

Université du Québec en Outaouais

Les expériences adverses à l'enfance et la théorie de l'esprit chez les personnes ayant un diagnostic de schizophrénie et les personnes ayant un parent ou un membre de la fratrie atteint de la schizophrénie.

Essai doctoral

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Par
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Composition du jury

Les expériences adverses à l'enfance et la théorie de l'esprit chez les personnes ayant la schizophrénie et les personnes ayant un parent ou un membre de la fratrie atteint de la schizophrénie.

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RÉSUMÉ

Les personnes atteintes de schizophrénie présentent fréquemment des difficultés sur le plan de la théorie de l'esprit, soit la capacité à comprendre les pensées et les émotions d'autrui, lesquelles peuvent avoir des répercussions importantes sur leur fonctionnement social. Il demeure toutefois incertain si ces difficultés s'étendent aux apparentés du premier degré de personnes atteintes de la schizophrénie. Par ailleurs, les résultats contradictoires observés dans la littérature pourraient s'expliquer par l'influence de facteurs environnementaux, notamment les expériences adverses durant l'enfance, susceptibles d'affecter à la fois la cognition sociale et la vulnérabilité à la psychose. La présente étude vise à examiner la relation entre les expériences adverses durant l'enfance et les performances en théorie de l'esprit chez des personnes atteintes de schizophrénie, des personnes ayant un apparenté au premier degré atteint de schizophrénie et des personnes sans antécédents personnels ou familiaux de psychose. Un total de 115 participants ont complété l'étude, dont 108 ont été inclus dans les analyses (21 ayant la schizophrénie, 35 ayant un parent ou un membre de la fratrie atteint de la schizophrénie, 52 sans antécédents personnels ou familiaux de psychose). La théorie de l'esprit a été évaluée à l'aide d'un score composite combinant les performances à deux tâches validées : la tâche de fausse croyance (*False-Belief Task*) et la tâche d'inférence indirecte (*Hinting Task*). Les expériences adverses durant l'enfance ont été mesurées de façon rétrospective avec le questionnaire *Maltreatment and Abuse Chronology of Exposure*. Les résultats indiquent un effet significatif du groupe sur le score composite de théorie de l'esprit ($p < .001$). Les participants ayant la schizophrénie présentent des performances significativement inférieures à celles des participants sans antécédents personnels ou familiaux de psychose ($p < .001$). Les participants ayant un parent ou un membre de la fratrie atteint de la schizophrénie présentent des performances intermédiaires, se distinguant du groupe de participants ayant la schizophrénie ($p < .001$), mais non des participants sans antécédents personnels ou familiaux de psychose ($p = .073$). Les expériences adverses durant l'enfance sont également significativement plus élevées dans le groupe de participants ayant un parent ou un membre de la fratrie atteint de la schizophrénie que chez les participants sans antécédents personnels ou familiaux de psychose ($p < .001$). Toutefois, aucune différence significative n'est observée entre les participants ayant la schizophrénie et les deux autres groupes (apparentés au premier degré : $p = .097$; sans antécédents personnels ou familiaux de psychose : $p = .106$). Chez les participants sans antécédents personnels ou familiaux de psychose, une plus grande exposition aux expériences adverses durant l'enfance est significativement associée à des performances plus basses dans les tâches de théorie de l'esprit ($r = -.36$, $p = .031$), alors qu'aucune association significative n'est observée dans les groupes de participants ayant la schizophrénie ($r = .21$, $p = .395$) ou ayant un parent ou un membre de la fratrie atteint de la schizophrénie ($r = -.18$, $p = .360$). Cette étude est l'une des premières à examiner conjointement les expériences adverses durant l'enfance et la théorie de l'esprit chez des individus atteints de schizophrénie et des personnes ayant un parent ou un membre de la fratrie atteint de la schizophrénie. Les résultats mettent en lumière que les difficultés de théorie de l'esprit constituent une caractéristique importante de la schizophrénie et suggèrent qu'elles sont moins marquées chez les individus ayant un apparenté au premier degré atteint de schizophrénie. Les expériences adverses durant l'enfance semblent avoir un effet négatif sur la théorie de l'esprit chez les individus sans antécédents personnels ou familiaux de psychose, tandis que, dans la schizophrénie et chez les personnes ayant un apparenté au premier degré, des vulnérabilités

neurodéveloppementales ou des mécanismes compensatoires pourraient atténuer ou masquer ces effets.

Mots-clés : schizophrénie, théorie de l'esprit, expériences adverses durant l'enfance, cognition sociale

AVANT-PROPOS

Le présent essai doctoral s'inscrit dans le cadre du programme de doctorat en neuropsychologie de l'Université du Québec en Outaouais. Il porte sur les liens entre les expériences adverses durant l'enfance et la cognition sociale, plus particulièrement la théorie de l'esprit, auprès de personnes ayant la schizophrénie, ayant un parent ou un membre de la fratrie atteint de la schizophrénie ainsi qu'auprès de participants sans antécédents familiaux de psychose.

Cet essai doctoral est présenté sous la forme d'un article scientifique rédigé en anglais, conformément aux exigences du programme. Le projet a été réalisé sous la direction de Synthia Guimond. Les coauteurs ont contribué à divers niveaux, notamment à la conceptualisation du projet, à la collecte des données, au nettoyage des données et à la révision critique du manuscrit.

