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Psychopathology mediates between maltreatment and memory functioning in Burundian refugee youth

Florian Scharpf[a,*], Sven C. Mueller[b,e], Faustine Bwire Masath[a,c], Mabula Nkuba[c], Tobias Hecker[a,d]

[a] Department of Psychology, Bielefeld University, Germany
[b] Department of Experimental Clinical and Health Psychology, Ghent University, Belgium
[c] Department of Educational Psychology and Curriculum Studies, Dar es salaam University College of Education, Tanzania
[d] Department of Psychology, University of Zurich, Switzerland
[e] Department of Personality, Psychological Assessment and Treatment, University of Deusto, Bilbao, Spain

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ABSTRACT

Background: The detrimental impact of child maltreatment on children and adolescents' academic achievement and later socioeconomic wellbeing is well known. However, it is still unclear (1) whether maltreatment is actually linked to youth's long- and short-term memory deficits and (2) whether potential impairments are due to maltreatment per se or related psychopathology.
Objective: Based on the Attentional Control Theory, we investigated a mediational model in which maltreatment would be related to psychopathology (internalizing symptoms, posttraumatic stress symptoms, posttraumatic cognitions), which would in turn be related to impaired memory functioning.
Participants and setting: We drew on a sample of 155 Burundian refugee youth (aged 11 to 15) currently living in refugee camps in Tanzania and at high risk of experiencing ongoing maltreatment by parents.
Methods: Youth reported on their experiences of maltreatment and psychopathology in structured clinical interviews and completed visuospatial memory tasks involving a short-term and a working memory component (Corsi Block Tapping Test) and delayed recall from long-term memory (Rey-Osterrieth Complex Figure).
Results: Structural equation modeling showed that psychopathology mediated the association between increased maltreatment and reduced working memory capacity ($\beta = -0.07$, $p = .02$), with a trend towards mediation for short-term memory ($\beta = -0.05$, $p = .06$). Higher levels of maltreatment, but not psychopathology, were directly linked to long-term memory deficits ($\beta = -0.20$, $p = .02$).
Conclusions: Preventive efforts targeting maltreatment and interventions focusing on related psychopathology are needed to counter memory deficits and their potential negative implications for academic and socioeconomic outcomes.

Maltreatment can be defined as any threatened or actual act of physical, sexual, and emotional abuse and neglect by a parent or caregiver that harms or has the potential to harm the child's physical, cognitive, or emotional development (Leeb et al., 2008). Children

* Corresponding author at: Department of Psychology, Bielefeld University, P. O. Box 100131, 33501 Bielefeld, Germany.
E-mail address: florian.scharpf@uni-bielefeld.de (F. Scharpf).

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and adolescents who experienced maltreatment are at an increased risk of developing a range of psychopathology, including post-traumatic stress disorder (PTSD), internalizing problems, e.g., anxiety and depression, and externalizing problems, e.g., aggression and conduct problems (De Bellis et al., 2013; Hecker et al., 2016; Lansford et al., 2014; Palosaari et al., 2013). Moreover, maltreatment has been associated with lower levels of academic achievement that may persist into adulthood (Boden et al., 2007; Mills et al., 2019), impairing the socioeconomic well-being and livelihoods of individuals, families, communities, and societies (Currie & Widom, 2010). Low socioeconomic status (SES) and poverty, in turn, increase the risk of child maltreatment (van IJzendoorn et al., 2020), implying a vicious cycle. It is therefore of utmost importance to identify risk factors for academic achievement in the context of maltreatment.

One factor that appears to be crucial for youth's academic outcomes is working memory. Working memory refers to the temporary maintenance and manipulation of information and is associated with neural activity in fronto-parietal brain areas particularly the dorsolateral prefrontal cortex and the parietal cortex (Chai et al., 2018). Longitudinal studies showed that working memory capacity significantly predicted higher reading ability and mathematical skills in youth (Alloway & Alloway, 2010; Christopher et al., 2012). However, memory is a wide domain and besides working memory, the concepts of short-term memory and long-term memory exist (Chai et al., 2018). Although the distinction between short-term memory and working memory is a matter of ongoing debate (Aben et al., 2012), the multi-component working memory model (Baddeley, 2000) offers a useful framework to conceptualize these memory functions: The central executive controls and coordinates the allocation of resources to two sub-systems associated with short-term storage of verbal (the phonological loop) and visuospatial information (the visuospatial sketchpad). Hence, short-term memory is considered a part of working memory, yet requires relatively fewer cognitive resources from the central executive (Baddeley, 2000). Accordingly, while working memory has been claimed a better predictor of intelligence than short-term memory, this is likely to reflect differences in attentional demands of the respective tasks rather than conceptual differences (Aben et al., 2012). Notwithstanding, findings indicating independent contributions of short-term and working memory to academic achievement (e. g. Bull et al., 2008) suggest that a differentiation between these memory functions may be practically useful. Long-term memory conceptually differs from the other two systems in terms of the period of time that information is stored (Aben et al., 2012). It can be further broken down into declarative memory for facts and events, which engages limbic brain structures, particularly the hippocampus, and non-declarative memory for habits and skills, which relies mainly on the cerebellum and motor cortex (Squire & Zola, 1996). Short-term and long-term memory appear to reflect related, but distinct processes that both contribute to intellectual functioning (Unsworth, 2010).

