



This electronic thesis or dissertation has been downloaded from the University of Bristol Research Portal, <http://research-information.bristol.ac.uk>

Author:

Tsunga, Lucinda P

Title:

Mental health and cognitive outcomes associated with early childhood violence exposure

a focus on children in low-middle income countries (LMICs)

General rights

Access to the thesis is subject to the Creative Commons Attribution - NonCommercial-No Derivatives 4.0 International Public License. A copy of this may be found at <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode>. This license sets out your rights and the restrictions that apply to your access to the thesis so it is important you read this before proceeding.

Take down policy

Some pages of this thesis may have been removed for copyright restrictions prior to having it been deposited on the University of Bristol Research Portal. However, if you have discovered material within the thesis that you consider to be unlawful e.g. breaches of copyright (either yours or that of a third party) or any other law, including but not limited to those relating to patent, trademark, confidentiality, data protection, obscenity, defamation, libel, then please contact collections-metadata@bristol.ac.uk and include the following information in your message:

- Your contact details
- Bibliographic details for the item, including a URL
- An outline nature of the complaint

Your claim will be investigated and, where appropriate, the item in question will be removed from public view as soon as possible.

Mental health and cognitive outcomes associated with early childhood violence exposure: a focus on children in low-middle income countries (LMICs)

Lucinda Panashe Tsunga

Thesis submitted to the University of Bristol and University of Cape Town in accordance with the requirements for award of the degree of Doctor of Philosophy
PhD Population Health Sciences

Bristol Medical School
PhD Paediatrics and Child Health

in the Faculty of Health Sciences

January 2024

Supervisors

Professor Abigail Fraser, University of Bristol

Professor Kirsten Donald, University of Cape Town

Associate Professor Jon Heron, University of Bristol

AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

SIGNED: [REDACTED] DATE: 03/01/2024.....

ABSTRACT

Knowledge about the exposure patterns of violence among preschoolers in low- and middle-income countries (LMICs) is still limited. Furthermore, little is known about the associations of violence exposure with mental health or cognitive functioning in this age group. This is important, given that children in LMICs experience a high burden of violence and therefore alongside policies to reduce violence exposure, understanding the impacts of violence can guide early interventions to mitigate its adverse effects.

In my thesis, I conducted two systematic reviews synthesizing the evidence on the mental health and cognitive outcomes associated with violence exposure in children in LMICs and identifying key gaps in the current literature. I further, directly investigated the lifetime violence exposure patterns of preschoolers in the Drakenstein Child Health Study (DCHS) in South Africa and subsequently investigated associations between lifetime childhood violence exposure at 4.5 years and mental health and cognitive outcomes at 5 years in this cohort.

Approximately 70% of the 17 reviewed studies from 20 LMICs found associations between violence exposure and poor cognitive outcomes in childhood, while all 58 reviewed studies from 26 LMICs found associations between violence exposure and mental health problems in childhood. In my own study in the DCHS, I found that 72% -75% of the children were reported as having been exposed to some form of domestic or community violence at a young age (3.5– 6 years). Overall violence exposure, domestic victimisation and witnessing community violence by 4.5 years was associated with increased internalising and externalising behaviours at age 5. Polyvictimisation was associated with increased externalising behaviours. Associations between witnessing domestic violence (or community victimisation) exposure alone with mental health were less robust. Lastly, there were associations between lifetime exposure to violence by 4.5 years and poor selective attention, receptive language, nonverbal intelligence and inhibition at 5 years.

This thesis highlights the adverse consequences of violence exposure in early life for mental health and cognitive problems in preschoolers living in high violence contexts. Mental health and cognitive problems manifest at an early age and emphasize the need for interventions to reduce violence exposure and its consequences in young children in LMICs.

DEDICATION AND ACKNOWLEDGEMENTS

I would like to thank my supervisors Professor Kirsty Donald, Professor Abigail Fraser and Associate Professor Jon Heron, who guided me through this process, nudging me in the right direction constantly. I appreciate that you never doubted me even when I doubted myself at times. I would also like to thank Professor Sarah Halligan, who consulted on a number of manuscripts for this thesis, and continuously provided insightful guidance. I would like to thank Associate Professor Susan-Malcolm Smith who introduced me to the DCHS and through this, triggered the start of my PhD journey. Thank you for all the opportunities for learning and growth you provided in all the years I have known you. I would also like to thank everyone involved in the DCHS, from project managers, primary investigators, researchers, research assistants, the data and admin teams and most importantly to the participants whose data contributed immensely to this PhD. I would also like to thank the University of Bristol's PVC-research and Enterprise Strategic Research Fund and the QRGCRF Strategy funded by Research England who funded my PhD project.

I would like to offer my gratitude to my partner Cornel, whose unwavering support and constant encouragement fuelled my progress throughout. Thank you for moving to another continent for this thesis and always making sure I was fed. I am grateful to my family, my mother Vivian and my sisters Lynette and Leandra who continuously support me in my academic endeavours including this PhD. I am grateful for my friends Michelle, Vakele, Fifi who constantly checked in on me and offered encouragement. I would also like to thank my Cotutelle cohort-mates, who made this journey feel that much less lonely. A special mention to Shani and Tanja whose friendship has meant the most to me. I am glad that this PhD brought you into my life and wish you all the best on your own PhD journeys.

Last but definitely not least, I would like to thank God for all this. Thank you that you were always there to lift me in my dark times on this journey.

I would like to dedicate this to the children who are experiencing violence, especially maltreatment, whose experiences are continually overlooked, you matter!

PUBLICATIONS AND PRESENTATIONS ARISING FROM THIS WORK

Publications

This PhD thesis integrates publications as individual chapters. It has been formatted following University of Cape Town and University of Bristol guidelines. Small adjustments were made to spelling, formatting, and the numbering of figures and tables for uniformity throughout the thesis. I confirm that I have been granted permission by the University of Cape Town's Doctoral Degrees Board to include the following publication(s) in my PhD thesis, and where co-authorships are involved, my co-authors have agreed that I may include the publication(s)

Chapter 2: Manuscript submitted to Journal of Trauma, Violence, & Abuse, anticipated citation: Tsunga, L., Hiscox, L.V., Halligan, S. L., Donald, K.A., Fraser, A. Violence Exposure and Cognitive Outcomes Among Children in LMICs: A Systematic Review. *Trauma, Violence, & Abuse*.

Author contributions: I formulated the aims and methodology of the study in partnership with my supervisors Abigail Fraser and Kirsty Donald. Sarah Halligan played a key role in conceptualizing and designing the study and provided critical revisions of the manuscript for intellectual content. I conducted literature searches and together with co-author Lucy Hiscox screened records obtained. We also extracted data from studies and conducted risk of bias analyses in consultation with all co-authors. I wrote the first draft of the manuscript, which was then reviewed by all co-authors who contributed conceptual and intellectual insights. Every author played a role in the completion of the final manuscript.

Chapter 5: Tsunga, L., Lake, M., Halligan, S. L., Malcolm-Smith, S., Hoffman, N., Heron, J., Zar, H., Fraser, A., Donald, K., & Stein, D. J. (2023). Early Childhood Violence Exposure Patterns in The Drakenstein Child Health Study (DCHS). *Wellcome open research*, 8, 36. <https://doi.org/10.12688/wellcomeopenres.18598.2>

Author contributions: I formulated the aims and methodology of the study in partnership with my supervisors Abigail Fraser, Jon Heron and Kirsty Donald. I performed all the analyses, with statistical advice and guidance given by Jon Heron. Marilyn Lake contributed

to data management. Sarah Halligan played a key role in conceptualizing and designing the study and provided critical revisions of the manuscript for intellectual content. Heather Zar serves as the principal investigator for the main study. Dan Stein and Nadia Hoffman lead the psychosocial study aspects and participated in revising the manuscript critically for intellectual content. Susan Malcolm-Smith and Kirsty Donald as co-investigators were responsible for implementation, training, and upholding quality assurance of the child assessments. I wrote the first draft of the manuscript, which was then reviewed by all co-authors who contributed conceptual and intellectual insights. Every author played a role in the completion of the final manuscript.

Chapter 6: Manuscript submitted to Research on Child and Adolescent Psychopathology,
Tsunga, L., Heron, J., Lake, M., Halligan, S. L., Malcolm-Smith, S., Hoffman, N., Zar, H.,
Fraser, A., Stein, D. J., & Donald, K.A. Exposure to Violence and Mental Health Outcomes
Among Pre-schoolers in A South African Birth Cohort.

Author contributions: I formulated the aims and methodology of the study in partnership with my supervisors Abigail Fraser, Jon Heron and Kirsty Donald. I performed all the analyses, with statistical advice and guidance given by Jon Heron. Marilyn Lake contributed to data management. Sarah Halligan contributed to concept and design and revising the manuscript critically for intellectual content. Heather Zar serves as the principal investigator for the main study. Dan Stein and Nadia Hoffman lead the psychosocial study aspects and participated in revising the manuscript critically for intellectual content. Susan Malcolm-Smith and Kirsty Donald as co-investigators were responsible for implementation, training, and upholding quality assurance of the child assessments. I wrote the first draft of the manuscript, which was then reviewed by all co-authors who contributed conceptual and intellectual insights. Every author played a role in the completion of the final manuscript.

We declare that the above articles were written by the author of this thesis, Lucinda Tsunga, with support from supervisors.

Signatures of supervisors

Prof Abigail Fraser



Prof Kirsty Donald



Assoc. Prof. Jon Heron



Presentations

The works directly within and those developed in the process of this thesis resulted in the following oral presentations:

1. **Tsunga L. et.al 2021:** Early Childhood Violence Exposure Patterns in the Drakenstein Child Health Study (DCHS): Presented at the University of Cape Town, Department of Paediatrics and Child Health Annual Research Day on 9 November 2021

2. **Tsunga L:** Video presentation submitted to the Africa Sustainable Development Goals (SDGs) Africa Summit 2021, titled: Towards #TheAfricaWeWant.

3. **Tsunga L. et.al 2023:** Violence Exposure, Mental Health and Cognitive Outcomes in Pre-schoolers - The Drakenstein Child Health Study. Presented at the Emotional Well-Being & Physical Health 2023 Summer Short Course, At Harvard University in Cambridge, Massachusetts July 2023

4. **Tsunga L. et.al 2023:** Exposure to Violence and Mental Health Outcomes Among Preschoolers in a South African Birth Cohort. Presented at 5th International Developmental Paediatrics Association (IDPA) Congress 2023 (28 November 2023 - 1 December 2023) Johannesburg, South Africa

***This presentation was awarded the 2023 IDPA Research Award**

COVID STATEMENT

This statement is written to explain how COVID-19 have impacted my thesis. It includes extension dates because of COVID-19 impact. The statement does not suggest that the quality of my work or the final thesis outcome is different to what it should have been if COVID-19 did not occur.

Given the Cotutelle nature of my PhD project, I was based at the University of Bristol from November 2019 – November 2020. I then returned to South Africa for 2 years for the University of Cape Town lag of my PhD project. I then returned to Bristol for the final PhD year from January - December 2023. Covid had a significant impact on my mental health as between 2020 and 2021. I was working in isolation mostly from home, without engaging in social activities with peers to help foster a community around the PhD process. I was also unable to see friends or family around this period which affected my support system. I had to seek out therapy services to help with support around these difficulties. Furthermore, in March 2022, I had covid for 2 weeks, although it was not severe enough to require hospitalisations, I experienced significant sinus headaches that required rest.

The power supply company in South Africa was extremely affected by covid since 2020 when I returned to South Africa. They report an increase in their demand during the lockdowns which impacted their already fragile equipment and as a means to cope, there are intermittent periods nationally of daily rolling blackouts for periods ranging from 2 - 8 hours. These impacted on my productivity as internet connection was also affected and it was difficult to conduct research during these periods.

Data collection for the one of the visits on the DCHS in my PhD research project is embedded was stopped due to covid in 2020 and parts of 2021. As such, some of the data I required for my thesis was incomplete, i.e. the children were much older and no longer met the criteria needed to collect data on my main exposure variable, such that the sample size is small.