Les données utilisées dans le cadre de cet essai doctoral proviennent de deux projets de recherche menés auprès de participants recrutés selon des procédures approuvées par les comités d'éthique de la recherche concernés. Toutes les normes éthiques en vigueur ont été respectées.

L'objectif principal de cet essai doctoral est de mieux comprendre comment les adversités vécues durant l'enfance peuvent influencer les habiletés de théorie de l'esprit chez les personnes ayant la schizophrénie ou présentant une vulnérabilité génétique à développer ce trouble. Les résultats visent à contribuer à l'avancement des connaissances sur les facteurs développementaux susceptibles d'influencer la cognition sociale chez les individus ayant la schizophrénie et ceux ayant un parent ou un membre de la fratrie atteint de la schizophrénie.

CHAPITRE I
ARTICLE SCIENTIFIQUE

Investigating the theory of Mind Deficits in Schizophrenia and those at Familial High Risk, and the Impact of childhood adverse experience.

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Summary

Individuals with schizophrenia often experience difficulties in theory of mind, the ability to understand what others think or feel, which has a major impact on their social functioning. It remains unclear whether difficulties in theory of mind extend to first-degree relatives of schizophrenia. Furthermore, conflicting findings across studies may reflect the influence of environmental factors, particularly childhood adverse experience, which can impact both social cognition and vulnerability to psychosis.

The current study aims to investigate the relationship between childhood adverse experience and theory of mind performance among individuals with schizophrenia, those at familial high-risk, and healthy controls. A total of 115 participants completed the study and 108 were included in the analyses (21 schizophrenia, 35 familial high-risk, 52 healthy controls). Theory of mind was assessed using a composite score combining performances from two validated tasks: the False-Belief Task and the Hinting Task. Childhood adverse experience was measured retrospectively with the Maltreatment Adverse Childhood Experience questionnaire.

We observed a significant effect of group on the theory of mind composite score ($p < .001$). Individuals with schizophrenia had significantly lower theory of mind performance than healthy controls ($p < .001$). Familial high-risk participants showed intermediate performance, differing from the schizophrenia group ($p < .001$) but not from healthy controls ($p = .073$). Childhood adverse experience was also significantly higher in the familial high-risk group than in healthy controls ($p < .001$). However, there was no significant difference between schizophrenia and the other groups (familial high-risk, $p = .097$; healthy controls, $p = .106$). Among healthy controls, greater childhood adverse experience was significantly associated with lower theory of mind performance ($r = -0.36$, $p = .031$), whereas no association was found in the schizophrenia ($r = .21$, $p = .395$) or familial high-risk groups ($r = -0.18$, $p = .360$).

This study is among the first to examine childhood adverse experience and theory of mind together in individuals with schizophrenia and those at familial high-risk. The findings suggest that individuals with schizophrenia show impairments in theory of mind, whereas these are less pronounced in those at familial high risk. Childhood adverse experience appears to negatively affect theory of mind in healthy individuals, while in schizophrenia and those at familial high-risk, neurodevelopmental vulnerabilities or compensatory mechanisms may overshadow or buffer its effects.

Keywords: schizophrenia, theory of mind, childhood adverse experience, familial high-risk, social cognition intermediate

1.Introduction

Schizophrenia is a complex psychiatric disorder characterized by disturbances in perception, cognition, and affect (American Psychiatric Association, 2013). Genetic factors play a major etiological role in the disorder with heritability estimated between 60% and 90% (Hilker et al., 2018; Zhang et al., 2022). The risk of developing schizophrenia is approximately 1% in the general population but increases to 7-10% in individuals with a genetic vulnerability, specifically those with an affected first-degree relative (Chou et al., 2017; Lo et al., 2020). However, genetics alone do not fully explain the disorder (Stilo & Murray 2019). Environmental factors, including obstetric complications, drug use, and traumatic experiences during childhood, interact with genetic risk (Stilo & Murray, 2019). Previous research showed that individuals with schizophrenia have higher prevalence of childhood adverse experience compared to healthy controls, with nearly 75% having experienced childhood adversity (Duhig et al., 2015; Popovic et al., 2019).

Social cognition, especially theory of mind, has been found to be a strong predictor of social functioning in individuals with schizophrenia (Bowie et al., 2006; Fett et al., 2011; Pennou et al., 2021; Thibaudeau et al., 2021). Theory of mind is the ability to attribute mental states to others to predict and explain their behaviors (Green et al., 2008; Green, et al., 2015). For example, if a person places an object somewhere and it is moved while they are away, theory of mind allows us to anticipate that they will search for it in its original location, rather than where it has been moved. Challenges in theory of mind are well documented in schizophrenia and remain present even when controlling for neurocognitive impairments (Weinreb et al., 2022; Wu et al., 2023).

Findings regarding theory of mind in individuals at familial high-risk for schizophrenia are mixed. Some studies have reported theory of mind difficulties in familial high-risk groups,

suggesting that these difficulties may emerge before the onset of illness (Hanun-Rodríguez et al., 2023; Łoś & Gajowiec, 2023; Meijer et al., 2012; Tucci et al., 2023). In contrast, other studies have found no significant differences between familial high-risk individuals and healthy controls (Abreu-Fernández et al., 2025; Cassetta & Goghari, 2014; Kelemen et al., 2004). These mixed findings highlight the need for further research to clarify the role of theory of mind difficulties in this population and the underlying factors influencing them.

