat limited success in predicting violence (Singh et al., 2011). Recent research indicates that cognitive functioning could be added to a list of possible risk factors. A recent review/meta-analysis on neuro-psychological functions reported lower IQ, memory and executive function in violent schizophrenia compared to healthy controls (Sedgwick et al., 2017). Later studies focusing specifically on the most severe type of interpersonal violence, homicide, confirmed more pronounced deficits for IQ, memory/learning (Stratton et al., 2018; Engelstad et al., 2018) and executive functions (Stratton et al., 2018) in homicidal compared to non-violent schizophrenia participants. Research on social cognition in violent schizophrenia has provided mixed results. The above-mentioned meta-analysis (Sedgwick et al., 2017) stated that results for theory of mind was inconclusive, but that facial emotion perception probably is reduced in violent schizophrenia. Since then, we reported larger social cognitive deficits for individuals with schizophrenia who committed homicide compared to non-violent people with...
schizophrenia, with particularly substantial impairments seen for theory of mind (Engelstad et al., 2019a). Others have found social cognition to predict violent outcome, both directly and by mediating the effect of nonsocial cognition, on inpatient violence in forensic schizophrenia (O’Reilly et al., 2015).

Another risk factor is childhood trauma. Childhood trauma can extend into adult life by conferring risk of developing psychotic disorders (Varese et al., 2012) as well as by increasing the risk of violence perpetration. The larger risk of later violent offending is seen in both non-psychotic (Widom, 2017) and psychotic populations (Bosqui et al., 2014). A meta-analysis concluded that among individuals with psychotic illness, those with a history of childhood maltreatment had twice the risk of committing violence (Green et al., 2017). Indeed, rates of childhood trauma are higher in individuals with schizophrenia and a history of violence compared to individuals with schizophrenia without a history of violence (Engelstad et al., 2019b; Storvestre et al., 2020).

The concurrent presence of increased rates of childhood trauma and larger social cognitive deficits in violent offenders with schizophrenia may suggest that childhood trauma could increase the risk of interpersonal violence through reduced social cognition. According to the traumagenic neurodevelopmental model of schizophrenia (Read et al., 2001), early trauma involves overactivation of the hypo-thalamic-pituitary axis (HPA) and increased release of glucocorticoids (McEwen, 2012) which can lead to abnormal neurodevelopment and changes in brain structure, perhaps also social cognition. Further, childhood maltreatment is associated with insecure attachment (Cyr et al., 2010). Disrupted attachment may deprive the child of the arena where representations of (oneself and) others are developed.

Interestingly, research in general schizophrenia populations has identified significant associations between childhood trauma and cognition (Vargas et al., 2019; Dauvermann and Donohoe, 2019). The majority of studies that examined associations between social cognition and childhood trauma, reported significant findings, specifically for neglect (Garcia et al., 2016; Kilian et al., 2018; Kincaid et al., 2018; Schalinski et al., 2018; Rokita et al., 2021; Vaskinn et al., 2021). Higher rates of childhood neglect were related to lower adult social cognition. There are exceptions, with some studies failing to identify such a relationship (Palmier-Claus et al., 2016), or for only some social cognitive domains (emotion perception, but not theory of mind) (Rokita et al., 2021), and for other types of childhood trauma as well (sexual abuse) (Vaskinn et al., 2021). No studies have examined this relationship in a psychosis sample with a history of violence, comparing it to the association in non-violent individuals with schizophrenia.

A thorough examination of a hypothesized pathway from childhood trauma to severe interpersonal violence through social cognition in schizophrenia requires a large sample, preferably followed longitudinally. In this study, we examine one step in such a pathway, i.e., between childhood trauma and social cognition in homicide offenders with schizophrenia (HOS). Previously, we reported elevated rates of childhood trauma (Engelstad et al., 2019b) and more pronounced social cognitive impairments (Engelstad et al., 2019a) in HOS compared to individuals with schizophrenia without a history of interpersonal violence. In this study, we combine data from our previous publications, asking if childhood trauma is significantly associated with social cognition among HOS participants, and if this differs from individuals with schizophrenia without a history of violence. Based on the existing literature, we hypothesize significant associations between childhood psychiatric neglect and social cognition, but make no predictions for specific social cognitive domains. Given previous findings, our null hypothesis is that significant associations will be present in both schizophrenia groups.