The neural substrates underlying memory functioning appear to be adversely affected by altered biological stress responses resulting from child maltreatment (Wilson et al., 2011; Young-Southward et al., 2020). Neuroimaging studies with adult victims of child maltreatment demonstrated abnormalities in memory-related fronto-limbic brain structures, such as decreased hippocampal volumes (Hart & Rubia, 2012; Teicher et al., 2012). Neuropsychological studies revealed corresponding deficits in tasks of verbal and visual memory domains in maltreated children and adults (Irigaray et al., 2013; Kavanaugh et al., 2017; Young-Southward et al., 2020). Memory may be directly affected by maltreatment through stress-induced brain changes or indirectly through maltreatment-related psychopathology (Augusti & Melinder, 2013). Some studies suggest that memory deficits in maltreated children are not related to current PTSD symptoms (Augusti & Melinder, 2013; Biedermann et al., 2018; De Bellis et al., 2013), whereas others indicate that PTSD symptoms exacerbate memory functions above and beyond maltreatment (De Bellis et al., 2009, 2010). Similarly, studies with children exposed to war-related (Chen et al., 2019; Elbert et al., 2009) and other traumatic events (Samuelson et al., 2010; Yasik et al., 2007) have produced inconsistent evidence regarding the role of PTSD symptoms. However, a unilateral focus on clinical samples with PTSD may obscure associations between maltreatment and memory functioning by masking memory deficits owing to maltreatment per se and neglecting other common mental health sequelae of maltreatment such as internalizing and externalizing problems (Hart & Rubia, 2012; Stover & Keeshin, 2018).

Attentional Control Theory (Eysenck et al., 2007) provides a useful theoretical framework of how psychopathology may impair performance on cognitive and specifically memory tasks by diverting attention to task-irrelevant internal (e.g., symptoms) and external (e.g., distractors) stimuli. Internalizing symptoms, such as anxious worry and depressive ruminations, are thought to interfere with the central executive's capacity to inhibit task-irrelevant stimuli, shift attention between tasks, and update memory representations (Eysenck et al., 2007). With regard to PTSD, core symptoms such as intrusions and hypervigilance to threat can disrupt attentional control, particularly in the context of emotional cues (Fani et al., 2019; Leskin & White, 2007; Vasterling et al., 1998). Furthermore, maltreatment as a chronic interpersonal trauma may be associated with children's negative beliefs about themselves, e. g., "*I am helpless*", and about the world, e.g., "*the world is a dangerous place*" (Meiser-Stedman et al., 2009). Such appraisals were associated with higher levels of PTSD, internalizing and externalizing symptoms in maltreated youth (Leeson & Nixon, 2011; Münzer et al., 2017). Although it is conceivable that these posttraumatic cognitions may impair memory task performance by draining the central executive's attentional resources, their role for maltreated youth's memory functioning has not been investigated so far. While internalizing problems, PTSD symptoms and posttraumatic cognitions appear to represent different clinical concepts (de Haan et al., 2020), they may impair memory functioning through the same underlying mechanism, i.e., by interfering with attentional resources needed to solve relevant tasks. Moreover, all these symptoms are mediated by prefrontal brain regions (Macdonald et al., 2016; Maier et al., 2012) and thus share neural substrates with short-term/working memory and attentional control (Chai et al., 2018). Therefore, it may be useful to conceptualize them as *attention-interfering symptoms* and examine their joint role in memory functioning.

In the current study, we aimed to investigate the mediational role of potentially attention-interfering psychopathology (internalizing problems, PTSD symptoms, posttraumatic cognitions) in the association between child maltreatment (physical and emotional abuse, neglect) and different visuospatial memory functions (short-term, working, and long-term memory). So far these associations have been mainly examined among children and adolescents in Western high-income countries (Augusti & Melinder, 2013; De Bellis et al., 2010; DePrince et al., 2009), who had usually been recruited from mental health and social services and thus are likely to have had no recent exposure to parental maltreatment, leaving concurrent links between maltreatment, children's psychopathology and

