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Title: Cognitive reserve moderates the relationship between childhood maltreatment, objective and subjective cognition, and psychosocial functioning in individuals with first-episode psychosis

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ABSTRACT

Objective: This study aimed to assess the relationship between CM, objective and subjective cognition, and psychosocial functioning in adults with first-episode psychosis (FEP) by examining the moderating role of cognitive reserve (CR). A secondary objective was to explore whether unique CM subtypes (physical and/or emotional abuse, sexual abuse, physical and/or emotional neglect) were driving this relationship.

Method: Sixty-six individuals with FEP (M_{age} = 27.3, *SD* = 7.2 years, 47% male) completed a comprehensive neuropsychological test battery, the Cognitive Complaints in Bipolar Disorder Rating Assessment (COBRA), the Functioning Assessment Short Test (FAST), the Childhood Trauma Questionnaire (CTQ), and the Cognitive Reserve Assessment Scale in Health (CRASH). Linear regression analyses were conducted to evaluate the interaction effect of CR between CM, cognitive and psychosocial variables, controlling for age, sex, and social desirability (CTQ-denial-minimisation).

Results: In adults with FEP overall CM interacted with CR to predict COBRA-subjective cognitive complaints, but not neurocognitive or psychosocial functioning. Sexual abuse and physical neglect interacted with CR to predict verbal memory. Most of CM subtypes interacted with CR to predict FAST-leisure time, whereas only emotional neglect interacted with CR to predict FAST-interpersonal relationships. Overall, greater CR was related to better functioning.

Conclusions: The current results indicate that associations between specific CM subtypes, subjective and objective cognition, and psychosocial domains are moderated through CR with greater functioning. Early interventions focused on CR seeking to improve cognitive and psychosocial outcomes, with emphasis on improving subjective cognitive functions would be beneficial for individuals with FEP and CM.

Keywords: Childhood Trauma; Memory; Subjective Cognitive Complaints; Interpersonal Relations; Early Psychosis

Clinical impact statement: This study suggests that cognitive reserve moderates the relationship between childhood maltreatment, objective and subjective cognition, and psychosocial functioning as a protective factor in adults with first episodes of psychosis. This finding highlights the importance of developing cognitive reserve treatment approaches that seek to prevent cognitive (e.g., memory) and psychosocial (e.g., social relations and leisure) dysfunctions and to improve subjective cognitive functions for people with early psychosis and childhood maltreatment histories.

1. INTRODUCTION

Psychotic disorders are among the leading causes of functional disability and a public health concern worldwide (Anderson, 2019). Impairments in cognitive and psychosocial functioning are both core features from early stages of the disorders, representing the main obstacles to recovery (Harvey et al., 2022; McCleery & Nuechterlein, 2019; Velthorst et al., 2017). However, there is considerable heterogeneity in the cognitive and psychosocial profile of psychotic disorders (Menezes et al., 2006; Mørkved et al., 2020), and factors that may explain this variability -besides clinical severity and treatment side effects- remain poorly understood.

Exposure to childhood maltreatment (CM), including all subtypes of physical and/or emotional abuse, sexual abuse, physical and/or emotional neglect, occurring under 18 years of age (Gilbert et al., 2009) could represent a factor of interest. A large proportion of individuals with a psychotic disorder are exposed to CM (Bonoldi et al., 2013), with prevalence rates as high as 85% in schizophrenia spectrum disorders (Larsson et al., 2013). At least one subtype of CM is reported by 61% of individuals with first-episode psychosis (FEP) (Breitborde et al., 2009), with emotional abuse being the most frequent subtype reported (Vila-Badia et al., 2021).

CM is related to neurobiological (Smith & Pollak, 2021; Teicher & Samson, 2016), clinical characteristics (Teicher et al., 2021), and social pathways (Heriot-Maitland et al., 2022; McCrory et al., 2019, 2022) that may lead to cognitive (Schalinski et al., 2018) and psychosocial impairment (Rodriguez et al., 2021) in people with psychotic disorders. The cognitive difficulties associated with CM include alterations in neurocognitive functions such as