TABLE OF CONTENTS

<i>Chapter 1. Introduction</i>	23
1.1. Overview	23
1.2. The LMIC context.....	24
1.3. Categories of violence.....	27
1.4. Child mental health problems.....	28
1.5. Neurocognition	30
1.6. Childhood violence exposure and mental health problems	33
1.7. Childhood violence exposure and cognitive outcomes	33
1.8. Mechanisms.....	34
1.9. Overall aim and specific objectives.....	41
1.10. Overview and structure of the thesis.....	42
<i>Chapter 2. Violence Exposure and Cognitive Outcomes Among Children in LMICs: A Systematic Review</i>	44
2.1. Background.....	44
2.2. Methods.....	46
2.3. Information sources and search strategy	49
2.4. Data management and selection.....	49
2.5. Data Extraction	49
2.6. Risk of bias assessment	50
2.7. Data synthesis	52

2.8.	Results	53
2.9.	Discussion.....	77
2.10.	Supplementary	82
<i>Chapter 3. Violence Exposure and Mental Health Outcomes Among Children in LMICs: a Scoping Review of the Literature</i>		86
3.1.	Background.....	86
3.2.	Methods.....	87
3.3.	Results	90
3.4.	Discussion.....	110
3.5.	Implications and future directions.....	114
3.6.	Conclusion.....	114
3.7.	Supplementary material	116
<i>Chapter 4. Methods</i>		118
4.1.	Cohort description.....	119
4.2.	Study context:	119
4.3.	Cohort overview	121
<i>Chapter 5. Early Childhood Violence Exposure Patterns in the DCHS</i>		131
5.1.	Background.....	132
5.2.	Research methods.....	134
5.3.	Results	139
5.4.	Discussion.....	147

5.5.	Conclusion.....	151
5.6.	Supplementary.....	152
<i>Chapter 6. Exposure to Violence and Mental Health Outcomes Among Preschoolers in a South African Birth Cohort.....</i>		153
6.1.	Background.....	154
6.2.	Method.....	155
6.3.	Results	163
6.4.	Discussion.....	165
6.5.	Conclusion.....	169
6.6.	Supplementary.....	171
<i>Chapter 7. Violence Exposure and Cognitive Outcomes Among Pre-schoolers in A South African Birth Cohort.....</i>		175
7.1.	Background.....	175
7.2.	Methods.....	177
7.3.	Results	184
7.4.	Discussion.....	194
7.5.	Supplementary.....	201
<i>Chapter 8. Discussion</i>		213
8.1.	Overview of background and summary of key results	213
8.2.	Discussion of key findings.....	217
8.3.	Strengths and limitations.....	222
8.4.	Implications and future directions.....	230

8.5. Conclusion.....	232
<i>References</i>	<i>233</i>
<i>Appendices.....</i>	<i>292</i>
<i>Systematic Review Protocol: Violence exposure and cognitive and behavioural outcomes among children LMICs.....</i>	<i>293</i>
<i>Sex Stratified Analyses.....</i>	<i>301</i>

LIST OF ABBREVIATIONS AND ACRONYMS

ACEs:	Adverse childhood experiences
AIDS:	Acquired Immune Deficiency Syndrome
CBCL:	Child Behaviour Checklist
CECV:	Child Exposure to Community Violence Checklist
CI:	Confidence interval
DCHS:	Drakenstein Child Health Study
HPA:	Hypothalamic-pituitary-adrenal
HIV:	Human immunodeficiency virus
HICs:	High-income countries
IPV:	Intimate Partner Violence
LMICs:	Low-and middle-income countries
NGO:	Non-governmental organisation
OECD:	Organisation for Economic Co-operation and Development
PRISMA:	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PTSD:	Post-traumatic stress disorder
RoBANS:	Risk of Bias Assessment Tool for Nonrandomized Studies
SD:	Standard deviation
SE:	Standard error
SES:	Socioeconomic status
USA/US:	United States of America
WHO:	World Health Organization

LIST OF TABLES

Table 1.1 Cognitive domains and subdomains commonly assessed in cognitive assessments	31
Table 2.1 Childhood violence exposure definitions	48
Table 2.2 Description of selected studies, including participant characteristics, violence exposure types, cognitive outcomes measures.....	55
Table 2.3 Results of studies not included in forest plots and studies with mediation and moderation analyses	65
Table 3.1 Violence and mental health systematic review study characteristics	95
Table 4.1 Sociodemographic characteristics of DCHS active sample and sample lost to follow up.....	125
Table 4.2. Measures	127
Table 5.1 Demographic profiles and baseline descriptive statistics of the sample stratified by visit.....	140
Table 5.2 Prevalence of exposure to specific violence types at each study visit.....	142
Table 5.3 Prevalence of forms of violence by each visit stratified by sex.....	144
Table 5.4 Violence exposure by marital status and household income (p-value: Chi-square test).....	145
Table 5.5 Prevalence of polyvictimization stratified by sex	146
Table 6.1 Sociodemographics, violence exposure and mental health descriptive statistics in imputed data (N = 978)	162
Table 6.2 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in imputed data	164

Table 7.1 Sociodemographics and violence exposure descriptive statistics in imputed data, N = 978 185

Table 7.2 Descriptive statistics of cognitive scores in imputed data 186

LIST OF FIGURES

Figure 1.1 Categorisation of violence	26
Figure 1.2 Conceptual framework of the hypothesised pathways through which violence exposure affects child mental health and cognition	36
Figure 2.1 PRISMA flow diagram showing manuscript selection violence and cognitive outcomes systematic review	54
Figure 2.2 Forest plot depicting effect sizes for maltreatment and cognitive outcomes grouped by cognitive domain.....	62
Figure 2.3 Forest plot depicting correlations between maltreatment and executive functions studies. EF = Executive Functions; R BQSS = Boston Qualitative Scoring System	63
Figure 2.4 Forest plot depicting effect sizes between domestic violence and cognitive outcomes.	71
Figure 2.5 Risk of bias summary: review authors' judgements about each risk of bias item for each included study. (A) RoBANS risk of bias domain summary; (B) RoBANS study risk of bias summary	75
Figure 2.6 Confounder matrix illustrating confounding control of 13 studies by three confounding constructs Sociodemographics, Socioeconomics and Caregiver Characteristics (A) and overall confounding control for each construct (B).....	76
Figure 3.1 PRISMA flow diagram violence and mental health outcomes systematic review .	91
Figure 3.2 Choropleth map of reviewed study distributions in LMICs	93
Figure 3.3 RoBANS risk of bias domain summary	105
Figure 3.4 RoBANS study risk of bias summary	106
Figure 3.5 Confounder matrix illustrating overall confounding control of the 58 reviewed studies	108

Figure 3.6 Confounder matrix by variable.....	109
Figure 4.1 Map of the DCHS centred around the Drakenstein Municipality within Western Cape province, South Africa.....	119
Figure 4.2 Flow chart of the DCHS sample selection	123
Figure 4.3 DCHS Assessment timeline of thesis measures	126
Figure 5.1 DCHS flowchart for CECV data collection	138
Figure 6.1 Flow chart of DCHS participation and missing data in assessment of violence exposure and mental health outcomes	157
Figure 7.1 Flow chart of DCHS sample and missing data patterns	178
Figure 7.2 Forest plot estimates of associations between community violence and cognitive functions in imputed data (N = 978).	188
Figure 7.3 Forest plot estimates of associations between domestic violence and cognitive functions in imputed data (N = 978)	190
Figure 7.4 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in imputed data (N = 978).	192

LIST OF SUPPLEMENTARY MATERIAL

Supplementary Table 2.1 Development assistance committee (DAC) List of official development assistance (ODA) recipients effective for reporting on 2020 flows (LMICS) ...	82
Supplementary Table 2.2 Database search terms violence and cognition systematic review	84
Supplementary Table 3.1 Violence and mental health systematic review search terms.....	116
Supplementary Table 5.1 Prevalence of violence exposure in subsample	152
Supplementary Table 6.1 Descriptive statistics and comparison between observed and imputed samples.....	171
Supplementary Table 6.2 Results of linear regression analyses examining violence exposure on internalising and externalising behaviour problems with observed data	172
Supplementary Table 7.1 Sociodemographic and violence exposure in observed data	201
Supplementary Table 7.2 Cognitive scores in observed data	202
Supplementary Figure 2.1 Decision making flow chart violence and cognition systematic review.....	85
Supplementary Figure 3.1 Violence and mental health systematic review decision-making flow chart	117
Supplementary Figure 6.1 Missing data patterns.....	173
Supplementary Figure 7.1Forest plot estimates of associations between community violence and cognitive functions in imputed data (N = 978).	203
Supplementary Figure 7.2 Forest plot estimates of associations between domestic violence and cognitive functions in imputed data (N = 978).	204

Supplementary Figure 7.3 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in imputed data (N = 978).	205
Supplementary Figure 7.4 Forest plot estimates of associations between community violence and cognitive functions in observed data.....	207
Supplementary Figure 7.5 Forest plot estimates of associations between domestic violence and cognitive functions in observed data.....	208
Supplementary Figure 7.6 Forest plot estimates of associations of overall violence exposure, polyvictimisation and cognitive functions in observed data	209
Supplementary Figure 7.7 Forest plot estimates of associations between community violence and cognitive functions in observed data.....	210
Supplementary Figure 7.8 Forest plot estimates of associations between domestic violence and cognitive functions in observed data.....	211
Supplementary Figure 7.9 Forest plot estimates of associations of overall violence exposure, polyvictimisation and cognitive functions in observed data	212

LIST OF APPENDIX MATERIAL

Appendix Table 1 Sociodemographics and Violence Exposure Descriptive Statistics in Observed Data Stratified By Sex	301
Appendix Table 2 Mental Health Descriptive Statistics in Observed Data Stratified By Sex	302
Appendix Table 3 Cognitive Scores Descriptive Statistics in Observed Data Stratified By Sex	303
Appendix Table 4 Sociodemographics and Violence Exposure Descriptive Statistics in Imputed Data Stratified By Sex	304
Appendix Table 5 Mental Health Descriptive Statistics in Imputed Data Stratified By Sex	305
Appendix Table 6 Cognitive Scores Descriptive Statistics in Imputed Data Stratified By Sex	306
Appendix Table 7 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in females using observed data	307
Appendix Table 8 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in males using observed data	308
Appendix Table 9 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in females using imputed data	309
Appendix Table 10 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in males using imputed data	310
Appendix Figure 1 Forest plot estimates of associations between community violence and cognitive functions in females using imputed data	311

Appendix Figure 2 Forest plot estimates of associations between domestic violence and cognitive functions in females using imputed data	312
Appendix Figure 3 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using imputed data	313
Appendix Figure 4 Forest plot estimates of associations between community violence and cognitive functions in females using imputed data	314
Appendix Figure 5 Forest plot estimates of associations between domestic violence and cognitive functions in females using imputed data	315
Appendix Figure 6 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using imputed data	316
Appendix Figure 7 Forest plot estimates of associations between community violence and cognitive functions in males using imputed data	317
Appendix Figure 8 Forest plot estimates of associations between domestic violence and cognitive functions in males using imputed data	318
Appendix Figure 9 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using imputed data	319
Appendix Figure 10 Forest plot estimates of associations between community violence and cognitive functions in males using imputed data	320
Appendix Figure 11 Forest plot estimates of associations between domestic violence and cognitive functions in males using imputed data	321
Appendix Figure 12 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using imputed data	322
Appendix Figure 13 Forest plot estimates of associations between community violence and cognitive functions in females using observed data	323