cognitive functioning unclear. However, many children worldwide are living in contexts, particularly in low- and middle-income countries, where violence against children is highly normative and poses an ongoing risk for their well-being and functioning. In such settings, only two studies in Tanzania (Hecker et al., 2016) and in Uganda (Ainamani et al., 2021) provide initial, yet inconsistent evidence on the role of psychopathology in the association between maltreatment and cognitive functioning. Internalizing problems mediated the association between harsh discipline by parents and working memory performance in Tanzanian primary school children (Hecker et al., 2016), whereas PTSD and depressive symptoms did not mediate the relation of maltreatment to working memory and executive functioning in a sample of Ugandan youth (Ainamani et al., 2021). Both studies, however, relied on convenience samples and did not assess the severity of maltreatment. Within low- and middle-income countries, youth living in refugee camps can be considered at a particularly high risk of experiencing ongoing maltreatment by caregivers. In addition to a generally high societal acceptance of violent child-rearing, multiple other risk factors for maladaptive parenting and children's mental health, including high levels of caregivers` mental health problems, widespread poverty, community violence and overcrowded housing, accumulate in these settings (Bermudez et al., 2018; Rubenstein & Stark, 2017). Notwithstanding, we are not aware of any study that has investigated direct and indirect associations between maltreatment, psychopathology and cognitive functioning among children living in resource-poor refugee camps. Chen et al. (2019) found that poverty, but not trauma exposure and PTSD symptoms, were related to working memory deficits of Syrian refugee adolescents living in Jordan. While maltreatment, an ongoing stressor just as poverty, may be similarly relevant for refugee youth's cognitive functioning, it might also be more amenable to change by interventions compared to material conditions, which are often more dependent on policies and external funding. However, to inform interventions, studies determining the role of maltreatment for the psychosocial and cognitive functioning of youth living in refugee camps are needed at first. Therefore, in our study we drew on a representative community sample of Burundian refugee youth living in refugee camps in Tanzania, who could be considered at a high risk of experiencing ongoing maltreatment by parents.

The study hypotheses are displayed in Fig. 1. In line with the prediction of Attentional Control Theory that psychopathology would impair performance especially on tasks relying on the central executive, we expected that 1) psychopathology would mediate (indirect association *a x f*) the association between maltreatment and visuospatial working memory (direct association *c*). Considering the conceptual overlap of short-term and working memory (Aben et al., 2012), we also expected that 2) psychopathology would mediate (indirect association *a x e*) the association between maltreatment and visuospatial short-term memory (direct association *b*). However, given evidence suggesting different attentional demands for short-term and working memory (Aben et al., 2012), we also hypothesized that 3) psychopathology would have a stronger effect on working memory compared to short-term memory (direct association $f > e$). Studies using delayed recall of verbal and visual information have produced mixed findings as to whether children with internalizing symptoms are impaired in long-term memory (Günther et al., 2004; Toren et al., 2000). Moreover, studies with children and adults suggest that PTSD is not related to memory retrieval when controlling for initial learning (Samuelson et al., 2010; Vasterling et al., 1998). Given this inconsistent evidence, we did not have directed a priori hypotheses regarding the link between maltreatment, psychopathology, and visuospatial long-term memory (indirect association *a x g* and direct association *d*).

1. Methods

1.1. Sampling and procedures

The present study utilized a sub-sample of a larger cohort of refugee children and adolescents who took part in a research project on refugee families` mental health carried out in three large refugee camps in Western Tanzania. The families had fled political violence in neighboring Burundi starting in 2015. Children and both of their parents or primary caregivers had been recruited using a combined systematic and random sampling approach (for more details see Scharpf et al., 2019). The study purpose, associated risks, and participants` rights were thoroughly explained to families in oral and written form. Each family member provided their informed consent through signature or fingerprints. All but two families agreed to participate. Structured clinical interviews were conducted individually

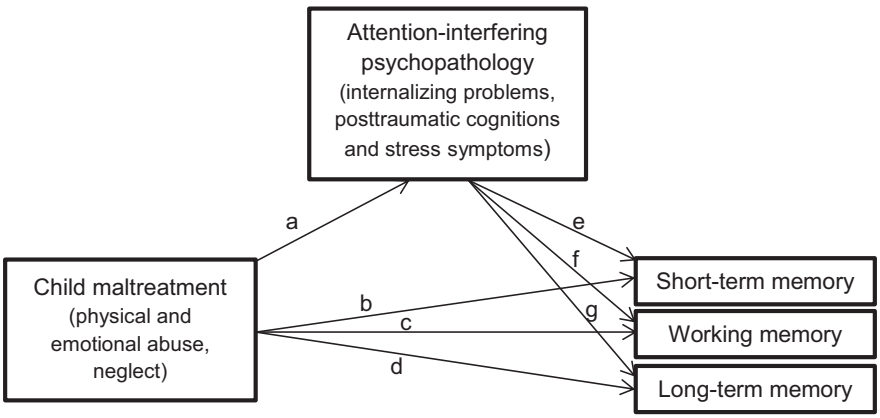


Fig. 1. Conceptual model of associations between maltreatment, attention-interfering psychopathology and memory functioning.

with children and parents in a discrete setting by Tanzanian master-level psychologists as well as research assistants from the refugee community who had been trained as interviewers or interpreters prior to data collection (Scharpf et al., 2019). After the interviews, the families received 8 USD in cash. The study was approved by the Ethics Commission of the University of Zurich (No. 2017.10.2) and the National Institute for Medical Research in Tanzania (No. NIMR/HQ/R.8a/Vol.IX/2632).

1.2. Participants

The sub-sample (n = 155, 72 girls) utilized for the present investigation comprised all adolescents between 11 and 15 years currently attending school and without a medical condition potentially impairing their memory test performance (e.g., sight problems, epilepsy; cf. Table 1).

1.3. Instruments

The test instructions and measures were translated from English to Swahili (or existing Swahili versions of measures were used) using blind-back translation (Brislin et al., 1973).