worse executive functioning, working memory (Vargas et al., 2019), attention, concentration, mental speed processing, and verbal intelligence (Aas et al., 2011; Campbell et al., 2013). In addition, a history of CM seems to be particularly important when considering the aetiology of subjective cognitive impairment (Mitchell, 2008), involving daily subjective cognitive difficulties and complaints (Lantrip et al., 2023). Furthermore, there is sound evidence of a relationship between CM and psychosocial impairment in people with psychotic disorders, such as difficulties in global functioning and establishing or maintaining social roles and relationships (Alameda et al., 2014; Christy et al., 2022; Fares-Otero et al., 2023a). While there is a wealth of research of an association between CM, objective and subjective cognition, and psychosocial impairment, little is known so far about the effect modifiers through which this relationship either decrease or increase. Examining potential factors associated with differential cognitive/psychosocial outcomes in individuals with FEP would be valuable to optimally target prevention strategies and personalise early treatment efforts (Arango et al., 2022; Vieta & Berk, 2022).

Cognitive reserve (CR), namely the ability of an individual to flexibly and efficiently make use of available brain resources and cognitive networks to adapt functionally and structurally in response to the environment (Kolb & Gibb, 2011), is thought to actively resist the effects of illness-related changes (Stern, 2002; Stern et al., 2020) and to be a protective factor for cognitive and psychosocial outcomes in FEP (Amoretti et al., 2022; Amoretti & Ramos-Quiroga, 2021). Considering that the development of CR is closely related to brain plasticity and to all aspects of life experience (Stern, 2009) and that people with higher CR may present better cognitive and psychosocial functioning in the illness course (Herrero et al., 2020), there is surprising dearth of empirical research investigating the interplay between objective and subjective cognition, psychosocial functioning and CR, least of all in individuals with FEP and CM histories. Therefore, to provide understanding of the link between CM and cognitive and psychosocial outcomes, examining potential moderating effects of CR is required.

CM is frequently studied as a general category or as an individual subtype, however there are also differential associations between specific CM subtypes and various cognitive and

psychosocial outcomes in people with psychotic disorders (Christy et al., 2022; Mørkved et al., 2020). Given the frequent co-occurrence of CM subtypes (Kim et al., 2017), research has demonstrated the importance of accounting for the effects of CM subtypes to differentiate between unique and shared associations. While CM subtypes are individually associated with cognitive and psychosocial outcomes, physical neglect followed by physical abuse are the strongest predictors of cognitive impairment in people with psychotic disorders (Aas et al., 2012), yet only physical neglect seems to be associated with attention and working memory impairment (Mørkved et al., 2020). In addition, meta-analytic research indicates that all CM subtypes except sexual abuse (Christy et al., 2022) are associated with global functioning, with emotional and physical neglect emerging as primary predictors of functional outcomes. Moreover, most CM types are negatively associated with social functioning and interpersonal relations, but unrelated to independent living or occupational functioning (Fares-Otero et al., 2023a) in psychotic disorders. As such, there is empirical support for differential relationships between CM subtypes and specific cognitive and psychosocial dimensions.

Consequently, the primary objective of the current study was to examine if CR moderates the association between CM, objective and subjective cognition, that is, neurocognitive function and subjective cognitive complaints, and psychosocial functioning in adults with FEP. The secondary objective was more exploratory in nature and sought to investigate whether unique maltreatment subtypes (physical and/or emotional abuse, sexual abuse, physical and/or emotional neglect) were driving this relationship. We hypothesised that CR moderates the relationship between CM and cognitive and psychosocial outcomes as a protective factor in adults with FEP.

2. METHODS

2.1. Participants and study design

Participants were drawn from the 'Prodromes and Predictors in First Episode Mania and Psychosis'—ProPreF project, a 2-year longitudinal, multicentric study of individuals presenting an affective or non-affective FEP. First data from this larger project in which prodromes, risk

factors and markers of vulnerability were examined, have been recently published (Sagué-Vilavella et al., 2022; Varo et al., 2022; Verdolini et al., 2022).

In this cross-sectional study, we used baseline data to examine the proposed relationships between CR, CM, cognitive and psychosocial outcomes in FEP. The current study was approved by the Regional Committee for Medical Research Ethics (HCB/2017/1020) and was conducted in accordance with the ethical standards as laid down in the Declaration of Helsinki and its later amendments. All participants provided written informed consent prior to their inclusion in the study.