Importantly, evidence suggests that theory of mind difficulties are also more prevalent in individuals exposed to childhood adverse experience who have not developed any psychiatric disorders (Germine et al., 2015; Turner et al., 2022; Pelucchi et al., 2023). Furthermore, childhood adverse experience is linked to an increased risk of developing schizophrenia (Chen et al., 2024; Flinn et al., 2025; Rosenfield, et al., 2022). Some studies showed that physical neglect can be a predictor of social cognitive difficulties in schizophrenia, and particularly theory of mind impairments (Cavero et al., 2025; Gorgellino et al., 2025; Rokita et al., 2021; Vaskinn et al., 2021). Childhood maltreatment is also associated with neurocognitive impairments, including lower intellectual functioning, memory, and executive functioning in individuals at familial high risk for psychosis (Berthelot et al., 2015), as well as poorer working memory and inhibitory control in nonclinical populations (Cowell et al., 2015). These findings underscore the importance of childhood adverse experience in individuals with schizophrenia and those at familial risk for schizophrenia. While some studies have explored the relation between childhood adverse experience and neurocognition in individuals at familial high-risk, the relation with theory of mind remains unknown. Childhood adversity may influence theory of mind through stress-related neurodevelopmental mechanisms; however, this effect may differ depending on the underlying vulnerability to psychosis (Aas et al., 2023). In schizophrenia, primary disease processes may

overshadow the effects of trauma, whereas in healthy individuals, variability related to adversity may be more readily detectable.

A better understanding of how adverse childhood experiences can affect theory of mind in individuals with schizophrenia and those at familial high-risk could clarify the previous inconsistencies in the literature. In the current study, our objective was to explore the role of adverse childhood experiences on theory of mind performance in schizophrenia and familial high-risk. More specifically, we aimed to 1) compare the theory of mind performance of individuals diagnosed with schizophrenia, individuals at familial high-risk and healthy controls, and 2) investigate whether higher levels of adverse childhood experiences are negatively associated with the theory of mind performance among individuals with schizophrenia, those at familial high-risk and controls. We hypothesized that 1) theory of mind performance will vary among the three groups: individuals with schizophrenia are expected to have the lowest performance, followed by those at familial high-risk with intermediate performance between the other two groups, and finally, the healthy control group is expected to have higher performance, and 2) higher level of traumatic childhood experiences is expected to be associated with greater difficulties in theory of mind task performance. Given the current state of the literature, it is not possible to predict whether the strength of this association differs across groups. Therefore, the interaction between group and childhood adversity will be explored.

2. Methodology

Participants

A total of 115 participants completed the study and 108 were included in the analyses (21 schizophrenia, 35 familial high-risk, 52 healthy controls). A total of 7 individuals with schizophrenia had performance below chance level on the false belief task and were therefore

excluded, as such performance cannot be reliably interpreted as reflecting theory of mind ability and may instead reflect difficulties with task comprehension or engagement. Their exclusion did not significantly alter the demographic characteristics of the groups (see Table S5). Participants for the current study were recruited through two larger preregistered studies funded by the NARSAD Young Investigator Grant (NCT04681807) and e-RIHM Grant (NCT04159662). These studies included magnetic resonance imaging (MRI) measures. However, the current analyses focus exclusively on behavioral data. Participants were recruited from multiple sources, including the schizophrenia unit at the Royal Ottawa Mental Health Centre; community clinics such as the On Track–Champlain District Regional First Episode Program; and local community services. Additional recruitment methods included online platforms (e.g., eMentalHealth.ca, Kijiji, Facebook, and Twitter), referrals from colleagues, and the Royal Ottawa Mental Health Centre patient registry. Participants were also recruited through first-degree relatives with schizophrenia and other family members.

Inclusion criteria required participants to be between 15 and 55 years of age, except for familial high-risk, who had to be under 35 to ensure that they were still within the primary age-related risk period for developing a psychotic disorder. All participants needed an $IQ \geq 70$ (using the Wechsler Abbreviated Scale of Intelligence; WASI) and the ability to read and speak fluent English. Patients had to have an established diagnosis of schizophrenia or schizoaffective disorder confirmed by the Mini International Neuropsychiatric Interview (MINI), be in an enduring illness state, and have stable medication for at least one month. Familial high-risk individuals had to have a sibling or a parent with a diagnosis of schizophrenia or schizoaffective disorder. If the diagnosis was not made at the Royal, the familial high-risk participants completed a questionnaire (Family Interview for Genetic Studies; FIGS) to confirm the psychotic disorder of the relative. Healthy

controls were required to have no major psychiatric illness or family history of psychosis. Exclusion criteria for all participants consisted of a history of significant neurological or medical disorders which may produce cognitive impairment, a substance use disorder (within the past 3 months), and any MRI contraindication since they were part of a larger brain imaging study (e.g., metallic head implant, history of seizure, pacemaker, etc.).

The current study obtained ethical approval from the University of Quebec in Outaouais's ethics committee (#2024-2904) and data collection for the two larger studies took place at the Royal Mental Health Institute (REB # 2018037 and 2019033). Prior to participation, all participants provided written, informed consent.