1.3.1. Short-term and working memory

The Corsi Block Tapping Task (CBTT) has been extensively used to assess visuospatial memory both in clinical and experimental studies (Berch et al., 1998). In the first stage (CBTT forward), the child was required to copy sequences of black blocks fixed on a wooden board (see Supplementary File 1 for details on the apparatus and instructions) in the same order as shown by the interviewer, providing an indicator for visuospatial short-term memory capacity. In the second stage (approximately 15 min later), the child was asked to reproduce block sequences in reversed order (CBTT backward), which is considered an indicator of visuospatial working memory due to the parallel demands of storing and manipulating the sequences (Bull et al., 2008). In both conditions, the number of correctly reproduced sequences was used as an index of memory capacity. The forward and backward conditions of the CBTT have been used to assess children's visuospatial short-term and working memory, respectively (Bull et al., 2008). Previous studies with adult samples have demonstrated a better performance of participants in the forward compared to the backward condition, which has been explained by a heavier load on the central executive in the backward condition (Brunetti et al., 2014; Vandierendonck et al., 2004). In line with this, children in our study correctly reproduced a significantly higher number of sequences in the forward condition compared to the backward condition, $t = 11.54$, $p < .001$. Being independent of educational level and technical equipment, the CBTT has shown to be a feasible and economic assessment of memory (Hecker et al., 2016).

1.3.2. Long-term memory

The Rey-Osterrieth Complex Figure (ROCF; Waber & Holmes, 1985) is a widely-used assessment of visuospatial memory within declarative memory. The task involves copying a complex geometrical figure and then reproducing it from memory either

Table 1
Description of sample characteristics and study variables.

Adolescents (n = 155)	
Age, M (SD)	13.01 (1.18)
Educational level, % (n)	
Class 1 and 2 (Primary)	23.9 (37)
Class 3 and 4	39.3 (61)
Class 5 and 6	32.2 (50)
Class 7 and 8 (Secondary)	4.5 (7)
Lives with, % (n)	
Both biological parents	83.8 (130)
One biological parent	8.4 (13)
Relatives (e. g. uncle, sister)	3.9 (6)
Other people (e. g. foster parents)	3.9 (6)
Orphan (half or full orphan), % (n)	11.6 (18)
Study variables, M (SD, range)	
Short-term memory (CBTT forward)	6.61 (2.72, 0–13)
Working memory (CBTT backward)	4.43 (2.78, 0–14)
Long-term memory (ROCF)	192.53 (51.89, 115.15–500.00)
Exposure to war-related trauma	4.01 (3.77, 0–16)
Child maltreatment (CTSPC)	82.91 (83.80, 0–446.00)
Emotional problems (SDQ)	4.22 (2.31, 0–10)
PTSD symptoms (UCLA-RI-5)	15.07 (11.41, 0–49)
Posttraumatic cognitions (CPTCI)	6.97 (6.72, 0–24)

CBTT, Corsi Block Tapping Task; ROCF, Rey-Osterrieth Complex Figure; CTSPC, Child-Parent Conflict Tactic Scales; SDQ, Strengths and Difficulties Questionnaire; UCLA-RI-5, The University of California at Los Angeles Child/Adolescent PTSD Reaction Index for DSM 5; CPCTI, Child Posttraumatic Cognitions Inventory.

immediately, after a delay, or both (Shin et al., 2006). We administered the ROCF according to the procedure described by Waber and Holmes (1985; cf. Supplementary File 1). Approximately 25 min after the copy trial, children were asked to draw the figure from memory. The copied and recalled figures were each scored according to the criteria by Meyers and Meyers (1995), which break down the ROCF into 18 units and rate each unit's accuracy and placement by 0, 0.5, 1 or 2 points, resulting in possible scores between 0 and 36. Ratings were done by two independent raters and intraclass correlations (ICC) were excellent (ICC = 0.97) for the copy score and good (ICC = 0.70) for the recall score (Cicchetti, 1994). We calculated a memory quotient consisting of the sum of the copy and recall score, divided by the copy score and multiplied by 100.

1.3.3. Exposure to war-related trauma

Youth reported on their exposure to different war-related traumatic events (e.g., physical injury, sexual assault, dangerous flight) on a checklist of 22 items with a dichotomous *yes* (1)*/no* (0) response scale. The sum score of all items was used for analyses. The checklist has been validated for the use with war-affected populations in the Great Lakes Region in Eastern Africa (Ertl et al., 2010; Neuner et al., 2004).

1.3.4. Child maltreatment

Maltreatment by parents was assessed using the Parent-Child Conflict Tactic Scales (CTSPC; Straus et al., 1998). Children reported on the frequency of specific acts of physical abuse, emotional abuse, and neglect by each parent within the past year over 23 items with a 7-point Likert scale (0 = *never happened* to 6 = *more than 20 times per year*). Mothers` and fathers` scores were summed up to receive a total score of parental maltreatment. The CTSPC have previously been used successfully in Sub-Saharan Africa (Nkuba et al., 2018). Internal consistency of the maltreatment scale was $\alpha = 0.89$.