The inclusion criteria were: (i) age between 18 and 45 years at the time of first evaluation; (ii) having experienced a FEP in the previous four years, determined with the Structured Clinical Interview based on DSM-5 criteria (SCID-5); (iii) and being stable or in full or partial clinical remission (i.e., after discharge from the hospital) (Andreasen et al., 2005).

The exclusion criteria were: (i) the presence of mental intellectual disability (defined as intelligence quotient (IQ) < 70); (ii) the presence of any medical condition that may affect neuropsychological evaluation and/or performance; (iii) alcohol or substance dependence in the previous year to study inclusion (except for caffeine and nicotine); (iv) having received electroconvulsive therapy in the 12 months before participation.

2.2. Measures

2.2.1. Clinical assessment

Relevant sociodemographic and clinical data were collected for all participants. Sociodemographic data included age, sex, and education. Parental socioeconomic status (SES) was determined using Hollingshead's Two-Factor Index of Social Position (Hollingshead & Redlich, 2007). The duration of untreated psychosis (DUP) was calculated as the number of days between the first manifestations of psychotic symptoms and the initiation of psychiatric treatment (for those presenting psychotic symptoms at onset). The clinical symptoms were assessed with the Spanish validated versions of the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987), the Young Mania Rating Scale (YMRS) (Young et al., 1978), the

Montgomery–Asberg Depression Rating Scale (MADRS) (Montgomery & Åsberg, 1979), and the Clinical Global Impression Scale (CGI) (Guy, 1976). On each scale, the items were summed to obtain a total score, with higher scores indicating greater severity.

2.2.2. Childhood maltreatment

The presence of CM occurring under 18 years of age was determined using the Spanish version (Hernandez et al., 2013) of the self-report Childhood Trauma Questionnaire-Short Form (CTQ-SF) (Bernstein et al., 2003) compromising 28 items. Five categorical subscales of CM were assessed: physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect, and responses were given in a 5-point Likert scale (i.e., 1 = never true to 5 = very often true) (Bernstein & Fink, 1998). Scores for subtypes of CM were created using the sum of the five items of the CTQ-SF assessing each type of CM, and a total CM score was computed by summing responses to the 28 items. The CTQ-SF minimisation-denial subscale (Church et al., 2017) was used to identify individuals with a tendency to give socially desirable responses or produce false negative reports (e.g., 'When I was growing up, I had the perfect childhood').

In this study, Cronbach alpha for overall CM was $\alpha = 0.850$ and for each subscale of the CTQ-SF was for physical abuse $\alpha = 0.728$, emotional abuse $\alpha = 0.858$, sexual abuse $\alpha = 0.913$, physical neglect $\alpha = 0.526$, and emotional neglect $\alpha = 0.804$. For the social desirability the obtained score was $\alpha = 0.660$.

2.2.3. Cognitive reserve

CR was measured using the Cognitive Reserve Assessment Scale in Health (CRASH), an instrument specifically designed to measure CR in people with severe mental illness (Amoretti et al., 2019). The CRASH provided a global score and for each of the following domains: education, occupation, intellectual and leisure activities including sociability and withdrawal. The score ranges from 0 to 90, with higher scores indicating greater CR.

2.2.4. Neurocognitive function

All participants underwent a comprehensive and standardised neuropsychological assessment when they were stable or in partial remission (Andreasen et al., 2005). The neuropsychological battery measured the following cognitive domains: 1) *Processing speed* index of the Wechsler Adult Intelligence Scale (WAIS-III) (Wechsler, 1955) derived from the performance on the Digit Symbol and Symbol Search subtests); 2) *Working memory* index of the WAIS-III (Wechsler, 1997), derived from the performance on the Digit Span, Arithmetic and Letter-Number Sequencing subtests 3) *Verbal learning and memory* assessed with the California Verbal Learning Test (CVLT) (Delis et al., 1993); 4) *Logical memory* evaluated with the Wechsler Memory Scale 3rd edition (WMS-III) (Wechsler, 1997); 5) *Sustained attention* tested with the Continuous Performance Test–II (CPT-II) version 5 (Conners, 2005); 6) *Executive functioning* evaluated with the computerised version of the Wisconsin Card Sorting Test (WCST) (Berg, 1948), the Controlled Oral Word Association Test (COWAT) (Benton, 1967), including verbal fluency derived from the performance on the phonemic verbal fluency (F-A-S), and semantic fluency (Animal Naming) subtests respectively; 7) *Emotional intelligence* measured using the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) (Mayer et al., 2003). All scores were standardised with respect to the subject's age and/or educational level according to standardised normative data found in the test manual. Higher scores correspond to better performance in all cognitive domains except for attention. All assessments were performed by a trained psychiatrist or psychologist.