Appendix Figure 14 Forest plot estimates of associations between domestic violence and cognitive functions in females using observed data	324
Appendix Figure 15 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using observed data	325
Appendix Figure 16 Forest plot estimates of associations between community violence and cognitive functions in females using observed data	326
Appendix Figure 17 Forest plot estimates of associations between domestic violence and cognitive functions in females using observed data	327
Appendix Figure 18 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using observed data	328
Appendix Figure 19 Forest plot estimates of associations between community violence and cognitive functions in males using observed data.....	329
Appendix Figure 20 Forest plot estimates of associations between domestic violence and cognitive functions in males using observed data.....	330
Appendix Figure 21 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using observed data.....	331
Appendix Figure 22 Forest plot estimates of associations between community violence and cognitive functions in males using observed data.....	332
Appendix Figure 23 Forest plot estimates of associations between domestic violence and cognitive functions in males using observed data.....	333
Appendix Figure 24 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using observed data.....	334

Chapter 1. Introduction

1.1. Overview

Violence, particularly among children, is a major public health issue worldwide (1). The WHO estimates that half of the children in the world experience violence each year and approximately three in four children between 2 - 4 years frequently experience maltreatment by parents or caregivers (2). Maltreatment refers to actions or failures to act by a parent or caregiver that result in harm, potential harm, or pose a threat of harm to a child (up to 18 years old). It typically encompasses, physical, sexual, psychological (or emotional) abuse (3). The WHO (2020) report also documented that, one in five children younger than 5 years reside with a mother who experiences IPV. Furthermore, about 75% of children between the ages of 2 – 4 in the world, were found lacking legal protection from corporal punishment (2). Violence exposure in childhood affects children in both HICs and LMICs (2). However, the majority (approximately 80%) of the children in the world reside in LMICs (4) and it has been documented that children in these setting experience a high burden of violence (2). For example, LMICs contributed 90% of the global Disability-Adjusted Life Years (sum of years of life lost and years lived with disability) lost to interpersonal violence against children up to 15 years of age in 2016 (5). Given these estimates on violence exposure in children, especially those in LMICs, it is imperative to understand its impact on early childhood development, a period characterised by physical, socio-emotional and cognitive development, laying the groundwork for subsequent health and development (6) and a key point for intervention.

The term “early childhood development” describes the development of the physical, socio-emotional, neurocognitive and motor domains during the period from birth to eight years (7). Experiences and environmental exposures during this period are crucial for early brain systems and developmental success. Later developmental periods are dependent on the skills and learning that is acquired in early childhood (6,8). Nurturing care is understood as a stable environment attuned to children’s health and their welfare needs, providing safety, early learning opportunities and developmentally enriching interactions (9). It encompasses social factors such as family dynamics, childcare, education, community characteristic, and policy contributions which all influence child development (10). Nurturing care is thus critical for child development and stems from mutual connections instigated by caregivers towards their

children and is maintained by environments (6). Early childhood violence exposure is a factor that can disrupt the nurturing care system and potentially alter developmental trajectories.

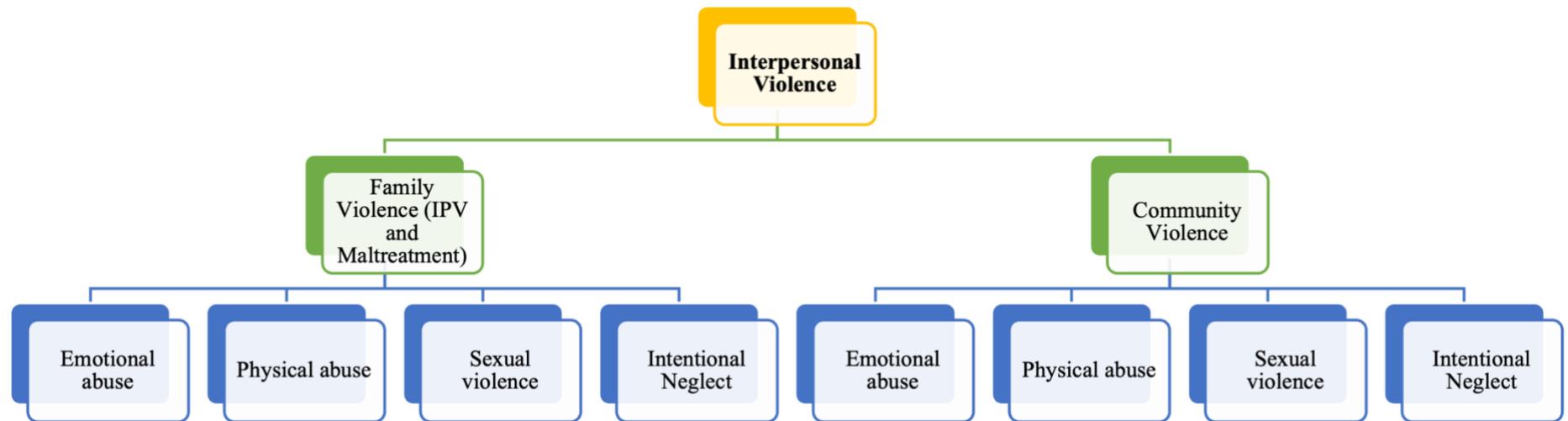
Exposure to various types of violence in childhood has been associated with behavioural problems in children and adolescents and psychopathology in adults (11–16). Violence exposure in early childhood has also been linked to poor cognitive outcomes in children, adolescents, and adults (17–21), these in turn impact academic achievement (22–26) and socioeconomic prospects later (27). Hypotheses for mechanisms through which violence exposure affects mental health and cognition, posit that, psychological trauma, similar to physical trauma has the potential to disrupt brain development especially during sensitive developmental windows. Consequently, the brain damage results in psychopathology and/or cognitive impairment (28–32).

1.2. The LMIC context

The consequences of childhood violence exposure, are far-reaching, adversely affecting individuals and economies. At the extreme, violence can result in the loss of life, serious injury and/or disability. Over and above, individuals exposed to violence incurring, medical costs (33), violence can be costly in other ways. For example, violence exposure can increase the likelihood of engaging in high-risk behaviours (i.e. smoking, alcohol and substance use, unsafe sex, eating disorders) which are some of the leading causes of death, cardiovascular disease, and mental health problems and HIV/AIDS (34). Furthermore, violence exposure in childhood as described above, has been associated with reduced cognitive ability and poor educational attainment (22,35,36). On a societal-level, the consequences of violence through these intermediary factors reduce productivity and increase the burden on health, welfare and criminal justice systems (12,37–42). In addition, alcohol use, substance use disorders, mental health problems and impulsive behaviours in turn increase violence perpetration, creating a cycle (43). The burden of violence in LMIC countries is higher than in HICs with mortality rates due to violence in these countries approximately 2.5 times higher than HICs' (44,45). For example, looking specifically at South Africa, an LMIC, the WHO 2002 reports indicated that its homicide rates of children younger than 5 years (14.0 and 11.7 per 100 000 for boys and girls, respectively), were more than twice the global average (44).

LMICs are plagued by other systemic burdens (such as HIV epidemics) and there is a demand for economic growth such that the added cost of violence increases strain to these

economies (46–48). Consider for instance, an LMIC with inadequate healthcare infrastructure, limited access to mental health services and an underdeveloped legal system. In such a setting, the capacity to provide healthcare to individuals affected by violence is severely constrained, especially when such resources are already stretched thin due to the pressing demands of other prevalent health crises, such as HIV and substance use disorders. Furthermore, in other LMICs that may not have such resources (i.e mental health services) in the first place, individual costs of violence are even more pronounced. Individuals exposed to violence would thus lack of access to critical support services such as therapeutic interventions that are critical for mitigating the impact of violence on their lives. Unfortunately, there is much less evidence regarding the relationships between violence exposure and health outcomes or interventions in LMICs compared to HICs (16,17,49). As such health practitioners and policy makers have very little to draw on when finding solutions to alleviate this burden. Notably, the negative outcomes may have more serious effects on children in LMICs due to poor access to mental health and social services (50,51).



Polyvictimisation

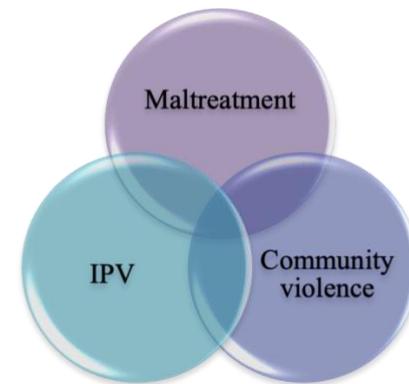


Figure 1.1 Categorisation of violence

1.3. Categories of violence

Violence, as defined by the WHO, is “the intentional use of physical force or power, threatened or actual against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation (44).” The phrase “use of physical force or power” widens the traditional understanding of the nature of violent acts by including those resulting from threats and intimidation and not limited to physical acts of violence. In the typology of violence proposed by the WHO, the first subcategory, family violence and IPV, refers to violence mostly between members of the same household and intimate partners and typically, though not entirely, occurring in the home. Community violence, the second subcategory refers to violence between unrelated individuals who may or may not be acquainted and generally occurs outside the home. Included in the former subcategory are other forms of violence such as child abuse. The violent acts can take the nature of physical, sexual, psychological abuse or deprivation/neglect. These four types of violent acts occur in each of the broad categories and the subcategories of violence mentioned (44). While neglect can be intentional and unintentional, unintentional neglect such as in the case of deprivation is beyond the scope of the thesis. In addition, polyvictimisation is a concept capturing exposure to multiple types of violence (52) is an important indicator capturing the burden of violence, see Figure 1.1 for a summary.

It is important to consider the co-occurrence of violence in the lives of children. A growing body of research has highlighted that different forms of violence tend to occur together such as IPV and child maltreatment. Researchers have found that these forms of violence often coincide within a single family, spanning across different generations (53,54). It was documented in a review that IPV and child maltreatment share numerous risk factors, for instance, they are prevalent in environments where social norms tolerate violence, gender inequality is high, and legal repercussions for violence are insufficient (54). Additionally, factors such as marital discord, financial strain, parental substance abuse, depression, criminal involvement, and male unemployment contribute to the occurrence of both forms of violence (54). These risk factors are prevalent in LMIC

settings increasing the risk of children's exposure to these forms of violence. Indeed, a meta-analysis investigating the co-occurrence of IPV and child maltreatment in LMICs found that a positive association between the two, with some studies identifying maternal age, parental education level as well as alcohol and substance use as risk factors for the co-occurrence (55). While research investigating the co-occurrence of community violence and other types of violence is limited, researchers have demonstrated that neighbourhoods influence child maltreatment (see review: (56)). Indeed, studies have shown associations between community violence and parent-child interactions as well a community violence and maltreatment, finding that children exposed to community violence tend to experience abuse in their family (57,58). Researchers argue that the increased stress on parents as a result of living in neighbourhoods with high levels of social disorder may result in the maltreatment that children subsequently experience (59). Furthermore, recently, it was found that living in neighbourhoods with positive environment for children was associated with lower maltreatment in children (59). Other researchers have found that exposure to community violence tend to also co-occur with IPV (60). Unfortunately, crime and other social problems are common in LMIC contexts (61), as such children in these contexts have a risk of exposure to community violence as well as maltreatment and IPV.

Another phenomenon widely investigated in the literature is that of intergenerational transmission of violence. Researchers have found that individuals who were maltreated as children are likely to experience or perpetrate IPV as adults (62–64) and abuse their children (65,66), thus continuing the cycle of violence across generations. As such, interventions that tackle violence in childhood have the potential to break the cycle of violence that plague many families.

1.4. Child mental health problems

In young children, mental health problems are typically characterised as either internalising or externalising problems (67,68). Internalising behaviour conditions reflect problems that are inwardly focussed and reflecting the internal psychological and emotional state of a child and include withdrawn, inhibited, anxious and depressed behaviours. Whereas externalising behavioural problems are negative outward

manifestations of a child's behaviour toward the external world such as disruptive, hyperactive, aggressive and delinquent behaviours (56).