Clinical measures

Individuals with schizophrenia and those at familial high-risk completed assessments to measure levels of positive and negative symptoms. For participants with schizophrenia, the Positive and Negative Syndrome Scale (PANSS) was used, while the Family Interview for Genetic Studies (FIGS) was used for those at familial high-risk to verify psychotic family history (Kay, Fiszbein et Opler, 1987; NIMH Genetics Initiative, 1992). The Structured Interview for Prodromal Syndromes (SIPS) was also administered to familial high-risk individuals to document the presence of psychotic symptoms (Woods et al., 2010). The Wechsler Abbreviated Scale of Intelligence (WASI) was conducted for all participants to ensure they possessed the cognitive capability required for completing the study (Wechsler, 2008).

False Belief task

The False Belief task assesses the ability to predict behavior based on mental states (Dodell-Feder et al., 2014; Saxe and Kanwisher, 2003). This task includes 20 short narratives about forming a representation. There were two conditions in the task: (1) 10 false belief stories

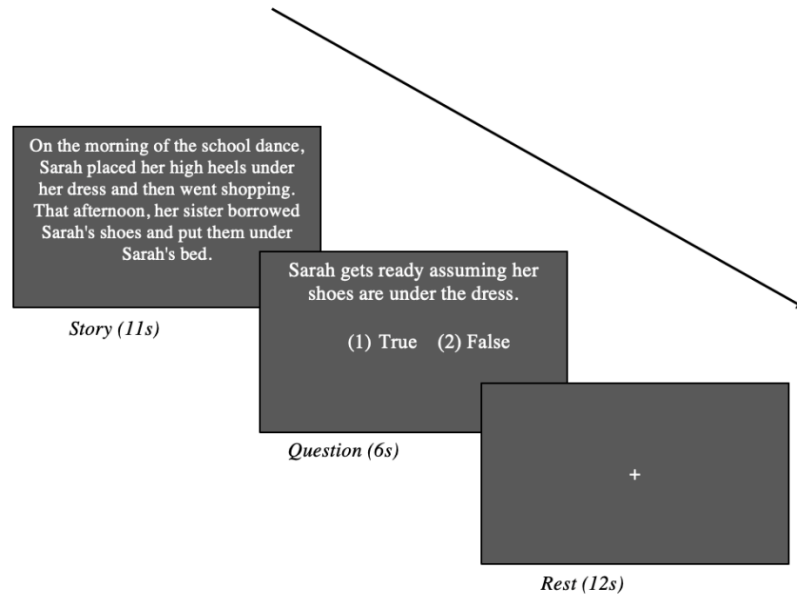
describing a belief and actions based on that belief (e.g., "On the morning of the school dance, Sarah placed her high heels under her dress and then went shopping. That afternoon, her sister borrowed Sarah's shoes and put them under Sarah's bed."), and (2) 10 stories describing physical states in the world using photographs, drawings, or maps (e.g., "The traffic camera took a picture of the black car as it ran the red light. Shortly after, the car was painted red, and the license plates were changed.").

Participants then responded to a true or false question related to either a reality-based situation or a false representation (e.g., false belief: "Sarah gets ready assuming her shoes are under the dress"; False Photograph: "According to the traffic camera, the car is black"). Both the false belief and false photograph stories required participants to represent false content. The main difference between the two conditions lied in the type of content presented. The false photograph condition served as a control condition, as it used similar reasoning processes as the False Belief task but did not require inferring another person's mental representations.

The task was conducted during a functional magnetic resonance imaging (MRI) scan. Each participant had two experimental runs lasting 5 minutes each. Each run comprised with blocks of stories, including five false belief stories (false belief condition) and five stories describing photograph (control condition). Stories from the two conditions were presented in an alternating sequence. Stories are presented for 11 seconds, followed by true or false questions for 6 seconds, and then a 12-second rest period where the participant fixated on a cross at the center of the screen. The False belief task showed good convergent validity with the Hinting Task (Hegde et al., 2021). For the analyses, False Belief Task performance was based exclusively on accuracy in the false-belief condition, as this condition specifically assesses theory of mind abilities.

Figure 1

A schematic diagram of the False Belief task showing the sequence of a single block.



Hinting task

The Hinting Task assesses the ability to infer intentions from indirect verbal cues (Corcoran et al., 1995). This task was done outside the MRI scanner. The experimenter had to read 10 short stories to the participants, in which one character subtly hints at a desire or intention and another character responds. After each story, participants were asked a question requiring them to infer the character's intended meaning (e.g., "Rebecca's birthday is approaching. She says to her dad: 'I love animals, especially dogs.'", "What does she mean when she says that?"). Responses were scored based on accuracy: a complete answer received a score of 2. If the participant's answer reflected only part of the hint or was incomplete, the experimenter provided an additional sentence as a clue (e.g., "Will the pet shop be open on my birthday, Dad?"). A correct response after the clue received a score of 1, while an incorrect response was scored as 0. Scenarios were presented one at a time, with no time limit for reading or responding. The Hinting Task demonstrates a good

construct validity and sensitivity to theory of mind impairments, especially in individuals with schizophrenia (Corcoran et al., 1995).