1.3.5. Internalizing problems

The Strengths and Difficulties Questionnaire (SDQ; Goodman et al., 2000) is a widely-used instrument to screen for children's and adolescents` emotional and behavioral problems within the past 6 months. The items are rated on a 3-point Likert scale with the response categories *not true (0)*, *somewhat true (1)*, or *certainly true (2)*. The SDQ has been previously utilized in Sub-Saharan Africa (Hoosen et al., 2018). For the analysis, the five items of the *emotional problems* subscale were used, which has shown good concurrent validity with other established self-report measures of internalizing problems (Muris et al., 2003). The sum score had a low internal consistency ($\alpha = 0.56$), which is however comparable to other studies (Hoosen et al., 2018) and can be partly explained by the low number of items.

1.3.6. PTSD symptoms

The University of California at Los Angeles Child/Adolescent PTSD Reaction Index for DSM 5 (UCLA-RI-5; Pynoos & Steinberg, 2015) covers the PTSD symptom clusters according to DSM 5 (American Psychiatric Association, 2013). The 31 items are rated according to the occurrence of each symptom within the last month on a 5-point Likert scale ranging from *none of the time* (0) to *most of the time* (4).The UCLA-RI-5 has shown good psychometric properties and has been used in various cultural settings (Doric et al., 2019; Takada et al., 2018). Internal consistency of the sum score was high in our sample ($\alpha = 0.91$).

1.3.7. Posttraumatic cognitions

The 10-item short form (McKinnon et al., 2016) of the Child Posttraumatic Cognition Inventory (CPTCI; Meiser-Stedman et al., 2009) is a self-report measure to assess negative cognitions about the self and the world following a traumatic event. The 10 items are rated on a 4-point Likert scale from *Don't agree at all* (0) to *Agree a lot* (3). Both the short and original versions of the CPTCI have demonstrated good psychometric properties (McKinnon et al., 2016; Meiser-Stedman et al., 2009). Internal consistency of the sum score was good in our sample ($\alpha = 0.85$). While past studies (Hitchcock et al., 2015; Münzer et al., 2017) referred the CPTCI items to a single trauma or the worst maltreatment experience, we referred the CPTCI items more generally to children's frightening experiences due to our sample's high rate of exposure to trauma and maltreatment.

1.4. Data analysis

All descriptive analyses were conducted with IBM SPSS Statistics Version 25. A total of 154 children (one excluded due to incorrect administration) provided CBTT data, and 153 children (two excluded due to refusal and early termination of the task) provided ROCF data for further analysis. There were no missing values in relevant study variables. We tested three structural equation models (SEM) with child maltreatment as predictor, children's attention-interfering psychopathology as mediator and the respective memory function as criterion using the package *lavaan* (Rosseel, 2012) implemented in the statistical environment R (R Core Team, 2019). Statistical fit of the models was indicated by a Comparative Fit Index (CFI) ≥ 0.95, a non-significant Root Mean Square Error of Approximation (RMSEA) ≤ 0.06 and a Standardized Root Mean Squared Residual (SRMR) ≤ 0.08 (Hu & Bentler, 1999). Psychopathology was modeled as a second-order latent construct with the first-order latent factors internalizing problems (represented by the individual items of the SDQ emotional problems subscale), PTSD symptoms (represented by the individual sum scores of the five symptom clusters in the UCLA-RI-5) and posttraumatic cognitions (represented by three parcels containing the CPTCI items). Item parcels were created randomly given the unidimensionality of the CPTCI in our sample (Little et al., 2013). The latent variables were allowed to co-vary with one another and their variances were fixed to unity. The loadings of the first-order factors internalizing problems and posttraumatic cognitions on the second-order factor psychopathology were constrained. Child maltreatment and

memory functions were modeled as observed variables in the SEM represented by the respective sum scores.

To test the first two hypotheses, we examined the significance of the respective indirect effects, i.e., the product of the associations between maltreatment and psychopathology and between psychopathology and short-term/working memory capacity (Mackinnon et al., 2002). To compare the relative impact of attention-interfering psychopathology on short-term and working memory, we checked whether the 95% confidence intervals around the respective standardized regression coefficients overlapped (Cumming, 2009). Preliminary analyses indicated that only the ROCF memory score deviated from normality according to West et al. (1995). Thus, maximum likelihood estimation (MLE) was applied to the short-term and working memory models and MLE with robust standard errors and Satorra-Bentler scaled test statistic was used to estimate the long-term memory model. All other statistical assumptions were met and there were no outliers. Age, gender, educational level, and children's exposure to war-related trauma were included as covariates. All analyses used a two-tailed $\alpha = 0.05$.