Internalising and externalising problems pose a public health concern affecting an estimated 13.4% of school aged children and adolescents globally (69). Specifically, a review spanning 27 countries (including nine from LMICs), found that the prevalence of any anxiety disorder was 6.5%, depressive disorder 2.6%, attention-deficit hyperactivity disorder (ADHD) 3.4%, and any disruptive disorder 5.7% in a review sample aged 6 -18 years (69). While comparatively little is known about the prevalence of mental health problems in younger children, in a recent meta-analysis spanning eight countries (including two from LMICs) it was estimated that approximately 20.1% of children between 1-7 years old have mental health disorders (70). The prevalence of any anxiety disorder was 8.5% while any depressive disorder was prevalent in 1.1% of the sample. In terms of specific disorders, oppositional defiant disorder (4.9%) and ADHD (4.3%) emerged as the most prevalent mental health disorders.

One of the most common measures used to screen children for internalising and externalising behaviour problems in research settings is the CBCL (67). The CBCL has been translated into multiple languages and is validated to screen for mental health problems in children aged 1.5 to 18 years. In the case of preschoolers (aged 5 years and under), the CBCL is typically administered to caregivers, who report on their children's behaviour. In these instances, it is commonly recognised that preschoolers may not possess the necessary cognitive capacity to report on their behaviour (71). For example, studies have shown that in addition to reading and language difficulties, young children often provide responses based on their current emotional state (72,73). Consequently, their reports may be less reliable. Although self-report measures exist, the majority of measures used for this population rely on parent or care-giver reports (74,75).

Mental health problems in childhood can persist into adulthood, but it is also common for internalising problems in childhood to shift to externalising problems in adolescence and adulthood, and vice versa (76–80). For example, children who exhibit externalising problems in childhood are at an increased risk of being delinquent teenagers and obtaining a criminal record as adults (81). Likewise, children experiencing internalising problems in childhood, are likely to suffer from depression and anxiety as adults (81). Moreover, mental health problems in childhood negatively impact other aspects

including academic achievement, risk of drug use, vocational prospects and violence and suicidality, which are costly to individuals and societies (82). Research understanding mental health in young children and contextual factors that contribute to it is important for early interventions to prevent the later negative outcomes. Yet there is very little, prospective longitudinal research investigating the risk factors for mental health problems in early childhood and in particular violence exposure.

1.5. Neurocognition

Neurocognition generally refers to mental processes related to acquiring knowledge, processing information, and engaging in reasoning used by individuals to interact and adapt to their environment (83,84). Cognitive functions that encompass neurocognition are typically grouped into domains with subdomains of elemental abilities within the overarching constructs (85). Table 1.1 summarises the cognitive domains typically assessed, including their subdomains and provides definitions: they mainly include visuo-perception, motor ability, and construction, attention, memory, processing speed, language ability and visuomotor skills (85). Other domains assessed typically encompass a combination of cognitive processes. For example, executive functions are a manifestation of the collaboration of several lower-order functions such as sensory, perceptual, and attentional abilities (86). While general cognitive functions, typically used to assess general intelligence or intelligence quotient (IQ) are a composite of various cognitive processes (87). Furthermore, academic performance typically involves cognitive functions that encompass various cognitive processes ranging in complexity such as language ability and executive functions (88). Of note, there is often overlap between the domain categorization of cognitive functions, for example, working memory is widely understood as part of the memory and executive functioning domains (89). Additionally, there appears to be a hierarchical processing in terms of cognitive functioning where functions collaborate in order of complexity to serve higher order complex functions (85). For instance, reasoning ability, a type of executive function, relies on working memory, which relies on effective attentional control and together these processes enable planning ability, another executive function (86). As such, dysfunction in one domain may affect others.

Table 1.1 Cognitive domains and subdomains commonly assessed in cognitive assessments

<i>Domain</i>	<i>Subdomain</i>	<i>Definition</i>
<i>Visuo-perception</i>	Object recognition	The ability to recognize and process meaningful stimuli in any sensory modality (90). This also includes visuospatial abilities, which refer to visual perception of object spatial orientation and relation (91).
	Organizational strategies	
<i>Motor and construction</i>	Copying	Motor skills : Basic components of motor activity such as fine motor abilities, manual dexterity, motor speed and balance.
	Drawing	Construction: ability to reproduce or produce drawings (of common objects) or block constructions (85)
<i>Attention</i>	Selective attention	The ability to attend to target information while ignoring irrelevant information (92)
	Sustained attention/vigilance	The ability to maintain attention over time (93).
<i>Memory</i>	Working memory	The capacity to retain and manipulate information for adaptive use, it is also considered an executive function (89)
	Episodic/declarative memory	Encoding, storage and retrieval of sensory information (verbal or nonverbal) into and out of long-term storage using working memory (90).
<i>Processing speed</i>	Procedural memory	Automatic learning and recall of motor actions or skills (90).
	Semantic memory	Long-term storage (memory) of general world knowledge (90).
<i>Language</i>	Prospective memory	The ability to remember intended actions or future tasks (90).
	Semantically relevant (fluency)	The ability to quickly execute tasks that vary in complexity (94).
<i>Visuomotor skills</i>	Coding and tracking	
	Naming	Encompasses both receptive and productive abilities, and involve understanding language, accessing semantic memory, identifying objects by name and responding to verbal instructions with corresponding behavioral actions (90).
<i>Executive functioning</i>	Fluency	
	Reading and comprehension	The co-ordination of visual perceptual and motor functions and include hand-eye-coordination (95).
<i>General intellectual functioning</i>		Executive function refers to a set of cognitive processes that manage and direct conscious thought and action towards purpose-driven behaviour (96,97).
	Reasoning	Encompasses the capacity for concept formation, creativity and abstract thinking (86).
<i>Academic performance</i>	Problem solving	Involves analysing and addressing problems to arrive at a viable solution (86).
	Cognitive flexibility	Ability to adapt and shift perspectives, focus and actions, between different tasks, according to the context (98,99)
<i>General intellectual functioning</i>	Inhibition	Ability to suppress a response in favour of an alternative action (98,100).
	Planning	The capacity for formulating, identifying and evaluating actions necessary to achieve a specific goal (86).
<i>Academic performance</i>		Overall capacity to behave with purpose, reason logically, and connect with one's surroundings. It encompasses a broad range of cognitive functions and skills (87).
		Mathematics, Reading, Writing (101).

Lastly, it is recognised that cognitive functions are subserved by distinct brain regions, such that within any given domain it is possible that some subdomains are impaired, and others remain intact (102).

Neurocognition is typically measured using cognitive assessments. Standardised test batteries grouped according to the subdomains above are used to measure one or more distinct functions (85). Generally, cognitive assessment compares an individual's performance to the expected performance based on appropriate norms for each measure. Test norms serve as a benchmark to evaluate an examinee's scores relative to population averages (102). There are multiple standardised tests available designed to assess a variety of cognitive domains in both adult and paediatric populations, see (90) and (103) for comprehensive lists. Reliable standardized and validated measures are used to enable researchers and clinicians to communicate and compare findings. Tests assess specific abilities, facilitating accurate interpretation of scores. One of the key aims of cognitive assessment is to gather insights about the brain's structural and functional capabilities, which helps in evaluating an individual's ability to perform daily activities, academic or vocational settings. Furthermore, cognitive tests have been used to investigate brain functioning (83,104).

Early childhood presents sensitive periods for brain development, which describe restricted developmental spans when specific brain systems and corresponding social-emotional, behavioural and/or cognitive functions are extremely responsive to input and modification from the environment (105). This period is also critical for brain maturation, as extensive growth in grey and white matter is seen in the first two years of life, when the brain reaches 80–90% of its adult size (106,107). Exposures such as toxic stress or violence can disrupt developmental processes leading to cognitive dysfunction (108). It is important for children to successfully attain neurocognitive skills during development. Cognitive abilities facilitate children's development and participation in their surroundings, encouraging both social and academic learning and consequently influencing various aspects of life. For example, a previous study found that cognitive abilities in childhood were associated with educational attainment (109) and with cognition in middle adulthood (110). Whilst mathematics and reading achievement at age 7 were associated with later adult socio-economic status in another study (111).

1.6. Childhood violence exposure and mental health problems

Exposure to violence in childhood has been associated with mental health problems across childhood, adolescence, and adulthood (112). A particular focus has been on the impact of childhood maltreatment on mental health, where studies have found that different types of maltreatment are risk factors for internalising and externalising problems in children and adolescents (14,113,114). Domestic violence has also received some attention with studies showing that children exposed to IPV have an increased risk of having mental health problems (115–117). Research investigating associations between community violence and mental health has been relatively scarce. Nonetheless, the available studies, primarily conducted in HICs, suggests that experiencing community violence as a victim is associated with adverse mental health outcomes, especially externalizing problems, in adolescents (16).

Where childhood exposure to polyvictimisation has been investigated in relation with mental health problems, researchers have found that exposure to multiple forms of violence has a larger effect on psychopathology than exposure to single forms of violence (118). Furthermore, studies have found a dose-response relationship between the number of types of violence experienced and the mental health problems experienced (118,119). However, the research into these relationships has largely been conducted in HICs limiting our understanding of these associations in children living in LMICs, who experience much higher levels of polyvictimisation alongside other environmental risks (119). Furthermore, the majority of research has focussed on investigating later childhood mental health outcomes, even if exposure to violence was measured in the early years (119). Chapter 3 discusses these issues in more detail based on a scoping review of the evidence available.

1.7. Childhood violence exposure and cognitive outcomes

Studies examining the impact of violence on the cognitive functions of preschoolers in LMICs are particularly scarce. Several cross-sectional studies conducted in USA have described cognitive deficits in adulthood are among the most common outcomes associated with maltreatment in childhood (120–123). In a recent review of studies in

HICs, the adverse effects of childhood maltreatment on ensuing cognitive functions were consistently described in paediatric and adult populations (20). The authors further highlighted how various forms of maltreatment in childhood may have separate and/or additive negative effects on various cognitive domains including general cognition, executive functioning and language ability. Regarding relationships with other forms of violence, a recent review largely consisting of school-aged and adolescent samples from HICs found that IPV was associated with poor cognitive functioning, in especially domains of general IQ, language and academic abilities (17). Research investigating community violence is more limited, with some studies linking exposure to community violence to poor outcomes in real-world settings such as lower school achievement in USA (124,125). Chapter 2 discusses these issues in more detail drawing on a systematic review of the existing evidence.

1.8. Mechanisms

Researchers have highlighted how violence exposure can adversely impact health through changes in the neurodevelopmental, neuroendocrine and immunological systems. Furthermore, studies have implicated various factors in the associations of violence exposure with mental health and cognitive functions in children (See Figure 1.2 for a summary). The section below summarises the current evidence for potential pathways linking violence exposure with mental health and cognitive functioning in childhood.

1.8.1. Violence exposure and brain development

Imaging studies in adult and paediatric populations have documented evidence suggesting that childhood violence exposure negatively impacts the development of various brain structures. For example, previous studies found that maltreated children had smaller overall brain volumes than non-maltreated children, with specific reductions in cerebral lobes, and cortical grey and white matter (126–129) Furthermore, others have found that maltreated adolescents with PTSD had altered development of the prefrontal cortex, an area essential for higher-order cognitive functions, with increased volume in certain areas and reduced volume in others when compared to controls (128,130–132)

Research has also highlighted the impact of maltreatment on limbic structures such as the amygdala and hippocampus, key to emotional processing and memory. While some studies found reduced amygdala volume in children who experienced emotional neglect or physical abuse (133,134), findings regarding hippocampal volume are inconsistent, with some studies showing no differences in maltreated children (126,127), while others, especially in adults, observing reduced hippocampal volumes (135,136).

Emerging research has investigated the impact of childhood violence exposure on other brain structures, such as the basal ganglia, cerebellum, corpus callosum, and white matter tracts, implicated in socio-emotional and cognitive development (129,133,137,138). Functional MRI studies have documented altered brain activity in maltreated children relative to controls, including changes in cognitive inhibition, emotional processing, and socio-emotional cue processing (139–143). Furthermore, electrophysiological studies using error-related negativity (ERN) and electroencephalographers (EEGs) have found increased responses to errors and emotional stimuli in maltreated children compared to controls, suggesting heightened vigilance and potential socio-emotional difficulties (144–146). These findings collectively suggest that violence exposure disrupts brain development, increasing the risk of mental health issues and impaired cognitive and emotional functioning.