MACE

The Maltreatment and Abuse Chronology of Exposure (MACE) is a 52-item self-report scale designed to assess the severity of exposure to ten types of maltreatment (Teicher and Parigger, 2015). For each of the 52 adverse experiences assessed, participants indicate whether the experience occurred and, if applicable, the age(s) at which it occurred by selecting the corresponding years from ages 1 to 18. Various forms of abuse or maltreatment, such as physical violence, sexual abuse, and exposure to domestic violence, were included. According to the study by Teicher, M. H., et al. (2015), the MACE demonstrated good convergent validity, correlating well with established retrospective measures of childhood maltreatment. Specifically, it showed a correlation of 0.738 for the severity and 0.698 for the number of traumatic experiences (Teicher, M. H., and Parigger, A., 2015). Questions regarding siblings were excluded due to some participants not having siblings and therefore are not part of the total score. To obtain the scores, each question indicating an adverse experience were scored as 1, and these scores were summed to generate a total score on 30. We focused only on the total MACE score, without dividing the questionnaire into subscales of MACE (Zorowitz et Tuominen, 2022).

Statistical analysis

All demographic and behavioral analyses were performed using R (version 3.5.1, <https://www.r-project.org/>).

Demographic variables were assessed using *ANOVA* for age, and chi-square tests for sex and ethnicity.

To obtain a composite measure reflecting the overall level of theory of mind, scores from the False Belief and Hinting task were converted into z-scores using the mean and standard deviation of the full sample, including participants from all three groups. Then, the average of these two measures was calculated for each participant. This approach allows the integration of two distinct assessments of theory of mind, providing a more robust estimate of the theory of mind abilities of the participants while reducing variance associated with single task.

To address the first aim, we conducted a linear model to compare composite theory of mind scores across the schizophrenia, familial high-risk, and healthy control groups, including age and sex as covariates. For the second aim, we conducted a multiple linear regression to examine if there was any association between childhood adversity and theory of mind performance, and if this association differed across groups. We included age and sex as covariates. A total of 20 schizophrenia, 28 familial high-risk and 37 healthy controls have completed both theory of mind tasks and the MACE questionnaire and were therefore included in this specific analysis.

Finally, we also explored if there was any group difference regarding the amount of childhood adversity reported in each group using the MACE.

3. Results

Demographics results

Table 1 shows significant between-group differences in age and sex between our groups. Therefore, we use age and sex as covariable in all our analysis.

Table 1

Demographic characteristics of schizophrenia, familial high-risk and healthy control individuals.

	Schizophrenia	Familial high-risk	Healthy controls	
	(n = 21)	(n = 35)	(n = 52)	
	N	N	N	<i>p-value</i>
Sex (Female/Male)	6/15	28/7	28/24	< .001
Ethnicity (Caucasian/Other/Missing)	10/8/3	25/6/4	19/23/10	0.206
	Mean/SD	Mean/SD	Mean/SD	<i>p-value</i>
Age	38.43/10.64	27.03/5.37	27.79/7.85	< .001
PANSS	61.71/9.56	NA	33.33/4.36	< .001
ToM composite score	-0.73/0.99	-0.007/0.60	0.28/0.76	< .001
False Belief score	0.71/0.04	0.79/0.03	0.84/0.02	0.006
Hinting task score	13.85/3.12	16.71/2.55	17.67/2.27	< .001
MACE total score	9.00/6.75	12.67/6.96	6.19/4.84	< .001

Note. SD = standard deviation; IQ = Intellectual quotient, PANSS = Positive and Negative Syndrome Scale. ToM composite score = Represents a z score, based on the overall performance at theory of mind tasks, including False Belief and the Hinting task. MACE = Maltreatment and Abuse Chronology of exposure.

Theory of mind

We observed a significant group effect on the theory of mind composite score, $F(2, 103) = 13.57$, $p < .001$ with a small effect size ($\eta^2 = .20$). Neither age ($p = .149$) nor sex ($p = .211$) significantly predicted theory of mind composite score. Pairwise analyses indicated that individuals with schizophrenia had a significantly lower performances than the healthy controls ($p < .001$). The familial high-risk group demonstrated intermediate performances, which did differ significantly from the schizophrenia group ($p < .001$), but not from healthy controls ($p = .073$) (See supplementary Table S3).

Figure 2

Theory of mind task performance across groups.



Note. FHR = Familial High-risk. Each boxplot displays the median (horizontal line). The vertical lines are whiskers. “*” indicates significant differences between the groups ($p < .05$).

Childhood adverse experience (MACE)