2.2.5. Subjective cognitive complaints

The subjective cognitive difficulties/complaints in daily life situations, was measured using the Cognitive Complaints in Bipolar Disorder Rating Assessment (COBRA) (Rosa et al., 2013). Higher scores correspond to higher subjective cognitive difficulties/complaints.

2.2.6. Psychosocial functioning

The Functioning Assessment Short Test (FAST) (Rosa et al., 2007) was used to assess psychosocial functioning referring to the last fifteen days before evaluation. The FAST compromises 24 items grouped in six different areas of functioning: 1) Autonomy; 2) Occupational functioning; 3) Cognitive functioning; 4) Financial issues; 5) Interpersonal relationships; and 6) Leisure Time. Items can be rated using a 4 - point scale, from 0 = no difficulty to 3 = severe difficulty. The global score is calculated by summing up all the scores of each item, ranging from 0 to 72, resulting in a measure of disability where higher scores refer to more serious difficulties.

In FEP, scores from 0 to 9 indicate no impairment; from 10 to 19, represent the category of mild impairment; moderate impairment compromises scores from 20 to 34; scores from 35 to 45 reflect moderate impairment; and scores from 46 to 72 reflect severe impairment (Amoretti et al., 2021).

2.2.6. Covariates

Age, sex, and social desirability (CTQ-SF minimisation-denial) were considered as covariates based on previous reports (Chen & Qin, 2020; Lee et al., 2022). Age was computed using participants' date of birth and the date of first evaluation. Sex was coded as 0 = female and 1 = male. A social desirability score was computed using the sum of the responses to three items (10, 16, 22) of the CTQ-SF minimisation-denial subscale (Church et al., 2017).

2.3. Statistical analyses

Descriptive statistics were used to define sample demographic and clinical characteristics. For estimates of frequencies of CM, predefined cut-offs (Bernstein & Fink, 1998) were used. Continuous variables were given as mean value ± standard deviation (*SD*) and were compared using Student *t*-test. Categorical variables were expressed as total number and percentages, and differences among groups were assessed through Chi-square (χ^2), of Fisher's exact test, as appropriate. Principal Component Analysis (PCA) was performed for neuropsychological

variables in order to avoid redundant information of separate test neurocognitive variables (e.g., free recall and semantic cued recall -short and long delay-of CVLT) and reduce measures to a few principal domains. The neurocognitive assessment was represented by five factor scores (verbal memory -measure of list-learning-, logical memory -story-based verbal task-, executive functions, sustained attention and verbal fluency), two indexes of the WAIS-III (working memory and processing speed), and an estimated IQ (see Table S1 in the supplement). Additionally, an overall neurocognitive composite score (global neurocognitive function) was calculated as an average of all neuropsychological domains. Pearson's correlation analysis was performed to identify the association between CR, CM, neurocognitive function and subjective cognitive complaints (COBRA), and psychosocial functioning (FAST).

Moderation (interaction) analysis was conducted using Linear Regression to examine if the effect of each type of CM and overall CM (continuous and independent variable) on the cognitive and psychosocial functioning (dependent variables) was the same across CR, another independent variable (moderator) (for the moderation analysis assumption see Figure 1). In other words, it was used to examine whether the moderator would change the direction and/or strength of the relationship between the independent and dependent variables. Every analysis included age, sex, and social desirability as covariates based on previous work (Chen & Qin, 2020; Lee et al., 2022). Due to exploratory purposes no multiple testing corrections were performed. Analyses were conducted using R and RStudio 4.2.1, using the 'interactions' package v.1.1.5, and SPSS version 26. Two-sided 95% credible intervals (CI) were reported, and the significance threshold for *p*-value was 0.05.