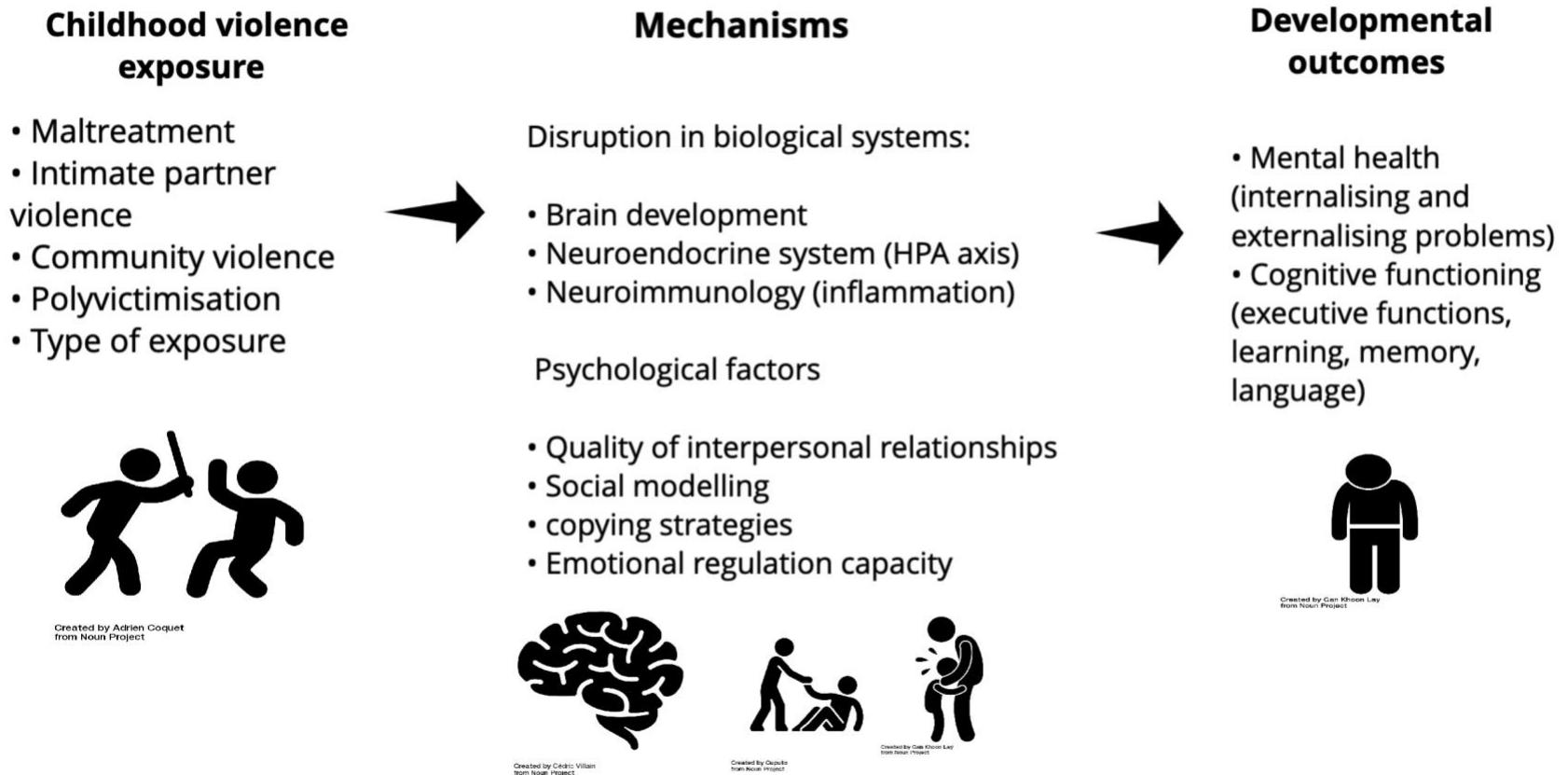


Figure 1.2 Conceptual framework of the hypothesised pathways through which violence exposure affects child mental health and cognition

1.8.2. Neuroendocrine system

While the research above has established a link between childhood violence exposure and alterations in brain structure and function, the underlying mechanisms remain unclear. The HPA axis, a major neuroendocrine pathway, is believed to play a key role in stress adaptation, with early life experiences shaping its development and impacting brain function long-term (147). Studies have observed chronic HPA axis activation in maltreated children, indicated by elevated cortisol levels (148–150), and changes in cortisol response patterns (151–156). Additionally, the toxic effects of elevated cortisol on the developing brain, particularly in regions such as the hippocampus, prefrontal cortex, and amygdala, have been demonstrated (157–159).

Researchers have also investigated the role of monoamine oxidase A (MAOA), an enzyme regulating neurotransmitters such as serotonin and dopamine. Variations in the MAOA gene have been associated with mental health problems in maltreated children (160–163). These findings suggest a complex interplay between genes and environmental stressors, such as violence, in shaping mental health outcomes. However, this area of research is still emerging, indicating the need for further studies to fully understand these biological mechanisms.

1.8.3. Neuroimmunology

The immune system, is not fully developed at birth and as a result, continues to develop in childhood and in response to environmental input (157,164). Inflammation, a key immune response, can have detrimental long-term effects when prolonged (165). Studies in both animals and humans have found that early immune system activation was associated with cognitive difficulties, neurodevelopmental conditions such as autism spectrum disorders and mental health problems including depression and schizophrenia (166–171). The immune system also plays a crucial role in brain development, influencing processes such synaptic transmission, myelination, and neurogenesis (172–177). Early immune activation can disrupt these processes, potentially affecting long-term brain function and behaviour (178).

Research has linked childhood violence exposure to increased inflammation and heightened sensitivity to stress. Studies have documented associations between childhood maltreatment and elevated plasma inflammatory markers in adults, as well as impaired acquired immunity in maltreated adolescents (179–184). Early adversity has been linked to higher inflammatory markers in children, and genetic predispositions can exacerbate these effects (185,186). Additionally, adults with depression and maltreatment histories were found to have increased inflammatory responses to stress (187–191), suggesting a link between early immune dysfunction and later mental health problems.

1.8.4. Psychosocial factors

Of note, when investigating violence exposure and developmental outcomes, psychosocial issues should be considered. For example, SES is an important factor to consider, especially in LMICs. It has been documented that children from economically disadvantaged backgrounds are more likely to experience violence (192–194). In addition, other factors prevalent in these contexts such as lack of access to resources including high-quality childcare, and stimulating neighbourhoods and homes, low parental warmth and environmental toxins affect children's socioemotional and cognitive development (195–198). Lastly, lack of support and poor resources in these environments hamper children's recovery when exposed to violence (199–201).

1.8.5. Nonbiological pathways

Researchers have also emphasised psychological pathways that play a role in children's violence exposure and their mental health and cognitive outcomes. The quality of interpersonal relationships has been implicated, especially within the family and has been found to impact children's mental health and cognitive development. Children exposed to IPV or maltreatment for example may experience difficulties in forming healthy relationships which can lead to internalising and externalising behaviours (202). Similarly, researchers have shown that children exposed to violence with supportive caregivers have a decreased risk of developing psychopathology (see metanalysis: (203)). In addition, exposure to violence in family settings may disrupt cognitive processes, affecting attention, memory and problem-solving abilities. Researchers have also suggested that children exposed to violence may learn aggressive behaviours

through social modelling, adopting aggressive coping strategies as a response to their environment (204). The normalization can lead to the development of a hostile interpersonal orientation, influencing how children perceive and interact with others. Children may come to accept violence as a normative behaviour, leading to desensitization to violence and a higher tolerance for aggressive actions. Furthermore, exposure to violence can shape children's cognitive orientation towards aggression and hostility. They may internalize beliefs that violence is an acceptable means of resolving conflicts or coping with stress. The normalization of violence and adoption of aggressive coping strategies can contribute to externalizing behaviours, conduct problems, and aggressive tendencies in children . The cognitive distortions and acceptance of violence resulting from this socialisation can affect cognitive processing, moral reasoning, and social problem-solving skills. These cognitive challenges may contribute to mental health problems and behavioural problems, impacting academic performance and cognitive development in childhood (204,205).

Another pathway is related to the development of emotion regulatory functions. Researchers have found that exposure to violence in childhood can lead to negative coping strategies and emotional distress. Specifically, exposure to violence can disrupt children's ability to regulate their emotions effectively (206). They may develop maladaptive coping strategies in response to the stress and trauma associated with violence exposure. Children may resort to avoidance, withdrawal, or other ineffective coping mechanisms to deal with the emotional distress caused by violence exposure. These strategies can lead to increased anxiety, depression, and aggression (205). The ongoing emotional distress resulting from exposure to violence can manifest as symptoms of posttraumatic stress, such as intrusive thoughts, nightmares, and hypervigilance (205). The cumulative effect of disrupted emotion regulation and negative coping strategies can contribute to mental health problems such as anxiety, depression, and behavioural problems (204–206). The emotional distress and mental health problems stemming from the stress pathway can impair cognitive functioning which may hinder academic performance and overall cognitive development in childhood (88,204,205). Indeed, researchers have found that effective coping strategies, such as seeking social support or engaging in problem-solving, can buffer the negative impact of violence exposure on mental health and cognitive functioning (204). In contrast, maladaptive coping mechanisms, such as avoidance or aggression, may

exacerbate mental health problems and cognitive difficulties (204). It has also been found that coping efficacy, or the belief in one's ability to cope with stressors, can also impact mental health outcomes by shaping children's resilience and adaptive functioning (204). Studies have also found that childhood violence exposure can lead to biased social information processing, where children are more sensitive to threat cues and perceive neutral situations as hostile. These biases are associated with various mental health problems, including anxiety, depression, PTSD, and externalising problems (206).

Lastly, children's exposure to violence in their homes and/or communities may lead to education disruption which in turn impacts children social emotional and cognitive skills attainment. Specifically, community violence poses a direct threat to safety and security of children which may result in temporary closures of school as well as fear and anxiety to attend school which may lead to truancy i.e. in settings in which there is gang violence (207). Children exposed to IPV may not attend school due to experiencing distress and or separation anxiety related to fear of leaving their affected parent (208,209). Additionally, school absenteeism has also been found in abused children (210), these children experience significant distress and or physical harm that likely impairs their ability to attend school. Furthermore, children may not want to risk others finding out about the abuse and as such miss school during periods when the abuse occurs. If these cycle continues, failure to attend school or alternatively attending school whilst in distress disrupts children's education and subsequent attainment of social emotional and cognitive skills resulting in mental health problems, cognitive difficulties and poor educational outcomes (211).

1.8.6. Summary

In sum, previous studies propose a mechanism through which stress can affect mental systems by illustrating that both physical and psychological trauma can negatively impact the brain especially during sensitive and critical windows of early brain development. Cortisol and inflammation due to life stressors (i.e. violence exposure) in childhood are potentially harmful internal mediators of the stress response system that might cause irreversible damage on the developing brain. Furthermore the quality of

interpersonal relationships, particularly within the family context, as well copying strategies and emotional regulation capacity emerge as a critical psychological factors influencing children's mental health and cognitive development following exposure to violence. The interplay of genetic, social, and biological elements shapes a mechanism whereby childhood violence exposure is associated with neuroendocrine-immune dysregulation. This can result in significant changes in both brain structure and various bodily functions during sensitive developmental periods. Subsequent psychopathology and cognitive impairment later reveal the epigenetic, physiological and psychological effects of the brain and body's adaptive processes to stress and traumatic events.