2. Results

Descriptive statistics are displayed in Table 1. Partial correlations between study variables under control of war exposure, age, gender and class are shown in Table 2. The measurement model of the latent variable attention-interfering psychopathology showed a good fit (CFI = 0.98, RMSEA = 0.038, $p = .76$, 90%-CI [0.00–0.063], SRMR = 0.067) and all factor loadings were significant at the level $p < .01$. The structural models for short-term, working and long-term memory demonstrated reasonable fit (see Table 3). The model findings are visualized in Fig. 2. Across models, higher levels of parental abuse and neglect within the past year were significantly associated with higher levels of attention-interfering psychopathology including internalizing problems, PTSD symptoms and negative cognitions about the self and the world ($\beta = 0.25/0.26$, $p = .001$). More psychopathology, in turn, was significantly linked to reduced working memory capacity ($\beta = -0.26$, 95% CI [−0.271, −0.245], $p = .002$) resulting in a significant indirect effect, $\beta = -0.07$, $p = .02$. Although the indirect effect failed statistical significance ($\beta = -0.05$, $p = .06$), more attention-interfering psychopathology was also significantly related to lower short-term memory capacity ($\beta = -0.20$, 95% CI [−0.216, −0.188], $p = .02$). The confidence intervals around the standardized regression coefficients of the associations between psychopathology and short-term respectively working memory did not overlap, indicating a significant difference.

Contrary to the models for short-term and working memory, attention-interfering psychopathology was not associated with delayed recall from long-term memory ($\beta = 0.05$, $p = .56$). However, more severe maltreatment by parents was significantly related to poorer long-term memory performance ($\beta = -0.20$, $p = .02$), resulting in a significant total effect ($\beta = -0.19$, $p = .02$). As we were also interested in the possibility that psychopathology was associated with encoding of information rather than its retrieval, we analyzed the mediational model with the ROCF copy performance as dependent variable (see Supplementary Fig. A). Neither maltreatment ($\beta = -0.04$, $p = .60$) nor attention-interfering psychopathology ($\beta = -0.04$, $p = .64$) were associated with encoding for delayed recall in the ROCF copy trial.

3. Discussion

This study investigated the mediational role of attention-interfering psychopathology in the association between maltreatment and different memory functions (short-term, working and long-term memory) in a sample of Burundian refugee youth with an increased risk of exposure to ongoing maltreatment. Higher levels of maltreatment by parents were indirectly related to lower short-term and working memory capacity through increased levels of internalizing problems, PTSD symptoms and maladaptive cognitions about themselves and the world. However, a direct link between more severe maltreatment and poorer long-term memory was observed.

The findings suggest that psychopathological symptoms interfered with the attentional resources the adolescents needed to perform well on the short-term and working memory component of the CBTT, which is in line with the prediction of Attentional Control Theory (Eysenck et al., 2007). As hypothesized based on the Attentional Control Theory, psychopathology had a relative stronger effect on

Table 2
Partial correlations between study variables.

	1	2	3	4	5	6	7
1. Maltreatment (CTSPC)	–						
2. Emotional problems (SDQ)	0.15*	–					
3. PTSD symptoms (UCLA-RI)	0.27**	0.23**	–				
4. Posttraumatic cognitions (CPTCI)	0.14*	0.36***	0.53***	–			
5. Short-term memory (CBTT forward)	−0.02	−0.10	0.05	−0.05	–		
6. Working memory (CBTT forward)	−0.05	−0.15*	0.01	−0.17*	0.51***	–	
7. Long-term memory (ROCF)	−0.20**	−0.03	−0.04	−0.08	−0.14	−0.10	–

CTSPC, Parent Child Conflict Tactic Scales; SDQ, Strengths and Difficulties Questionnaire; UCLA-RI, The University of California at Los Angeles Child/Adolescent PTSD Reaction Index for DSM 5; CPTCI, Child Posttraumatic Cognitions Inventory; CBTT, Corsi Block Tapping Test; ROCF, Rey-Osterrieth Complex Figure.

Note: Partial correlations controlling for war exposure, age, gender and educational level.

*** $p < 0.001$.

** $p < .01$.

* $p < .05$.

Table 3
Model fit statistics of structural equation models.

	Sample size	Comparative fit index	Root mean square error of transformation	Standardized root mean square residual
Short-term memory	154	0.95	0.048 (p = .58)	0.067
Working memory	154	0.95	0.045 (p = .65)	0.067
Long-term memory	153	0.96	0.039 (p = .82)	0.064