-Insert Figure 1 about here-

Fig. 1. The conceptual framework of this study

3. RESULTS

3.1. Participants characteristics

A total of 66 individuals were included, *M* age = 27.3, *SD* = 7.2, range = 18 to 44 years, 47% male, who at time of the assessment fulfilled diagnosis criteria for affective or non-affective

FEP (*M* illness duration = 0.62, *SD* = 0.87 years; 70% affective psychosis). Participants showed on average minimal levels of manic (YMRS; *M* = 1.36, SD = 2.55) and depressive (MADRS; *M* = 6.73, SD = 5.29) symptoms, and minimal levels of positive symptoms (PANSS positive score; *M* = 8.32, *SD* = 2.44), negative symptoms (PANSS negative score; *M* = 11.42, *SD* = 5.02), and general psychopathology (PANSS general score; *M* = 24.20, *SD* = 6.77). Further sociodemographic and clinical characteristics of the study population are shown in Table 1.

-Insert Table 1 about here-

Table 1. *Sociodemographic and clinical characteristics of the sample*

3.2. Presence of childhood maltreatment subtypes in the sample

Frequencies reflecting experience of at least one behaviour associated with each CM subtype are shown in Table 1. The most reported CM experience was emotional neglect, followed by physical neglect, emotional abuse, physical abuse, and sexual abuse. Of note, emotional abuse was higher reported (t = -2.065, p = 0.043) in participants with non-affective FEP (n = 20) than with affective FEP (n = 45) (see Table S2 in the supplement).

The results of the CTQ indicate a low-medium burden, thus overall, the sample showed a low-medium degree of suffering CM. Prevalence rates for each type of CM are shown in Table 2, by sex in Table S3, and by diagnoses (affective vs. non affective psychosis) in Table S4 in the supplement. Of note, among participants, those with non-affective FEP (n = 14) reported higher levels of emotional neglect moderate-severe (χ^2= 4.92, p = 0.036) than those with affective FEP (n = 42).

-Insert Table 2 about here-

Table 2. *Prevalence of childhood maltreatment subtypes in the sample*

3.3. Associations between childhood maltreatment, objective and subjective cognition, and psychosocial functioning

Means, *SDs*, and bivariate correlations between key study variables are reported in Table S5 in the supplement. In terms of neurocognitive function, physical abuse was associated with poorer

executive functioning (r = -0.253, p = 0.045, 95% CI [-0.467, -0.012]). In terms of subjective cognitive complaints, overall CM (r = 0.338, p = 0.023, 95% CI [0.105, 0.599]) and emotional abuse (r = 0.306, p = 0.039, 95% CI [0.069, 0.510]) were associated with higher COBRA. Finally, regarding psychosocial functioning, only emotional neglect was associated with poorer FAST-interpersonal relationships (r = 0.258, p = 0.036, 95% CI [0.017, 0.471]).

3.4. Moderation effects of CR between overall CM, objective and subjective cognition, and psychosocial functioning

In terms of overall CM, a moderating effect, after adjusting for age, sex, and social desirability, of CR in the relationship between overall CM and global neurocognitive function (β = 0.147, SE = 0.136, p = 0.288) or psychosocial functioning (FAST-total) (β = -0.014, SE = 0.018, p = 0.418) was not observed (see Table 3). However, overall CM interacted with CR to predict lower subjective cognitive complaints (β = -0.024, SE = 0.010, p = 0.022) and better FAST-leisure time (β = -0.006, SE = 0.003, p = 0.047).

3.5. Moderation effects of CR between CM subtypes, objective and subjective cognition, and psychosocial functioning

In terms of CM subtypes, after adjusting for age, sex, and social desirability, physical (β = -0.110, SE = 0.519, p = 0.041) and emotional abuse (β = -0.066, SE = 0.023, p = 0.008), but any type of neglect or sexual abuse interacted with CR to predict lower COBRA-subjective cognitive complaints. Sexual abuse (β = 1.373, SE = 0.394, p = 0.001) and physical neglect (β = 0.556, SE = 0.251, p = 0.032) interacted with CR to predict verbal memory. Only physical neglect interacted with CR to predict global neurocognitive function (overall neurocognitive composite score) (β = 0.953, SE = 0.441, p = 0.038). Finally, emotional neglect interacted with CR to predict better FAST-interpersonal relationships (β = -0.025, SE = 0.008, p = 0.002), and better FAST-leisure time (β = -0.012, SE = 0.005, p = 0.018). Overall, greater CR was related to better functioning (see Figure 2 and Table 3).