1.9. Overall aim and specific objectives

There are important gaps in the literature as discussed above and in the reviews in Chapter 2-3: Firstly, while most children globally reside in LMICs, there is limited knowledge about the extent or range of violence they experience in early childhood. There is also a need for literature synthesising the current evidence in this population. Secondly, the greater proportion of the available literature has focussed on maltreatment, with other types of violence such as community violence and IPV receiving far less attention. Thirdly, research investigating how exposure to violence impacts developmental aspects such as mental health and neurocognitive abilities in childhood is limited, especially in these contexts. Lastly, research investigating the impact of exposure to multiple forms of violence on these domains is limited. The thesis aims to understand the burden of violence preschoolers in LMICs face as this is key for informing strategies for interventions tackling violence in these contexts. Furthermore, the thesis aimed to provide a better understanding of the impact of violence on developmental outcomes as this can inform strategies for targeted therapeutic interventions for young children experiencing violence in these settings, providing them with coping mechanisms to prepare them for the emotional and cognitive demands of school. More specifically, the thesis objectives were the following:

1.9.1. Objective one

To identify and assemble the existing evidence on the relationships between violence exposure and cognitive outcomes in children in LMICs and identify knowledge gaps (Chapter 2).

1.9.2. Objective two

To identify and assemble the existing evidence on the relationships between violence exposure and mental health outcomes in children up to the age of 11 in LMIC settings and to identify knowledge gaps and themes in the current literature (Chapter 3).

1.9.3. Objective three

To explore and describe the violence exposure patterns of preschool children in an LMIC (Chapter 5).

1.9.4. Objective four

To investigate the relationship between violence exposure and mental health problems in preschoolers in an LMIC, specifically, to investigate associations between overall violence exposure, different violence exposure types and polyvictimisation with mental health problems (Chapter 6).

1.9.5. Objective five

To investigate the relationship between violence exposure and cognitive outcomes in preschoolers in an LMIC specifically, to investigate associations between overall violence exposure, different violence exposure types and polyvictimisation with various cognitive functions (Chapter 7).

1.10. Overview and structure of the thesis

This chapter has provided an introduction to the topic of childhood violence exposure, mental health and cognitive outcomes in LMICs and the mechanisms that drive these relationships. Next, a systematic review chapter is presented which systematically

reviews the literature investigating violence exposure and cognitive outcomes in children living in LMICs. Following this, a scoping review chapter is presented which reviews the literature investigating violence exposure and mental health problems in children living in LMICs. Subsequently, a methods chapter is outlined, providing a comprehensive view of the Drakenstein Child Health Study (DCHS), a South African birth cohort study within which the thesis is situated. This section details the study's design, population, methodologies, and ethical considerations. Finally, the thesis includes three results chapters and a discussion chapter. The three results chapters present results from the analysis describing the violence exposure patterns of preschoolers from the DCHS and associations between violence exposure and mental health and cognitive outcomes in this sample. Subsequently, the discussion chapter synthesises the key themes, contributions and gaps of the thesis while also considering the implications and recommendations for future research and practice.

Chapter 2. Violence Exposure and Cognitive Outcomes Among Children in LMICs: A Systematic Review

Manuscript submitted to Journal of Trauma, Violence, & Abuse,

Tsunga, L., Hiscox, L.V., Halligan, S. L., Donald, K.A., Fraser, A. Violence Exposure and Cognitive Outcomes Among Children in LMICs: A Systematic Review.

My contributions and those of my co-authors: I formulated the aims and methodology of the study in partnership with my supervisors Abigail Fraser and Kirsty Donald. Sarah Halligan played a key role in conceptualizing and designing the study and provided critical revisions of the manuscript for intellectual content. I conducted literature searches and together with co-author Lucy Hiscox screened records obtained. We also extracted data from studies and conducted risk of bias analyses in consultation with all co-authors. I wrote the first draft of the manuscript, which was then reviewed by all co-authors who contributed conceptual and intellectual insights. Every author played a role in the completion of the final manuscript.

Relevance to the thesis: This chapter addresses the first aim of the thesis by first synthesising the evidence on the relationships between violence exposure and cognitive outcomes in children in LMICs. While the previous chapter briefly discussed the epidemic that is violence and its associations with mental health and cognitive outcomes along with proposed biological mechanisms that include brain systems, neuroendocrine and neuroimmune systems. The current chapter systematically reviewed the research available using specific criteria in order to provide a more comprehensive understanding of the current evidence on the associations between violence exposure and cognitive outcomes in childhood. Findings from this review provide the rationale for the subsequent results chapters within the thesis. Chapter 7 investigates violence exposure and cognitive outcomes in preschoolers using data from a South African prospective birth cohort.

2.1. Background

As previously discussed in Chapter 1 Exposure to violence during childhood is a significant human rights and public health concern that can result in enduring adverse

health and social outcomes throughout an individual's life. To date, the existing literature has primarily focused on investigating the effects of violence exposure on physical health (41,212) or mental health and psychosocial functioning (14,112,117,118). Cognitive outcomes have received comparatively less attention. Cognition plays a role in emotional processing, social functioning, educational achievement, and vocational outcomes (88,213,214). As such, cognitive impairments can have far-reaching consequences, significantly affecting a child's day-to-day functioning and long-term prospects (88).

The available research investigating the potential impact of childhood exposure to violence on cognitive outcomes has predominantly been conducted in adolescents and adults living in HICs, (17–21,215). Overall, studies have described associations between maltreatment in childhood and poor cognitive outcomes, including lower general intelligence, poorer literacy and numeracy skills, and deficits in executive functions such as attention and working memory (19–21,215). Associations have also been found between exposure to IPV and poorer intelligence quotient (IQ) scores, poor verbal abilities, and academic skills (17,115). While there is limited research focusing on community violence, one study conducted in the USA found that adolescents exposed to community violence were at risk for lower IQ scores (216). Other research found that US preschoolers living in violent contexts exhibited attention problems, poor impulse control, and lower pre-academic skills (217,218).

It is well-documented that children in LMICs have a greater exposure to violence than those in HICs (1). The added burden of violence is taxing on LMICs, which have underdeveloped economies and public health systems (33,219). Furthermore, the effect of violence exposure on children's cognitive abilities, and consequently their educational achievements, impacting both individuals and society as a whole (88).

Understanding the potential consequences of violence exposure for cognitive outcomes in children living in LMICs, and the factors that could mitigate against those consequences, can inform policy and interventions to prevent persistent adverse consequences of violence exposure (220), and potentially contribute to breaking cycles of violence and poverty (221,222).

I conducted a systematic review and synthesized evidence that examined associations between exposure to various forms of violence in childhood and cognitive outcomes in

children aged 11 years and under, residing in LMICs. This age limit allowed me to capture preschoolers and school-aged children who are largely neglected in the literature. My specific research questions were: is children's exposure to violence in LMICs associated with their cognitive performance and is there any evidence of potential moderators of violence-cognition associations?

2.2. Methods

2.2.1. Protocol

The process and reporting of results in this systematic review were guided by the 2020 PRISMA statement for reporting systematic reviews (223). The protocol was registered on PROSPERO (CRD42021268450) and is included in the thesis appendix.

2.2.2. Eligibility Criteria

Observational studies that investigated the relationship between childhood violence exposure and cognitive outcomes assessed in children aged 11 or younger were included. The studies included comparisons between violence-exposed and non-exposed groups, as well as investigations into the associations between the extent of violence exposure and cognitive functioning. Study designs included cross-sectional, case-control, and cohort studies. There were no restrictions on publication dates. All studies had to be written in English due to the language constraints of the authors. Reviewed studies were those published in peer-reviewed journals.

The target population comprised children living in LMICs. The OECD classification system was used to classify countries as LMICs based on income levels and economic development (see supplementary Table 1). Studies were included if the mean age of participants at the outcome assessment was 11 years or under or if at least 80 per cent of the sample fell within this age range.

Definitions of the types of violence considered are presented in Table 2.1. Based on existing characterisations ((224–229) acts of violence could include: (a) violence of a sexual nature, such as unwanted touching, forced sex, attempted unwanted sex, sexual harassment or pressurised/coerced sex), (b) emotional acts of violence, such as verbal and psychological abuse, (c) physical acts of violence, such as corporal punishment, violent discipline, and physically abusive behaviours, (d) neglect, (e) bullying, such as

cyber, physical or verbal bullying, (f) witnessing domestic violence or parental IPV, (g) witnessing community violence, including sexual assault, burglary, mugging, the sound of gunshots and gang violence (h) collective violence committed by larger groups of individuals or by states, including social, political, war and economic violence. Studies on ACEs where included where experiences that fall under the above scope of violence exposure were reported. In such cases, I reported on the ACEs that fell under this scope, and results were reported separately for each ACE.

Cognitive function encompasses a wide range of mental processes and abilities that enable individuals to acquire knowledge, process information, and engage in reasoning. Domains of cognitive functions include executive functioning (attention, working memory, inhibitory control, problem-solving, abstraction, planning and organization, cognitive flexibility); learning and memory (verbal, visual, tactile, prospective, remote memory), language ability (expressive, receptive language), intelligence (IQ, reasoning), processing speed, perception and motor functions, social cognition and academic performance (205,206). Interrelated developmental aspects such motor function and as socio-emotional development where they were investigated within a cognitive development framework were also included (232).

Table 2.1 Childhood violence exposure definitions

Physical violence/abuse	Acts that involve inflicting physical harm or having the potential to cause harm. These acts are typically under the control of a parent or an individual in a position of responsibility, power, or trust. They may occur as isolated incidents or be repeated over time.
Sexual violence/abuse	Instances where a child is engaged in sexual activity without full comprehension, the ability to give informed consent, or the necessary developmental readiness. It encompasses activities that violate both legal and social norms within society. Child sexual violence can involve an adult or another child who, due to age or developmental differences, holds a position of responsibility, trust, or power. The purpose of such activity is to fulfil the needs or gratify the other individual involved.
Emotional violence/abuse	The failure to provide a nurturing and appropriate environment including the availability of a primary attachment figure which supports a child's development of emotional and social competencies in line with their potential and societal context. It involves acts that have the potential to cause harm to the child's health, physical, mental, spiritual, moral, or social development. These acts are typically within the control of a parent or an individual in a position of responsibility, trust, or power. Examples of such acts include restricting the child's movement, engaging in patterns of belittling, denigrating, scapegoating, threatening, scaring, discriminating, ridiculing, or employing other non-physical forms of hostile or rejecting treatment. The ultimate effect is hindering the child's ability to develop a stable and comprehensive range of emotional and social skills.
Neglect	The failure to adequately meet the child's needs across various domains, including health, education, emotional development, nutrition, shelter, and safety, taking into account the available resources accessible to the family or caretakers. It involves acts or omissions that have the potential to cause harm to the child's health, physical, mental, spiritual, moral, or social development. This includes the failure to provide appropriate supervision and protection to children to the extent that is reasonably feasible, ensuring their well-being and safety.
Witnessing domestic violence	When children see, hear, actively intervene in, or personally experience the consequences of physical or sexual assaults involving their caregivers
Bullying	Bullying involves enduring repeated negative actions from one or more individuals over an extended period. The victim often faces challenges in defending themselves against such behaviour. The review will include studies on both the perpetration and victimization of bullying, including cyberbullying and peer-to-peer victimization.
Community violence	Children's exposure to interpersonal violence outside of their homes, schools, institutions, or organized workplaces can occur through witnessing, perpetrating, or being directly victimized. This form of violence, known as community violence, encompasses various types such as physical violence, sexual violence, assaults by authority figures (e.g., police), and violence linked to gangs and traffickers.
Collective violence	Violence perpetrated by larger groups or states can be classified into different categories. Social violence refers to violence carried out to promote a specific social agenda. Political violence encompasses acts associated with war, violent conflicts, state violence, and similar actions conducted by larger groups. Economic violence involves attacks motivated by economic gain, orchestrated by larger groups.

Note: The definition of physical, sexual, and emotional violence and neglect are from the WHO (233). The definition of domestic violence is from Edleson, 1999; Jouriles et al., 2001; Wolak & Finkelhor, 1998. (225–227). The bullying definition is from Gredler (228). Community and collective violence as defined by the World Report on Violence and Health, World Health Organization (234).