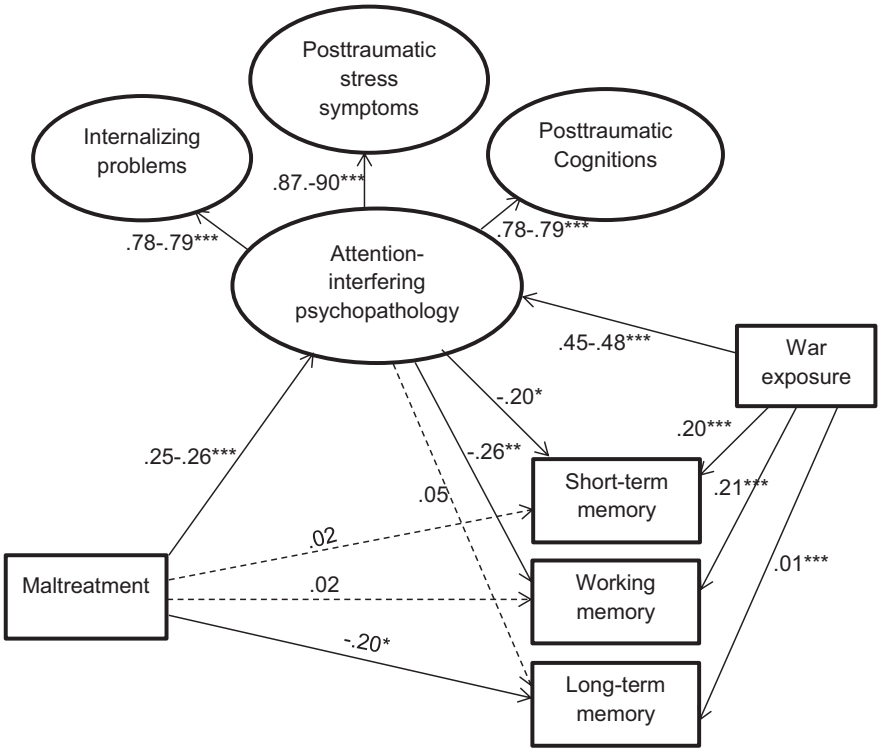


Fig. 2. Structural equation modeling results for the associations between maltreatment, psychopathology and memory functioning. The three structural equation models for each memory function are displayed in one figure for improved clarity. There was a significant indirect effect of maltreatment on working memory via psychopathology ($\beta = -0.066$, $p = .023$) and a trend towards a significant indirect effect of maltreatment on short-term memory via psychopathology ($\beta = -0.052$, $p = .057$). There was a significant direct and total effect of maltreatment on long-term memory ($\beta = -0.187$, $p = .016$). The covariates age, gender and class are not shown. Dashed lines indicate nonsignificant effects. ***$p \leq .001$, **$p \leq .01$, *$p \leq .05$.

working compared to short-term memory. This suggests that interference by psychopathology was greater in the executively more demanding working memory task, which is consistent with previous studies using tasks with a short-term and working memory component (Eysenck et al., 2005; Franklin et al., 2010; Opris et al., 2019). The finding also supports the idea of short-term and working memory as conceptually overlapping functions that differ in the amount of required attentional resources (Aben et al., 2012; Baddeley, 2000). Overall, our findings are in line with a robust body of research documenting visuospatial short-term and working memory deficits in clinical and community samples of children and adolescents with internalizing problems (Blanken et al., 2017; Moran, 2016; Owens et al., 2012; Vasa et al., 2007).

To the best of our knowledge, this study represents the first scientific investigation of the associations between maltreatment by parents, psychopathology and cognitive functioning in youth living in refugee camps. Our findings are in part consistent with a recent study conducted in a refugee setting (Chen et al., 2019), which found that chronic poverty and not past exposure to war-related trauma were related to working memory deficits, and underscore the detrimental nature of ongoing maltreatment for refugee children's mental health and adjustment above and beyond war trauma and flight. Unlike Chen and colleagues, we observed a negative association between psychopathology and working memory performance, which may be explained by the joint impact of different types of psychopathology that are likely to interfere with attentional control.

Our study is also one of the few (Ainamani et al., 2021; Hecker et al., 2016) examining independent associations between maltreatment, mental health problems and cognitive functioning in a context where violence against children is considered a socially acceptable and effective practice. Our findings in a representative community sample and including an assessment of maltreatment severity rather than only occurrence lend support to those of a previous study suggesting a mediational role of mental health problems

in the link between maltreatment and cognitive functioning (Hecker et al., 2016). While it has been shown that parents` violent discipline may be less strongly related to children's mental health problems in cultures with a high normativeness of violent discipline (Lansford et al., 2005), demonstrating the negative direct impact of maltreatment on objective performance indicators including cognitive tests in addition to self-rated mental health is essential to create awareness of the harmful nature of violence against children and thus contribute to societal change in such contexts.

In addition to the cultural and socio-economic context, our study's dimensional conceptualization of maltreatment and psychopathology as well as the assessment of different memory functions differ from most previous studies conducted in Western high-income settings, which compared groups of children, i.e., maltreated and non-maltreated, with and without PTSD, and assessed one memory function only (Augusti & Melinder, 2013; Beers & De Bellis, 2002; De Bellis et al., 2013; Kavanaugh et al., 2015). On the one hand, this makes it difficult to compare our findings to these studies. On the other hand, our findings suggest that both the level of psychopathology and the specific memory function need to be taken into account when examining links between maltreatment and memory.

From a neurobiological perspective, the pattern of associations between attention-interfering psychopathology and short-term/working memory capacity is consistent with the overlap of the respective underlying neural substrates in the pre-frontal cortex (Chai et al., 2018; Macdonald et al., 2016). Retrieval from long-term memory, however, is processed mainly by the hippocampus in the medial temporal lobe (Fjell et al., 2019). Although a strict functional and neural dissociation between short-term/working and long-term memory can be questioned (Jeneson & Squire, 2012), the smaller overlap in the underlying neural circuits may explain the lack of an association between psychopathology and long-term memory. In line with this, recent neuroimaging studies with adolescents (Lee et al., 2018; Malhi et al., 2019) and young adults (Teicher et al., 2018) found hippocampal abnormalities to be related to experiences of maltreatment per se and not to maltreatment-related psychopathology.