2. Methods

The study was undertaken at Vestre Viken Hospital Trust in Drammen, Norway, in collaboration with participating hospitals across Norway. Data was collected from 2015 to 2017. The Regional Committee for Medical and Health Research Ethics approved the study (REC South East 2015/713).

2.1. Participants

Twenty-six individuals with ICD-10 (WHO, 2004) diagnoses of schizophrenia (n = 23) or schizoaffective disorder (n = 3) sentenced to compulsory mental health care for homicide (n = 14) or homicide attempt (n = 12) were included in the HOS group. They were recruited through their treating clinician at collaborating security units, 6.5 (±3.5) years after the offense. Twenty-eight persons with schizophrenia (n = 27) or schizoaffective disorder (n = 1) were recruited from other (non-security) units to a non-violent schizophrenia comparison group (non-HOS). Non-violence was defined as having no history of interpersonal violence. Non-HOS were specifically recruited if they filled this criterion. Diagnostic evaluations were made prior to inclusion in our study, by clinicians at the treating institution. Information on history of violence was available from medical records and treating clinicians. We provided complete information about the study, and interested participants thereafter gave their written informed consent.

2.2. Instruments

2.2.1. Clinical information

Clinical symptoms were measured with the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987). We report scores for the 7-item positive and negative symptom scales (range 7 – 49) and the 16-item general symptoms scale (range 16 – 112). We calculated medication Defined Daily Dose (DDD) after WHO guidelines (WHO, 2018).

2.2.2. Measure of childhood trauma

We assessed childhood trauma with the Childhood Trauma Questionnaire, CTQ (Bernstein et al., 2003). The CTQ provides self-reported information on the presence of different types of childhood maltreatment, organized into five scales: physical, sexual or emotional abuse, emotional or physical neglect. Twenty-eight statements are rated on a 1 to 5 points scale, where 1 point corresponds to “never true” and 5 points to “very often true”. Three items concern possible response bias and are not included in these scales which have a range from 5 to 25 points.

2.2.3. Intelligence measure

We measured IQ with the two-test version of Wechsler’s Abbreviated Scale of Intelligence (WASI) (Wechsler, 2007) which consists of the Vocabulary and Matrix Reasoning subtests.

2.2.4. Social cognitive tests

Four measures of social cognition were administrated. Two of the measures assess emotion processing. Emotion in Biological Motion (EmoBio) (Heberlein et al., 2004) gives information on the ability to perceive emotions in moving bodies, whereas Pictures of Facial Affect (PFA) (Frommam et al., 2003) is a measure of facial emotion perception. The EmoBio test was scored according to the proportional method (Couture et al., 2010) using Norwegian norms (Vaskinn et al., 2016). Similarly, two tests measure ToM. The Hinting Task (Corcoran et al., 1995) assesses cognitive ToM, whereas the Movie for the Assessment of Social Cognition (MASC) (Ozimek et al., 2006) provides information for both affective and cognitive ToM (MASCa, MASCcog). As there may be differences between cognitive and affective ToM as regards relationships with childhood maltreatment (Vaskinn et al., 2021), we used both scores. The Norwegian versions of the Hinting Task (Fryhaug et al., 2019) and MASC (Fretland et al., 2015; Vaskinn et al., 2018) have both been found suitable for use in schizophrenia.
2.3. Statistical analyses

Normality tests showed that with the exception of CTQ emotional neglect, all CTQ variables were non-normally distributed (Shapiro-Wilk test, all ps < 0.01). Nonparametric analyses were therefore chosen. In addition, explorative analyses with boxplots revealed three outliers: one for CTQ sexual abuse in the HOS group and two for CTQ physical neglect, in the HOS and non-HOS groups, respectively. We excluded these three individuals in statistical analyses of the CTQ subscales in question.