Group difference for mace across groups

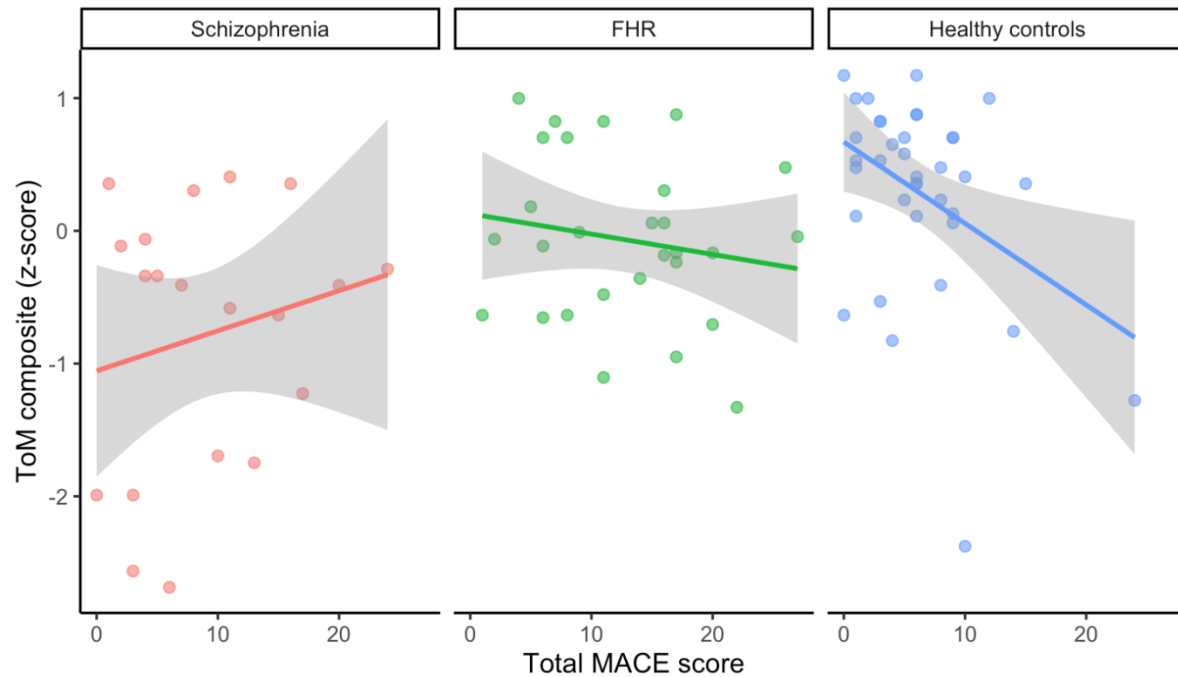
Linear model examining group differences in overall childhood adverse experience, controlling for age and sex, revealed a significant effect of group, $F(2, 53) = 8.79, p < .001$. Neither age ($p = .621$), sex ($p = .310$) significantly predicted childhood adversity scores. Pairwise analyses indicated that individuals in the familial high-risk group reported significantly higher levels of childhood adverse experience compared to healthy controls ($p < .001$). No significant differences were found between the schizophrenia group and the familial high-risk group ($p = .097$) or healthy controls ($p = .106$).

Theory of mind in association with childhood adverse experience

We observed a significant group interaction on the relationship between theory of mind scores and childhood adversity scores $F(2, 77) = 3.28, p = .043$. Neither age ($p = .299$) nor sex ($p = .277$) was significantly associated with theory of mind performance. Partial correlation controlling for age and sex revealed for healthy controls that higher childhood adversity was significantly associated with lower theory of mind performance ($r = -.36, p = .031$). However, there was no significant association between the childhood adverse experience and the theory of mind performance for schizophrenia ($r = .21, p = .395$) and those at familial high-risk ($r = -.18, p = .360$) (see Supplementary Table S4).

Figure 3

Association between theory of mind performance and the level of childhood adverse experience.



Note. FHR = Familial high-risk. MACE = Maltreatment and Abuse Chronology of exposure.

4. Discussion

The current study aimed to investigate the relationship between childhood adverse experience and theory of mind in schizophrenia and familial high-risk individuals. While individuals with schizophrenia showed significant challenges in theory of mind, we only found that greater exposure to childhood adverse experiences was associated with lower theory of mind ability among healthy controls. No association was found in either individuals with schizophrenia or those at familial high-risk.

The reduced theory of mind found in those with schizophrenia compared to healthy controls, reinforces the view that mentalizing difficulties are present in the disorder (Mike et al., 2019; Weinreb et al., 2022; Wu & Shen, 2023). Deficits in theory of mind contribute to difficulties in interpersonal relationships and social functioning (Fett et al., 2011). Theory of mind has been shown to be one of the strongest predictors of social functioning in schizophrenia (Fett et al., 2011; Pennou et al., 2021). Therefore, theory of mind is an important treatment target to consider in that population.

Contrary to our hypothesis, we did not observe any significant association in our sample between theory of mind and childhood adverse experience in schizophrenia, nor in the familial high-risk group. This contrasts with previous studies (Cavero et al., 2025; Gorgellino et al., 2025; Rokita et al., 2021; Vaskinn et al., 2021). The only significant association between childhood adversity and theory of mind was in healthy controls, which aligns with prior studies in non-psychiatric population (Germine et al., 2015; Turner et al., 2022). Baseline differences in theory of mind levels may have an influence on the observed associations. For instance, most healthy controls showed preserved theory of mind abilities, with most scores falling within the typical range, which may have left more room for childhood adversity to be associated with reductions in

performance in this group. In contrast, the theory of mind impairments in schizophrenia were already important, which may leave little room to detect additional declines related to childhood adversity on theory of mind performance. Therefore, this could reflect a floor effect that limited the ability to detect additional variance related to childhood adversity.