3.1. Practical and clinical implications

In addition to past experiences of violent conflict and flight, refugee children living in camps have to face multiple ongoing material and social stressors that may jeopardize their wellbeing and development. In particular, our findings suggest that maltreatment by caregivers not only incurs suffering in terms of psychopathology, but also impairs refugee youth's memory functioning. The important role of memory functioning for children's academic outcomes has been well established in Western non-refugee samples (e.g. Bull et al., 2008) and working memory has been found to mediate the associations between individual (placement in a low grade for age) and community risk factors (community safety) and academic outcomes in refugee children in Lebanon (Kim et al., 2020). Thus, maltreatment may also impede youth's academic progress with potentially adverse consequences for their socioeconomic well-being in later life. Considering the multiple structural, poverty-related factors that hamper refugee children's learning and that are heavily dependent on external funding and policies, it is all the more important to address those sources of risk in children's environment that are amenable to change, e.g. child maltreatment (Miller & Jordans, 2016). Therefore, practical efforts should target multiple levels to prevent maltreatment by caregivers and its detrimental impact on children's functioning. First, contextually relevant factors contributing to caregivers` use of violence against children need to be addressed, including parents` own mental health problems, the quality of the parent-child relationship and socio-economic status (Hecker et al., 2021; Scharpf et al., 2020). Individual and community-level beliefs regarding the acceptability of violence against children and barriers towards reporting maltreatment could be targeted through sensitization and psychoeducation activities (Bermudez et al., 2018; Hecker et al., 2016). Second, interventions should actively support refugee parents in their role as caregivers. Approaches that focus both on alleviating parents` distress and on equipping them with non-violent parenting skills, such as the Caregiver Support Intervention that was recently tested in a pilot randomized controlled trial in Syrian refugee families (Miller et al., 2020), hold particular promise. Third, interventions should aim at treating psychopathological symptoms related to maltreatment and trauma that may impair memory functioning by interfering with children's attentional resources. Cognitive-behavioral approaches may be especially suitable to tackle symptoms such as anxious worry and posttraumatic cognitions, and have shown promising first results for trauma-exposed youth in low-income settings (O'Callaghan et al., 2013). Moreover, such child-focused interventions could actively include parents to provide families with joint positive interactional skills and coping strategies to deal with stressful situations (Murray et al., 2018).

3.2. Strength and limitations

Major strengths of this study include the use of a randomly selected community sample of vulnerable youth living in refugee camps as well as the combination of youth's self-reported experiences of maltreatment and psychopathology with objective performance data, which reduces reporting and common method bias. Some limitations, however, require discussion. First, although the neuropsychological tests provided a feasible and economical assessment of different visuospatial memory functions of children living in refugee camps, the results are not generalizable to other populations and should be replicated using these and similar established instruments in other samples. In a similar vein, we only included youth who were currently attending school. Youth who are not in school are likely to be a particularly vulnerable group and more structural efforts are needed to improve these youth's access to learning. Second, given our cross-sectional design, the direction of mediation effects must be interpreted with caution. Longitudinal and experimental studies are needed to investigate temporal and causal associations between maltreatment, mental health, and memory functioning as well as the impact of memory functioning on academic outcomes. Third, we were not able to provide completely standardized conditions for our neuropsychological assessment, which may be considered a trade-off for an increased ecological validity of our field setting. Fourth, the specific role of sub-types of psychopathology and maltreatment for memory functioning may have been masked by our conceptualization of these constructs. Fifth, we did not consider other factors that potentially impact the cognitive development of

refugee children living in resource-poor camps, such as extreme poverty. Future studies should conduct a comprehensive risk assessment regarding refugee youth's cognitive functioning and also include exposure to maltreatment in the school context, which is likely to be particularly detrimental to children's cognitive and academic functioning. Finally, and sixth, we retrospectively assessed the frequency of children's self-reported maltreatment experiences within the past year, which may be prone to biases associated with recall and social desirability.

3.3. Conclusions

The findings of the present study suggest that maltreatment by parents may contribute to refugee children's memory deficits both directly and indirectly through increased levels of psychopathology. Thus, maltreated children, including those who appear resilient in the face of maltreatment by reporting relatively low levels of mental health problems, are likely to be impaired in their ability to learn and recall information, which may have detrimental consequences for their academic outcomes and socioeconomic prospects. In the context of refugee camps, ongoing maltreatment by parents may represent one of the most amenable risk factors for children's well-being amidst a myriad of predominantly structural stressors, e.g. related to sanitary conditions, housing, nutrition and material resources. Therefore, the findings call for preventive efforts on multiple levels, targeting individual (e.g. parents` mental health problems), collective (e.g. norms about the use and reporting of violence) and structural factors (e.g. lack of income) and providing caregivers` and families with knowledge and skills to strengthen positive interactions and manage conflicts in non-violent ways.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chiabu.2021.105165.

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