Initial examinations of the association between childhood trauma and social cognition were undertaken with Spearman question. These three individuals in statistical analyses of the CTQ subscales in risk of Type II errors no corrections were made for multiple testing, but only statistically significant associations (p < 0.05) of at least medium effect size (< 0.30) according to Cohen’s rules of thumb (Cohen, 1988) were included in subsequent analyses.

IQ may be related to both childhood trauma (Vargas et al., 2019) and social cognition (Bora et al., 2009). Thus, as follow-up analyses, we chose to conduct partial correlations of significant associations between childhood trauma and social cognitive variables while controlling for the effect of IQ.

3. Results

Significant group differences were present for education, IQ, inpatient/outpatient status, negative symptoms and medication dose (Table 1). See Table 3 for the results of the Spearman’s rho correlation analyses. Three were both statistically significant and of medium magnitude, all three in the HOS sample. This was the case for the associations between CTQ emotional neglect and Hinting Task (Spearman’s rho = −0.437, p = 0.026) as well as between CTQ physical neglect and both Hinting Task (Spearman’s rho = −0.443, p = 0.027) and MASCcog (Spearman’s rho = −0.545, p = 0.005). Follow-up partial correlation analyses controlling for WASI IQ reduced the strength of these associations. The association between CTQ physical neglect and Hinting Task (see Fig. 1) remained significant (r = −0.415, p = 0.044), but this was not the case for the relationship between CTQ physical neglect and MASCcog (r = −0.339, p = 0.106) or between CTQ emotional neglect and Hinting Task (r = −0.259, p = 0.210). The association between CTQ physical neglect and Hinting Task remained significant also when controlling for negative symptoms (r = −0.541, p = 0.006) and antipsychotic medication (r = −0.469, p = 0.021). A larger number of inpatients is expected for the HOS group, and education is related to IQ. Hence, no follow-up analyses were conducted to control for these variables.

4. Discussion

We have previously shown that the current HOS sample has more severe childhood trauma (Engelstad et al., 2019b) and larger social cognitive impairment (Engelstad et al., 2019a) compared to non-violent individuals with schizophrenia (reproduced in Table 2). The objective of this study was to examine if childhood trauma is related to adult social cognition in HOS. In support of our hypothesis, which was based on the existing literature, childhood neglect was significantly associated with social cognition, specifically with cognitive ToM, but only in HOS. Physical neglect was significantly correlated with our two cognitive ToM measures, i.e. Hinting Task and MASCcog. Better social cognition was associated with less childhood trauma. The latter turned non-significant after controlling for IQ, but was still of moderate size. Only the former association remained significant after controlling for IQ, perhaps because it is an easier task. Ceiling effects have been reported for the Hinting Task (Davidson et al., 2017). Emotional neglect also had a statistically significant correlation coefficient with Hinting Task, but this turned non-significant when removing the effect of IQ. In the non-HOS group, no association reached statistical significance.

Our findings are in both agreement and disagreement with previous studies. As regards the first matter, neglect has emerged as the most relevant type of childhood trauma for social cognition in schizophrenia. The current findings in the HOS sample align with those of previous schizophrenia studies in documenting this relationship (Garcia et al., 2016; Kilian et al., 2018; Kincaid et al., 2018; Schalinski et al., 2018; Rokita et al., 2021; Vaskinn et al., 2021). The traumagenic model of schizophrenia (Read et al., 2001) posits abnormal neurodevelopment, to which reduced cognition can be an accompanying feature. However, the effect of childhood maltreatment on brain structure and function depends on age at exposure as well as type of maltreatment (Teicher et al., 2016). Interestingly, neglect and abuse probably have different neurodevelopmental effects (McLaughlin et al., 2014) which may be one explanation for their different associations with social cognition. Schalinski et al. (2018) demonstrated this in a study of adults with psychotic disorder. They found that abuse at age 3 was associated with reduced attention, learning and memory, while neglect at age 11–12 was related to worse social cognition.