It is also possible that individuals with higher levels of childhood adversity, such as those at familial high-risk in our sample, developed adaptive responses to chronic familial stress that shaped their theory of mind. In this context, compensatory mechanisms, including stronger mentalizing skills or greater parental attention, may have buffered the negative effects of adversity on theory of mind (Buchanan et al., 2024; Cojocaru, et al., 2024). One study supports this idea and highlighted that optimal parental bonding attenuated the effect of childhood adversity on social cognition, which suggest that protective developmental factors can mitigate the influence of adversity on social cognition processes (Rokita et al., 2021). This may also help explain why findings on theory of mind in high-risk individuals remain inconsistent. Previous studies reported that individuals with familial high-risk have lower theory of mind abilities compared to healthy controls (Hanun-Rodríguez et al., 2023; Łoś & Gajowiec, 2023; Meijer et al., 2012; Tucci et al., 2023). However, other studies did not find any significant differences (Abreu-Fernández et al., 2025; Cassetta et Goghari, 2014; Kelemen et al., 2004). The current study also shows that familial high-risk individuals performed significantly better than the schizophrenia group on the theory of mind task and while they had an intermediate performance, they did not significantly differ from controls. This intermediate pattern suggests that familial vulnerability may be associated with subtle theory of mind difficulties that are less pronounced than in schizophrenia and may be partially offset by compensatory mechanisms. Future research should explore factors that may

influence theory of mind outcomes in individuals at familial high-risk of psychosis exposed to early adversity, such as quality of parental bonding and social support.

The fact that individuals with schizophrenia in our sample did not report significantly higher overall childhood adverse experience compared to healthy controls is not in line with previous findings (Cavero et al., 2025; Gorgellino et al., 2025; Rokita et al., 2021; Vaskinn et al., 2021). This may be a specificity of our sample important to consider while interpreting the current findings. In addition, this might be related to the self-report measure for childhood adverse experience we used in the current study. Recall bias, reduced autobiographical memory specificity, and broader cognitive difficulties associated with psychosis may affect MACE scores and partly explain the discrepancy between our findings and the existing literature (Berna et al., 2016; Mihaljević-Peleš et al., 2019). Furthermore, participants with schizophrenia in our sample were older than healthy controls, which may have increased the temporal distance from childhood experiences and further exacerbated recall difficulties. The MACE has been shown to be more sensitive than other measures of childhood adversity, such as the Childhood Trauma Questionnaire (CTQ), in psychiatric populations (Boisselier, N., et Soubelet, A., 2023; Fosse et al., 2020). However, to our knowledge, only two studies have used the MACE in schizophrenia to assess childhood adversity (Teicher et Parigger, 2015; Rokita et al., 2021), and neither compared them to healthy controls. For that reason, it is difficult to make strong conclusion regarding the group differences. Further research using the MACE to assess childhood adversity in individuals with psychosis compared with healthy controls is needed.

Strength and limitations

To the best of our knowledge, the current study is the first to directly compare individuals with schizophrenia, those at familial high-risk, and healthy controls within the same design,

providing a comprehensive view on theory of mind and childhood adversity level across groups. Another strength of the study is the use of validated childhood adverse experience measure and a composite theory of mind score which combine two validated tasks administered at separate time points, thereby enhances reliability.

This study also has some limitations. First, sibling-related items from the maltreatment adversity childhood exposure questionnaire were removed because not all participants had siblings, which reduced the richness of the childhood adversity data, an aspect that may be particularly relevant for the familial high-risk group. Second, we did not investigate the timing of childhood adverse events even though the age at which adversity occurs is likely to shape its impact on social cognition (Enlow et al., 2012; Seguí-Grivé et al., 2024). Third, self-report measures of childhood adverse experience may have been affected by recall or reporting biases, especially in the schizophrenia group, where cognitive impairments can hinder autobiographical memory (Berna et al., 2016). More research needs to explore the impact of these factors on the maltreatment adversity childhood exposure questionnaire. Also, the cross-sectional nature of the study limits any inference about causal relationships between childhood adversity and theory of mind. Finally, the relatively modest sample sizes in the schizophrenia and familial high-risk groups limit the statistical power and generalizability of the findings. Finally, although the broader studies included functional magnetic resonance imaging (fMRI), these data were not included in the present analyses. Future research integrating behavioral and fMRI data could provide additional insight into the neural processes underlying the association between childhood adversity and theory of mind across levels of psychosis vulnerability. Given the relatively small sample size and cross-sectional design, these interpretations remain tentative. Despite these limitations, the study helps contextualize how childhood adversity may relate to social-cognitive functioning across levels of

psychosis vulnerability. The differential patterns observed across healthy controls, familial high-risk individuals, and those with schizophrenia suggest that baseline differences in social-cognitive functioning may influence the detectability of adversity-related effects.

Conclusion

This study provides evidence that theory of mind difficulties are present in schizophrenia, and that they are less pronounced in individuals at familial high-risk. Childhood adverse experiences were associated with poorer theory of mind performance only in healthy controls. The absence of a similar association in schizophrenia and familial high-risk groups suggests that the relationship between childhood adversity and theory of mind may differ in the context of psychosis vulnerability. One possible explanation is that individuals at familial high risk may develop some degree of resilience or coping strategies that reduce the impact of early adversity on social cognition. Understanding what supports this resilience could help guide prevention and early intervention efforts. Future studies with larger samples are needed to examine factors related to childhood adversity that may influence its association with theory of mind in psychosis and familial high-risk populations.

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Declaration of competing interest

SG has received consulting fees from Boehringer Ingelheim Canada within the last five years.

Author Contributions

Conceptualization: HS, BB, JY, SG

Study design: HS, BB, JY, SG

Methodology: HS, BB, JY, SG

Data collection: LSB, HS, BB, JY, ML

Data curation: LSB,

Formal analysis: LSB, SG

Interpretation of data: LSB, SG, LT, MK

Visualization: LSB, SG

Writing – original draft: LSB, SG

Writing – review and editing: LSB, HS, BB, ML, JY, SG, LT, MK

Supervision: SG

Project administration: JY, HS, BB, SG

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Supplementary Tables

In this section, we report additional analyses in which we examined different variables that may contribute to the childhood adversity and theory of mind scores across the different group.