4. DISCUSSION

This study investigated whether CR moderates associations between CM, objective and subjective cognition, and psychosocial functioning in people with FEP. Independent of CR, CM exposure was associated with higher subjective cognitive complaints and poorer neurocognitive function and psychosocial functioning in individuals with FEP, which is in line with previous research (Aas et al., 2011, 2012, 2014; Dauvermann & Donohoe, 2018; Hjelseng et al., 2020; Lantrip et al., 2023; Stain et al., 2014; Vargas et al., 2019). We confirmed a moderation role of CR in the relationship between CM, cognitive and psychosocial outcomes. However, moderation effects of CR differed depending on the subtype of CM and cognitive/psychosocial domain examined, supporting the presence of some specific effects.

As a main finding there was a significant moderation effect of CR in the relationship between overall CM and subjective cognitive complaints, but not between overall CM and neurocognitive function or psychosocial functioning. We found that individuals with FEP who reported overall CM and higher CR experienced less subjective cognitive complaints, so that the effects of CM on less daily cognitive complaints and difficulties were moderated by CR. The finding that CR moderated the subjective cognitive complaints is consistent with existing literature (Jia et al., 2021; Mazzeo et al., 2019) and in line with the majority of research to date has studied how CR is likely to impact cognitive outcomes (Amoretti et al., 2022; Ayesa-Arriola et al., 2021; Grande et al., 2017; Nelson et al., 2022; Opdebeeck et al., 2018).

Moreover, the analyses of CM subtypes revealed that greater CR was associated with lower subjective cognitive complaints in relation to physical and emotional abuse. Regarding neurocognitive function, CR was associated with better verbal memory in relation to sexual abuse and physical neglect. A simple explanation for the differential effects is that certain CM experiences may be unrelated to these cognitive functions. In addition, it could be possible that there was not enough power in the present analysis to detect this relationship. Considering this is the first study to find that the interaction between CM (and its subtypes) and CR were evident for specific cognitive outcomes, replication studies are needed.

Notably, the association between emotional neglect and interpersonal relationships and leisure time was better at higher levels of CR. This pattern is in line with previous research (Buonocore et al., 2022), and may indicate that CR exerts control over social behaviours and leisure time, and has the potential to improve autonomy and social life in those with FEP and a history of neglect. This lack of efficacy over social relations and behaviours is consistent with previous research in survivors (Conaway & Hansen, 1989; Haslam & Taylor, 2022). Without a belief in one´s capability to have control over one´s emotions and behaviours, it is difficult to draw upon any social strategies and execute the associated behaviours. In the case of the current study, the behaviour was to establish and maintain social relationships and spend leisure time. Conversely, self-efficacy towards control over one´s feelings and behaviours has the potential to improve social abilities. Of interest is that neglect is often underestimated and overlooked in clinical assessments (Larsson et al., 2013) and that different CM subtypes frequently co-occur (Kessler et al., 2010). Accordingly, effective CR interventions may include an emphasis in the development of social approaches (Pfaltz et al., 2022) in addition to ecological cognitive strategies in those with FEP and CM, including emotional, physical and sexual subtypes.

Altogether, the analyses of CM subtypes showed moderation effects of CR between specific CM subtypes and cognitive/psychosocial domains, but not clear pattern emerged. The variations across CR within and between samples in the literature may be one explanation for the inconsistent findings regarding whether CM and its subtypes impact the accuracy of cognitive (Dauvermann & Donohoe, 2018) and psychosocial outcomes (Alameda et al., 2014; Christy et al., 2022; Fares-Otero et al., 2023a) in FEP. Also, these inconsistences could be due to individual stress responses, different coping strategies, factors of resilience (Nugent et al., 2014), anxiety and depressive symptoms (García-Moreno et al., 2021; Goltermann et al., 2021), and variability of cognitive and psychosocial functioning in psychotic disorders that is partially explained by genetic risk (Popovic et al., 2019; Richards et al., 2020). In addition, protective and unfavourable environmental factors and related epigenetic effects might also play a role. In our study, the small number of cases in the sub-analyses may have hampered the possibility to reach significant results (e.g., on moderation effects of CR between overall CM and FAST-

interpersonal relationships, and between emotional neglect and subjective cognitive complaints). Also, the limited number of cases in the sub-analyses and the fact that participants showed minimal level of symptoms has prevented us from drawing any substantial conclusion across diagnoses (affective vs. non-affective FEP).