We would like to propose that a psychological description can complement such neural explanations. The physical and emotional needs of a neglected child are disregarded, demonstrating to the child that his feelings and mental states do not matter and are not worthy the attention of the caregiver. The abused child, on the other hand, is the target for the attention of the abusing adult as the verbal and physical behavior of the adult are directed towards the abused child. The experience of being worthy of the attention of another may be required for the development of the ability to truly perceive the other. Instead of being provided with the necessary learning experiences of how to think about mental states (Heyes and Frith, 2014), an unnoticed, neglected child is understimulated, both socially and cognitively (McLaughlin et al., 2019), constituting one possible (psychological) reason for why neglect is more strongly associated with social cognition than is abuse.

The results, however, also contrast with previous research in schizophrenia. First, we found that cognitive ToM was the social

### Table 1

Demographics and clinical characteristics in homicide offenders with schizophrenia (n = 26) and non-violent schizophrenia controls (n = 28).

|                         | Homicide offenders with schizophrenia | Non-violent schizophrenia controls | Statistics       |
|-------------------------|---------------------------------------|-----------------------------------|------------------|
| Demographics            |                                       |                                   |                  |
| Age (years)             | 38.2 (7.3)                            | 36.7 (10.1)                       | t = 0.63, p = 0.534 |
| Sex (males/females)     | 25/1                                  | 25/3                              |                  |
| Education (years)       | 9.6 (2.2)                             | 11.1 (1.6)                       | t = −2.80, p = 0.007 |
| WASI IQ                 | 87.0 (16.7)                           | 98.0 (15.8)                      | t = −2.48, p = 0.016 |
| Clinical characteristics |                                       |                                   |                  |
| Treatment status        |                                       |                                   |                  |
| Inpatients/ outpatients | 16/10                                 | 3/25                              |                  |
| PANSS positive symptoms | 11.3 (4.3)                            | 10.1 (3.4)                       | t = 1.22, p = 0.227 |
| PANSS negative symptoms | 13.0 (5.4)                            | 10.5 (3.1)                       | t = 2.10, p = 0.041 |
| PANSS general symptoms  | 25.4 (6.0)                            | 23.4 (4.3)                       | t = 1.45, p = 0.153 |
| Medication, DDD         | 1.84 (0.80)                           | 1.36 (0.64)                      | t = 2.44, p = 0.018 |
| Illness duration (years)| 15.7 (6.7)                            | 13.7 (10.1)                      | t = 0.82, p = 0.414 |

WASI, Wechsler Abbreviated Scale of Intelligence; PANSS, Positive and Negative Syndrome Scale.; DDD, defined daily dose.
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did not represent the larger population very well. Alternatively, this was unexpected. Perhaps our non-violent schizophrenia sample.

Table 2
Childhood trauma scores and social cognition in homicide offenders with schizophrenia (n = 26) and non-violent schizophrenia controls (n = 28).

| Childhood trauma | Homicide offenders with schizophrenia | Non-violent schizophrenia controls |
|------------------|--------------------------------------|-----------------------------------|
| (minimum – maximum) | Median (range) | Median (range) |
| CTQ physical abuse (5 – 25) | 6 (5 – 21) | 5 (5 – 12) |
| CTQ emotional abuse (5 – 25) | 5 (5 – 20) | 5 (5 – 10) |
| CTQ emotional neglect (5 – 25) | 12 (5 – 21) | 10.5 (5 – 24) |
| CTQ physical neglect (5 – 25) | 8 (5 – 19) | 7.5 (5 – 16) |
| Social cognition (minimum – maximum) | Mean (SD) | Mean (SD) |
| Emobi (0 – 1) | 0.65 (0.15) | 0.74 (0.15) |
| PFA (0 – 100%) | 66.5 (13.5) | 70.3 (14.6) |
| Hinting Task (0 – 20) | 14.7 (3.7) | 16.0 (2.3) |
| MASC(0 – 18) | 8.1 (3.3) | 10.8 (3.2) |
| MASCog (0 – 26) | 12.4 (5.9) | 16.6 (5.0) |

previous studies may have included violent individuals, driving the identified significant associations between childhood trauma and social cognition. Whether cognitive ToM indeed is of particular relevance for violent schizophrenia therefore awaits future studies with larger clearly defined samples using a battery of social cognitive tests. In either case, it is interesting to note that ToM deficits appear across different offender samples (Karoglu et al., 2021).