2.2.3. Exclusion criteria

Exclusion criteria were: 1) Studies that examined children with special conditions, including disability or serious mental illness; 2) Studies that measured violence exposure indirectly such as classifying communities as violent without directly reporting individual exposure. However, studies on IPV were included even when there were no indices capturing whether children witnessed said violence, given that young children are often in their homes/the presence of their caregivers and are therefore particularly likely to be exposed to IPV (235,236).

2.3. Information sources and search strategy

A comprehensive search was conducted in Embase, Medline and PsycINFO using the search terms listed in Table 2.3. Non-peer reviewed literature indexed within these databases were also included. The reference lists of the included studies were also examined to identify any additional relevant articles. Variations of search terms and limiters were used to ensure the search was comprehensive and identified a broad range of literature (see supplementary Table 2.1 for the full search strategy). Searches were conducted in November 2021 and updated in May 2023.

2.4. Data management and selection

I conducted title and abstract screening. Full-text screening of the articles deemed eligible for inclusion was conducted by LH and myself, independently, with 90% interrater reliability. We initially differed regarding the inclusion/exclusion of four articles and disagreements were resolved through discussion.

2.5. Data Extraction

LH and I independently extracted data on authors, publication year, study design, country of study, participant characteristics, (i.e., sample size, age, sex), violence exposure (type, measurement tool, respondents), cognitive outcomes (type, measure) and key results.

2.6. Risk of bias assessment

LH and I also independently used the RoBANS (237) to assess the risk of bias. Any conflicts were addressed and settled by consensus. Risk of bias was assessed according to the six domains of the RoBANS: (1) *selection of participants* defined as selection bias caused by inadequate selection of participants, e.g. selection of controls from a different population sampling frame than cases in a case control study; (2) *confounding variables* defined as bias caused by inadequate adjustment of confounding variables; (3) *measurement of exposure* defined as information bias caused by inadequate measurements of exposure; (4) *blinding of outcome assessments* defined as detection bias caused by the inadequate blinding of outcome assessors such that they are aware of the exposure status; (5) *incomplete outcome data* defined as attrition bias caused by the inadequate handling of incomplete outcome data and (6) *selective outcome reporting* defined as reporting bias caused by the selective reporting of outcomes. Risk of bias was rated as *low*, *high* or *unclear* for each domain. The rating ‘unclear risk’ of bias was given when it was uncertain whether there was ‘high’ or ‘low’ risk of bias.

A study was rated as having ‘low risk’ of bias in the domain *selection of participants* in the following manner: For a *cohort study*, if it was a prospective cohort study where participants were selected as a single group and then classified according to their exposure status (exposed or unexposed). For a *case-control study*, if selection of controls or cases was unrelated to exposure. For a *cross-sectional study*, if study participants were comparable to the population of interest or if exposure and unexposed/low exposure groups were the same population group (same demographics). Whereas a rating of ‘high risk’ of bias was assigned in this way: For a *cohort study*, if in a prospective cohort study the exposure was associated with any variables the participants were selected on, which could bias the estimate of the exposure-outcome association. Alternatively, if it is a historical cohort study where both the exposure and outcome variables had already occurred when participants were selected, and selection of exposed and unexposed participants was related to developing the outcome of interest. For a *case-control study*, if selection of controls or cases was related to exposure. For a *cross-sectional study*, if study participants are not comparable to the population of interest or exposure and unexposed/low exposure groups are not from the same population group (different demographics) (237).

In the domain *confounding variables*, a judgement of 'low risk' was given to a study when key confounders were thoroughly identified and addressed either during the design phase (e.g., via matching, limiting participation, or other techniques) or during the analysis phase (e.g., through stratification, propensity score methods, statistical adjustments, or other approaches). Studies were rated as having a 'high risk' of bias if they did not adjust for any confounders during the design or analysis phases.

In the domain *measurement of exposure*, 'low risk' of bias was assigned a study in which data were collected from credible sources, such as medical/state records, reliable questionnaires were used (validity and reliability assessed and appropriate) or through structured interviews. A rating of 'high risk' of bias was given when a study used unvalidated questionnaires (measures that have not been assessed for validity or reliability), data were not obtained from structured interviews, there was interviewer bias where the investigators' attributes led to data standardisation that influenced the study's findings, or when recall bias, influenced by respondents' memory accuracy, had the potential to impact the study results (237).

The domain *blinding of outcome assessments*, applied mainly to case-control studies where 'low risk' of bias was assigned a study in which either the outcome assessments were conducted with blinding, or in cases where blinding was not implemented, but it was determined that its absence did not influence the outcome measurements (i.e. where standardised and validated measures for outcome assessments are used, trained assessors are used and inter-rater reliability is established, outcome data are obtained from multiple sources and there is agreement among them). 'High risk' of bias was assigned to case-control studies which lacked blinding (237).

In the domain *incomplete outcome data*, a rating of 'low risk' of bias was given to a study when there were no missing data, or when any attrition or missing data were not related to both the exposure and the outcome. 'High risk' of bias was given to a study when attrition or missing data were associated with both the exposure and outcome (237).

Lastly, *selective outcome reporting*, 'low risk' of bias was given when the experimental protocol was accessible, and the predetermined primary and secondary outcomes were described as initially intended. Alternatively, if all anticipated outcomes were

documented in the study descriptions, even when the experimental protocols were not provided. Studies were rated as having 'high risk' of bias if any of the following conditions were met: the pre-defined primary outcomes were not completely reported; the outcomes were not reported in accordance with previously defined standards; primary outcomes not pre-specified in the study were present, except for outcomes with clear explanations, such as unexpected adverse effects; there was incomplete reporting regarding the primary outcome of interest; important outcomes that would typically be reported for studies in related fields were absent. (237).

1.1.1.1. Confounding control assessment

Based on previous literature, I compiled a list of key confounding variables that may influence the relationship between violence exposure and cognitive outcomes in childhood. I identified eight confounding variables and grouped them into three domains: Sociodemographics (child age, child sex); Socioeconomics (household income, parental education); and Caregiver Characteristics (alcohol use, other substance use and mental health status).

I classified each confounder as being 'adequately' vs. 'inadequately' controlled for based on whether or not it was adjusted for in the design or analysis. Adjustment for potential confounding was assessed as: 'adequate control' - when at least one variable from each construct was adjusted for; 'inadequate control' - a lack of adjustment for any variable in any construct; or 'some concerns' - when adjustment for at least one variable was made for some, but not for all, constructs. I used the R package *metaconfoundr* to visualise the adequacy of adjustment for confounding variables by creating a confounding matrix ((238)).

2.7. Data synthesis

The forms of violence and cognitive outcomes assessed in each of the reviewed studies varied. Variation in the types of violence captured resulted in fewer than five unique studies with exposure measurements that were sufficiently similar to pool. I therefore did not conduct a meta-analysis and instead provide a descriptive synthesis.

2.8. Results

A total of 3403 records were retrieved. Removal of duplicates resulted in 2937 records for titles and abstract screening. This screening excluded a further 2895 records, leaving 42 articles for full-text screening. From these, a further 25 studies were excluded at this stage as they did not meet the study's inclusion criteria (see Figure 2). The final number of studies qualitatively synthesised in this review was $n = 17$.

2.8.1. Description of included studies

Table 2.2 summarises the key characteristics of the 17 included studies. All studies were published in peer-reviewed journals between 2010 and 2023. 16 studies were of a cross-sectional design in which violence exposure was retrospectively reported. One study had a longitudinal design with violence exposure assessed at an average age of 4.8 years, one year prior to the assessment of cognitive outcomes.

The total number of participants (N) within these studies ranged from 76 to 15 202 with a median of 303. Total N for the review is 27 643. The age of the samples ranged from 2 to 15 years, with an overall mean age of 8 years. The majority of the studies ($n = 12$) focused on school-aged children, while four studies comprised preschool samples and one study involved a mixed-age group, primarily consisting of school-aged children. All 17 of the studies included both male and female participants. The reviewed sample largely comprised of community samples; only one study included institutionalised children (239).

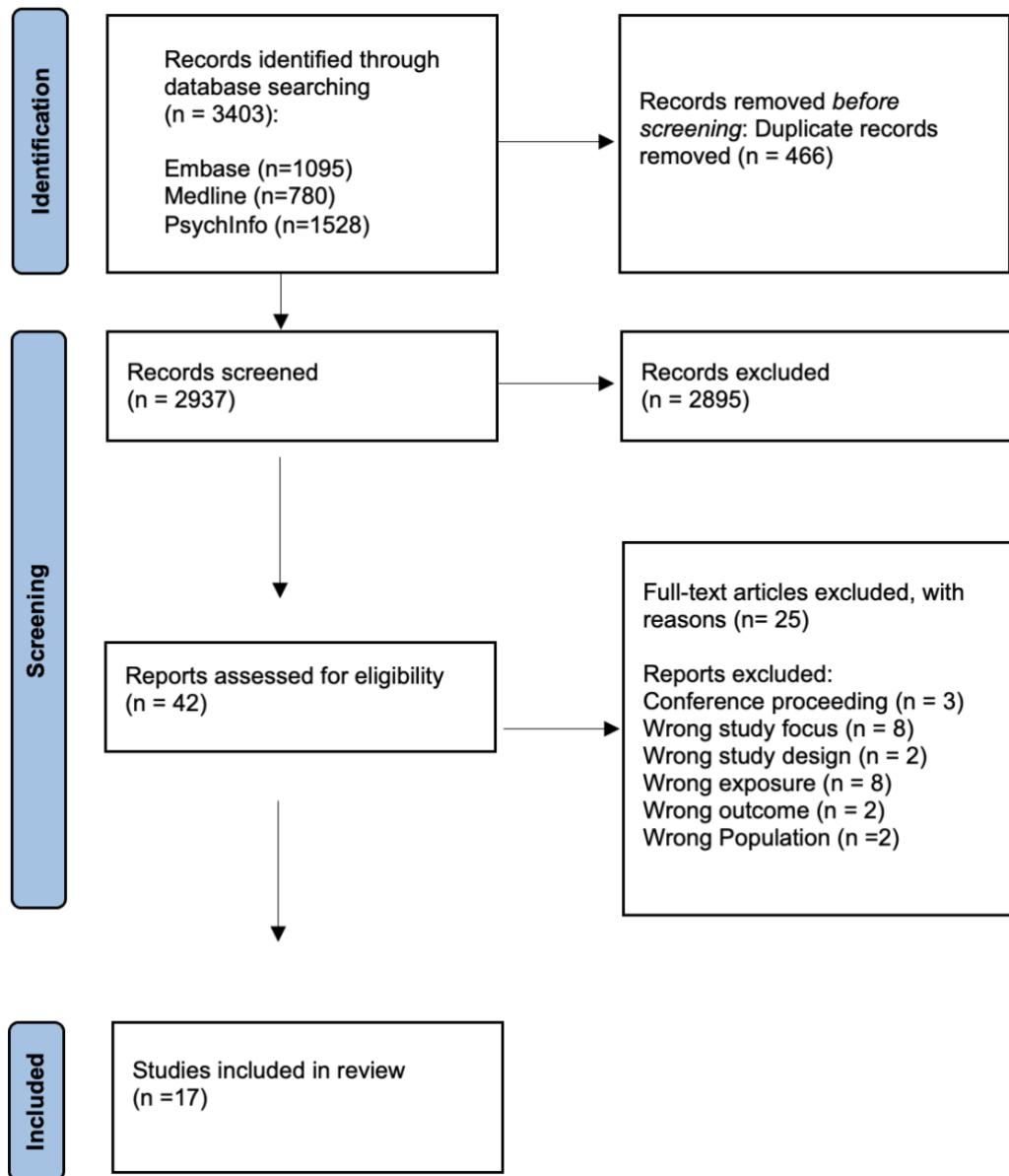


Figure 2.1 PRISMA flow diagram showing manuscript selection violence and cognitive outcomes systematic review

Table 2.2 Description of selected studies, including participant characteristics, violence exposure types, cognitive outcomes measures