Both cognitive (Büetiger et al., 2023; Popovic et al., 2019; Velikonja et al., 2021) and psychosocial functioning (Christy et al., 2022; Fares-Otero et al., 2023ab; Tzouvara et al., 2023) are implicated in the sequalae of CM and are transdiagnostic mechanisms in the development of psychopathology (McLaughlin et al., 2020). Our exploratory analyses provide insight into understanding the nuances of this relationship. Although CR is studied extensively as a valuable construct to predict cognitive and psychosocial outcomes (Amoretti & Ramos-Quiroga, 2021; Herrero et al., 2020; Nelson et al., 2022), there is a dearth of research regarding whether and how CR interact with cognitive and psychosocial functioning jointly impacted by CM, especially in individuals when psychosis begins to take shape. Further, without an existing theoretical framework explaining associations between CR and CM, this study investigated whether CR moderates between CM, objective and subjective cognition, and psychosocial functioning in a treatment-seeking outpatient sample of adults with FEP. Accordingly, examining CR as a moderator in the relationship between CM subtypes and cognitive and psychosocial functions is worth exploring further in future longitudinal intervention studies in affective and non-affective FEP.

4.1. Strengths and limitations

This study has several methodological strengths, such as, using a well-characterised sample of people meeting diagnostic criteria for FEP (experiencing minimal level of psychotic/mood symptoms). Also, the study taps into an instrument specifically designed to assess CR instead of using socio-behavioural proxies or residual approaches (Stern et al., 2020), and a standardised interview to establish diagnosis. In addition, examining subjective cognitive impairment is as relevant as objective impairment since it assesses cognitive difficulties in the real-life context from a personal perspective and is therefore an essence of individualised medicine, yet under-

recognised and under-studied (Tong et al., 2019). Other strength includes controlling for the CTQ minimisation-denial subscale scores which are infrequently reported (Church et al., 2017).

There are limitations within our study that are important to address and that should be considered when interpreting our findings. First, the cross-sectional data limit our understanding of causal relationships. Because data on CM, CR and cognitive/psychosocial functioning were collected at the same point in time, causal relationships between these study constructs cannot be addressed. Different experiences through life, including adverse childhood environment (Röhr et al., 2022; Sideli et al., 2022) can contribute to CR, which may vary based on the individual´s experiences. Therefore, future longitudinal studies (Vieta & Angst, 2021) involving larger samples are needed to replicate our findings and to determine the causality of associations. Second, the use of a rather small sample compromising of adults with FEP limits the generalisability of our results to healthy adults, mental disorders, or stages of the illness. Indeed, there may not have been enough power to detect interaction effects for the other cognitive and psychosocial domains in the current sample. Despite our exploratory results should be interpreted accordingly, findings would be valuable as they would offer the possibility of targeting the cognitive and psychosocial domains related to CM in the early treatment of people with FEP and CM exposure. Third, our neuropsychological assessment covers several neurocognitive domains, but could be even more comprehensive (e.g., visual, metacognition tasks). Fourth, retrospective self-reports on the presence of CM are subject to recall bias (Hardt & Rutter, 2004). However, empirical studies show that they are sufficiently reliable, and provide strong support for their validity in clinical samples (Baldwin et al., 2019; Newbury et al., 2018). Nevertheless, prospective studies that span childhood to adulthood are needed to examine causal relationships more thoroughly. Fifth, medication status and cannabis use (only in three participants) can be considered a potential confounder, even in patients with FEP (Ilzarbe & Vieta, 2023). Finally, given the lack of research on the topic, we did not make any specific hypothesis regarding the specific cognitive or psychosocial domains and decided to make a more exploratory approach for these domains. By identifying the unique effects of CR on specific CM subtypes and specific cognitive and psychosocial functioning and exploring

how constructs relate to one another in the context of FEP, the fine-grained analyses conducted as part of the current study will contribute to a better understanding of cognitive and psychosocial competence in survivors of CM with FEP. Ideally, analyses should be enriched by multimethod approaches, including imaging, biomarker research, epigenetics and genetics.