Study findings of a specific association between childhood trauma and social cognition in HOS are in line with a hypothesis that traumatic childhood experiences partly increase the risk of violent behavior through social cognitive deficits. This may be so because with social cognitive impairment comes a disadvantage when navigating the social world. A reduced ability to understand what others are communicating about thoughts and emotions may increase a person’s risk of violating others. Being unable to perceive or misperceiving something which is present (not detecting signs of distress or fear, labeling interest as critique, not picking up hints) or perceiving something that is not present (animosity, ridicule) constitute social cognitive impairment. This impairment may in turn increase the likelihood of interpersonal violence. In addition, deficient mentalizing could be accompanied by a compromised inhibitory mechanism that would otherwise stop an individual from hurting others. If the mentalizing deficit is particularly severe, as was the case for our current sample (performance up to 4 standard deviations below healthy controls: Engelstad et al., 2019a), there may be no stop signal or brake available, resulting in an even higher risk of severe interpersonal violence. For our participants this was reflected in taking or attempting to take the life of another. Killing someone is perhaps the ultimate disregard of the thoughts, emotions, intentions, wishes, wants, and dreams of another, i.e. substantially reduced ToM.

Our study has some limitations. The sample size is small, and the data is cross-sectional. This prevented us from using more sophisticated statistics and from building complex models with other risk factors included. The number of analyses increases the risk of Type I error. We acknowledge that the elevated risk of severe interpersonal violence in some individuals with schizophrenia is associated with factors beyond those included in the present examination. For instance, psychopathy is clearly of relevance (Engelstad et al., 2019b), and its impact on types of aggression has been shown to be mediated by mentalizing abilities (Bo et al., 2014). Further, childhood trauma scores were based on self-report which may be prone to response bias (MacDonald et al., 2016) including social desirability. Lastly, IQ was estimated using only two subtests.

Fig. 1. Scatterplot of the association between childhood physical neglect and Hinting Task performance in homicide offenders with schizophrenia (n = 25).
Missing data in HOS group: n = 25 for CTQ sexual abuse. Missing data in non-HOS group: n = 25 for EmoBio emotion abuse. EmoBio = Emotion in Biological Emotion. PFA = Pictures of Facial Affect. MSCaff = Movie for the Assessment of Social Cognition. MASCCog = affective ToM. CTQ = Childhood Trauma Questionnaire.

*significant associations (p < 0.05) of at least medium size (Spearman’s rho > 0.30) selected for follow-up analyses.

1 n = 24: 1 missing data, 1 outlier removed.
2 n = 25: 1 outlier removed.
3 n = 27: 1 outlier removed.

5. Conclusions

In conclusion, and in spite of the noted limitations, this study provided initial support of an association between childhood physical neglect and adult cognitive ToM in homicide offenders with schizophrenia. The most powerful intervention to avoid psychosis – and its accompanying feature of social cognitive impairment and, for some individuals, homicide – may well be public health interventions that seek to reduce exposure to known risk factors (Murray et al., 2021), such as childhood neglect. On a smaller scale, we recommend assessment and treatment of trauma and social cognitive impairment in schizophrenia, using trauma-informed care principles where the impact of childhood trauma on adult high-risk behavior is acknowledged (Levenson et al., 2016).

CRediT authorship contribution statement

Anja Vaskinn: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. Katharina N. Engelstad: Conceptualization, Methodology, Data curation, Writing – review & editing. Anne-Kari Torgalsbøen: Conceptualization, Methodology, Writing – review & editing. Bjørn Rishovd Rund: Conceptualization, Methodology, Resources, Writing – review & editing, Funding acquisition.

Declaration of Competing Interest

Anja Vaskinn has received honorarium from VeraSci. The other authors report no conflict of interests.

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