Table S1.

Theory of mind and mood partial correlations in each group.

Theory of mind composite	Depression		Anxiety	
	r	p	r	p
Schizophrenia (n=20)	.33	.162	-.05	.849
Familial high-risk (n=35)	.006	.972	.005	.979
Healthy controls (n = 27)	.07	.817	.22	.458

Note. Covariates included (age and sex). This analysis was conducted to examine whether there was group difference regarding the relation between theory of mind and mood.

Table S2.

Childhood adverse experience and mood partial correlations in each group.

MACE scores	Depression		Anxiety	
	r	p	r	p
Schizophrenia (n=20)	.41	.083	.49	.035*
Familial high-risk (n=35)	.58	.001*	.61	< .001*
Healthy controls (n = 27)	.097	.739	.66	.009*

Note. Covariates included (age and sex). This analysis was conducted to examine whether there was group difference regarding the relation between childhood adversity and mood.

Table S3.

Detailed theory of mind group differences using an analysis of covariance (ANCOVA) and follow-up pairwise ANCOVAs.

	False Belief	Hinting Task	Composite score
SZ - FHR	$p = .093$	$p < .001^*$	$p < .001^*$
SZ - HC	$p = .004^*$	$p < .001^*$	$p < .001^*$
HC - FHR	$p = .152$	$p = .092$	$p = .073$

Note. SZ = Schizophrenia, FHR = Familial high-risk, HC = Healthy controls. Covariates included (age and sex). These analyses were conducted to analyse the pattern of theory of mind performances across the task and the group.

Table S4.

Theory of mind composite scores and childhood adverse experience partial correlations in each group.

Group	r	p value
Schizophrenia (n = 20)	.21	.395
Familial high-risk (n = 28)	-.18	.360
Healthy controls (n = 37)	-.36	.031*

Note. Covariates included (age and sex). These analyses represent the second aim of the study in which we explored the relation between theory of mind and childhood adversity in each group.

Table S5.

Sample characteristics before and after exclusion of participants.

Schizophrenia group	Before quality control (n = 28)	After quality control (n = 20)	<i>p</i> value
Age Mean / SD	38.54 +/- 10.63	38.43 +/- 10.64	<i>p</i> = .972
Sex Female / Male	8/20	6/15	Fisher's exact <i>p</i> = 1.0

Note. SD = standard deviation. Independ-samples t-test was used to compare age between participants included before and after quality control of the false belief task. Fisher's exact test was used to compare sex distribution

Conclusion de l'essai

En conclusion, cette étude met en évidence des difficultés de théorie de l'esprit chez les personnes ayant la schizophrénie. En revanche, les personnes ayant un parent ou un membre de la fratrie avec la schizophrénie présentaient de meilleures performances que les personnes atteintes de schizophrénie, sans toutefois différer significativement des personnes sans antécédents personnels ou familiaux de psychose. Les expériences adverses durant l'enfance étaient associées à des performances plus basses dans les tâches de théorie de l'esprit uniquement chez les personnes sans antécédents personnels ou familiaux de psychose. Ces résultats suggèrent que la relation entre l'adversité durant l'enfance et la cognition sociale pourrait varier selon le niveau de vulnérabilité à la psychose. Des études menées auprès d'échantillons plus importants sont nécessaires afin de mieux comprendre les facteurs susceptibles d'influencer cette relation.

CHAPITRE II

LES RÉFÉRENCES

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ANNEXE

Le *Journal of Psychiatric Research* a été retenu comme revue cible pour la publication du présent article puisqu'il cible les thématiques abordées dans cette étude. En effet, cette revue publie des travaux portant sur les troubles psychiatriques ainsi que sur les facteurs environnementaux, sociaux et psychologiques qui leur sont associés. La présente étude, qui examine les relations entre les expériences adverses durant l'enfance, la théorie de l'esprit chez des personnes ayant la schizophrénie ou ayant un parent ou un membre de la fratrie atteint de la schizophrénie, s'inscrit directement dans ces champs d'intérêt.

Le manuscrit a été préparé en fonction des consignes du *Journal of Psychiatric Research*.

L'article comprend les principales sections attendues pour un article de recherche empirique, soit une introduction, une méthodologie, les résultats et une discussion. Il comprend également un résumé, des mots-clés, les références ainsi que les tableaux et figures pertinents. Le résumé doit être concis et factuel et comporter un maximum de **250 mots**. Il doit présenter brièvement l'objectif de l'étude, les principaux résultats et les conclusions principales. Les articles originaux sont limités à **4 000 mots pour le corps du texte**. Le résumé, les références, les légendes des figures, les remerciements et les déclarations de conflits d'intérêts sont exclus de cette limite. Les tableaux doivent être présentés sous forme de texte éditable et être numérotés selon leur ordre d'apparition dans le texte. Les figures doivent également être numérotées selon leur ordre d'apparition et être accompagnées d'une légende. Les références doivent être présentées de façon uniforme et contenir les informations bibliographiques nécessaires ; l'inclusion du DOI est fortement recommandée lorsqu'il est disponible.