4.2. Directions for future research

There are important implications of the current study for future research. Although CR and CM have largely been studied independently, our findings provide support to encourage scholars to further explore the relationship between CR, cognitive and psychosocial functions relative to CM. Moreover, with the implications of CR on verbal memory, subjective cognitive complaints. leisure, and interpersonal relationships in those with FEP and CM histories, examination of the predictive capacity of the moderating relationship found for functioning and social interactions (Alameda et al., 2014; Fares-Otero et al., 2023a; Sideli et al., 2022) is an interesting avenue for future research. Subjective complaints of own cognition are important narratives reflecting one's mental well-being. Additionally, with cognitive impairment and its close associations with abuse experiences, and with social difficulties associated with neglect, our study makes an important contribution to the field of CM by providing support for the interaction between specific CM subtypes and CR and its association with cognitive and psychosocial domains. Since psychopathology, cognitive and psychosocial impairments are associated with all CM subtypes (Pfaltz et al., 2022; Teicher & Samson, 2013), and our findings demonstrated that specific CM subtypes interacted with CR, it may be important to expand the study of cognitive and psychosocial functions beyond abuse and neglect (e.g., domestic violence). In turn, a careful mapping of different types of childhood adversities, timing of the trauma and severity of exposure is important to drive this field forward. Further research should also explore on effect modifiers of CR to highlight potential targets for intervention for those with FEP and build a robust pathway model between CM and cognitive/psychosocial functioning distinguishing between affective vs. non-affective psychoses.

4.3. Implications for clinical practice

Our findings are clinically relevant because they indicate that regular, standardised assessment of both objective performances and subjective complaints of cognitive functions and psychosocial abilities, CR and recording of CM (including all subtypes) are important in individuals with FEP. Research has indicated that building CR is a viable intervention to delay symptomatology, maintain and improve cognitive and psychosocial health (Scarmeas & Stern, 2003; Stern et al., 2019, 2020). Accordingly, CR skills may provide a buffer against the negative impact of CM on cognitive and psychosocial outcomes. The findings in the present study represent a significant contribution to the literature, which has primarily focused on the effects of CM and CR on cognitive and psychosocial outcomes separately, without considering subjective cognition. Our results highlight the moderation effects of CR and identifies adults with FEP and CM histories to be protected on certain neurocognitive and psychosocial abilities as well as subjective cognitive functions by CR. These findings emphasise the importance of CR interventions when providing treatment to adults with FEP and CM histories. Early trauma prevention as well as special CR training could lead to minimising subjective cognitive complaints, neurocognitive and psychosocial deficits even in sub-clinically affected individuals or people at ultra-high risk for psychosis (de la Serna et al., 2021).

5. CONCLUSION

This study examines whether CR moderates between CM, objective and subjective cognition, and psychosocial outcomes among people with FEP. By demonstrating that greater CR was significantly related to lower subjective cognitive complaints and better functioning in neurocognitive and psychosocial domains, the present study provides initial evidence that CR may also impact on accounts of childhood abuse and neglect, but further research is needed to provide definitive answers. This finding points to the importance of continuing to build CR across the lifespan and developing CR treatment approaches that seek to prevent dysfunctional cognitions (i.e., memory) and psychosocial functions (i.e., social relations and leisure), but also place emphasis on improving subjective cognitive functions for those with FEP and CM.

CRediT authorship contribution statement:

Conceptualisation: NEF-O, SA, NV. **Methodology:** NEF-O, SA. **Data collection:** SA, NV, MG, MS-N, MFF, LM, PS-P, IM, VSG, CG-R, IP. **Data curation:** SA, NV, MG, MS-N, MFF, LM. **Writing – original draft:** NEF-O, SA, NV. **Writing – reviewing & editing:** All authors. **Formal analysis, Software:** NEF-O, SA, RB. **Validation:** NEF-O, SA, RB. **Visualisation:** NEF-O, SA, RB. **Investigation:** NEF-O, SA, NV. **Supervision:** NV, EV. **Resources, Funding acquisition:** EV, SA, NV. All authors were involved in the interpretation of the data and approved the final version of the submitted manuscript.

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Data availability statement: The data that support the findings of this study are available from SA upon reasonable request. The data are not publicly available due to privacy restrictions.

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