Study Characteristics		Participant characteristics			Violence Exposure			Cognitive Outcome(s)	
Study, year, country	Study Design	Sample size	Age(s)	Sex	Violence exposure type(s); reporter	Age at Exposure	Tool	Type; reporter	Measure
Barnett et al., 2021(240), South Africa	CS	626	2 years	Males and Females	Domestic Violence (Maternal emotional, physical and sexual IPV.); Mothers	Within the last 12 months prior to the study	IPVQ	Neurodevelopment; Children	BSID-III
Barrera et al., 2013 (241), Colombia	CS	76	Means- Controls:10.11, Cases:10.23 , PTSD +: 10.92, PTSD-:9.88 years	Males and Females	Maltreatment (sexual abuse), N/A	Not reported	None	Executive functioning Attention Memory Visual Perceptual and Constructional abilities, Motor ability; Children Cognitive Development (Intellectual abilities) Communication (expressive and receptive communication skills); Parents, Caregivers, or Guardians	TMT, CVLT, ROCFT, Stroop Color-Word Interference Test, WCST
Bengwasan & Bancual, 2020 (242), Philippines	CS	206	3 - 12 years	Males and Females	Maltreatment: physical abuse, sexual abuse, neglect; Social Workers	At least six months prior to the study	None	DP-3	
Bernardes et al., 2020 (243), Brazil	CS	2016	Mean 9.72 (6 - 12) years	Males and Females	Maltreatment (emotional and physical neglect, and emotional, physical, and sexual abuse); Children and Caregivers	Lifetime exposure	CTQ	Executive functioning; Children	WISC III, Corsi blocks, M-Stroop, Go/NoGo, ROCF, BQSS, Savage system
Carvalho et al., 2017 (239), Brazil	CS	85	Control Group Mean 9.53 years, Maltreatment Group Mean 9.64 (6 - 12) years	Males and Females	Maltreatment; Children and Caregivers	Exposure to maltreatment prior to institutionalisation, specific age not reported	JVQ	General intellectual Functioning abilities, Attention and Working Memory; Children	WASI, WISC III, WISC-IV subtests
Diab et al., 2018 (244), West Bank and Gaza Strip	CS	303	Mean 10.94 (10.3 - 13.5) years	Males and Females	War Violence; Children	Not reported	Gaza Traumatic Event Checklist	Academic achievement (language and math scores); Children	Two examinations
Hecker et al., 2016 (245), Tanzania	CS	409	Mean age 10.50 (6-15) years	Males and Females	Maltreatment(Corporal punishment); Children	Lifetime exposure	pediMAC E	School performance and Working Memory capacity; Children	Mathematics, English, Swahili, Science, Corsi blocks

Study Characteristics		Participant characteristics			Violence Exposure			Cognitive Outcome(s)	
Study, year, country	Study Design	Sample size	Age(s)	Sex	Violence exposure type(s); reporter	Age at Exposure	Tool	Type; reporter	Measure
Jeong et al., 2020 (246), Benin, Cambodia, Cameroon, Democratic Republic of the Congo, Honduras, Jordan, Rwanda, Senegal, Timor-Leste, Togo	CS	15202	Mean age 47.22 (36 – 59) months	Males and Females	IPV; Mothers	Within the last 12 months prior to the study	CTSPC	ECD; Mothers	ECDI
Julio et al., 2023 (247), Philippines	CS	1506	10 - 12 years	Males and Females	Domestic Violence: physical IPV, emotional or psychological IPV, and controlling behaviour; Mothers	Lifetime exposure and exposure in the last 12 months prior to the study	CLHNS	Mathematical Ability, English Reading Skills, Native Language Reading Ability, and Nonverbal Intelligence; Children Cognitive development; Children	CLHNS, Philippine nonverbal intelligence local test
Kohrt et al., 2015 (248), Peru	CS	97	Mean 8.24 (5 - 11) years	Males and Females	Domestic Violence; Mothers	Lifetime exposure	WAST		Batería III
Leyton, 2020 (249), Honduras	CS	2256	3 - 4 years	Males and Females	Domestic Violence (IPV-controlling, emotional, physical and sexual violent behaviours); Mothers	Lifetime exposure	CTS	ECD; Mothers	ECDI
Malik et al. , 2010 (250), Pakistan	CS	100	Mean 10.38 (8-12) years	Males and Females	Maltreatment; Children	Lifetime exposure	CAS	Cognitive deficits and Reading problems; Teachers	CBRSC
Rocha et al., 2021 (251), Brazil	CS	3566	31.8 months	Males and Females	Domestic Violence (IPV); Mothers or head of the household	Within the last 12 months prior to the study	HITS	Child development; Mothers	ASQ-BR
Sartori et al., 2017 (252), Brazil	CS	82	8 - 9 years	Males and Females	Maltreatment (parental neglect) and Domestic violence (physical or sexual); Social Workers	Exposure to maltreatment before institutionalization, specific age not reported	None	Motor ability; Children	MABC-2
Vameghi et al., 2016, (253), Iran	CS	750	10.53 (6 - 18) months	Males and Females	Domestic Violence (physical, sexual, or emotional violence); Mothers	Lifetime exposure	Domestic Violence Questionnaire	Cognitive Development; Mothers	ASQ

Study Characteristics		Participant characteristics			Violence Exposure			Cognitive Outcome(s)	
Study, year, country	Study Design	Sample size	Age(s)	Sex	Violence exposure type(s); reporter	Age at Exposure	Tool	Type; reporter	Measure
Xing & Wang, 2018, (254), China (People's Republic of)	CS	150	Mean 10.83 (9 - 11) years	Males and Females	Maltreatment (Corporal punishment); Children	Within the last 12 months prior to the study	CTSPC	Executive Function; Mothers and Fathers	BRIEF-Parent Form
		213	Mean 4.80 years	Males and Females	Maltreatment (Corporal punishment); Mothers and Fathers	Corporal punishment within the past 12 months, measured a year prior to cognitive outcomes	CTSPC	Executive Function; Children	House and Pick the Picture, Something is the Same, Arrow, Pig, and Silly Sounds Game score

Note: ASQ = Ages & Stages Questionnaire; ASQ-BR = Ages & Stages Questionnaire–Brazil; ADHD = Attention Deficit Hyperactivity Disorder; Batería III = Woodcock-Johnson III- Spanish Version; BQSS = Boston Qualitative Scoring System; BRIEF = Behaviour Rating Inventory of Executive Function, Second Edition; BSID-III = Bayley Scales of Infant and Toddler Development, third edition; CAS = Child Abuse Scale; CBRSC = Comprehensive Behaviour Rating Scale for Children; CDC = Centre for Disease Control; CLHNS = Cebu Longitudinal Health and Nutrition Survey; CTQ = Childhood Trauma Questionnaire; CTS = Conflict Tactics Scale; CTSPC = Parent-Child Conflict Tactics Scale; CS = Cross Sectional; CVLT = California Verbal Learning Test; DP-3 = Developmental Profile III; ECD = Early Child Development; ECDI = Early Child Development Index; HITS = Hurt, Insult, Threaten, Scream questionnaire; IPV = Intimate Partner Violence; IPVQ = Intimate Partner Violence Questionnaire; JVQ = Juvenile Victimization Questionnaire; L = Longitudinal; M-Stroop = Modified Form of Stroop; MACE = Maltreatment and Abuse Chronology of Exposure - Pediatric Version; MABC-2 = Movement Assessment Battery for Children-2nd Edition; PTSD = Post-traumatic Stress Disorder; ROCFT = Rey-Osterrieth Complex Figure Test; TMT = Trail Making Test; TOL = Tower of London test; WASI = Wechsler Abbreviated Scale of Intelligence; WASI-II = Wechsler Abbreviated Scale of Intelligence Second Edition; WCST = Wisconsin Card Sorting Test; WAST = Woman Abuse Screening Tool; WISC III = Wechsler Intelligence Scale for Children, Third Edition (WISC-III); WISC-IV = Wechsler Intelligence Scale for Children – Fourth Edition; WRAT = Wide Range Achievement Test.

Studies were from 20 LMICs in total, spanning four continents (Africa, Asia, North America, South America): One study was a multi-country study conducted in Benin, Cambodia, Cameroon, the Democratic Republic of the Congo, Honduras, Jordan, Rwanda, Senegal, Timor-Leste and Togo. The remaining studies were single-country studies: four studies were based in Brazil, two studies each were from China (People's Republic of) and Philippines, the remaining eight studies were conducted in Columbia, Honduras, Iran, Pakistan, Peru, South Africa, Tanzania and West Bank and Gaza.

2.8.2. Violence exposure

The majority of studies ($n = 9$) investigated child maltreatment (239,241,242,250,252,255–258). Seven studies investigated exposure to IPV (240,246,247,249,251,253,259) and one study investigated war violence (244).

Fourteen of the seventeen studies used formal measures of violence exposure in their design. These included the Cebu Longitudinal Health and Nutrition Survey (CLHNS, $n = 1$) Conflict Tactics Scale (CTS, $n = 2$), Parent-Child Conflict Tactics Scale (CTSPC, $n = 2$), Child Abuse Scale (CAS, $n = 1$), Childhood Trauma Questionnaire (CTQ, $n = 1$), Domestic Violence Questionnaire ($n = 1$), Gaza Traumatic Event Checklist ($n = 1$), Hurt, Insult, Threaten, Scream Questionnaire (HITS, $n = 1$), Intimate Partner Violence Questionnaire (IPVQ, $n = 1$), Juvenile Victimization Questionnaire (JVQ, $n = 1$), Maltreatment and Abuse Chronology of Exposure - Paediatric Version (pediMACE, $n = 1$), and Woman Abuse Screening Tool (WAST, $n = 1$). There were three instances where studies relied on other means of assessing presence of violence exposure; one study did not use a measure for sexual abuse, and instead used a sample of children whose sexual abuse history was established by their current engagement in legal action to prosecute their alleged abusers (241). Another study relied on social worker case reports to identify children exposed to physical abuse, sexual abuse and neglect recruited at a psychotherapeutic center (242). Similarly, one study relied on social worker reports of children's exposure to parental neglect physical or sexual maltreatment in children living in foster homes (252).

Four studies relied on child self-report of violence exposure (244,250,256,257), whereas two studies used both children and caregivers as respondents (258,260). Six studies specifically used reports from mothers (240,246,247,249,253,261), one study asked

both mothers and fathers (255) and another asked mothers or heads of households (251). Two studies asked social workers (242,252) and one study did not require respondents given that it used other means of determining exposure including recruiting abused children from an NGO (241)

2.8.3. Outcomes

A range cognitive outcomes were investigated (see Table 3). Domains covered were early childhood cognitive, socioemotional and motor development (240–242,246,247,249,251–253); executive functioning, including attention and working memory (241,255,256,258,262,263); general intelligence (247,250,260); language ability (250,251); academic achievement (two studies: (244,264) and memory (241).

The majority of studies ($n = 10$) used children's performance on cognitive and academic tests to assess cognition (239–241,244,247,252,255,259,264,265), four studies used reports from mothers (246,249,251,253), one study used reports from parents, caregivers or guardians (242) another study used reports from mothers and fathers (254), and one study used reports from teachers (250).

Numerous cognitive instruments were used to assess cognition: Three studies used academic exams/tests (244,247,264). Two studies each used the Early Childhood Development Index (ECDI: (246,249), Rey-Osterrieth Complex Figure Test (ROCFT: (241,265), Stroop Colour-Word Interference Test (241,265) and Wechsler Intelligence Scale for Children, Third Edition (WISC III: (239,265). One study each used the Arrow, Pig, and Silly Sounds Game (255), Ages & Stages Questionnaire (ASQ: (253), Ages & Stages Questionnaire–Brazil (ASQ-BR: (251), Woodcock-Johnson III- Spanish Version (Batería III: (259), Boston Qualitative Scoring System (BQSS: (265), Behaviour Rating Inventory of Executive Function -Parent Form, Second Edition (BRIEF-Parent Form: (254), Comprehensive Behaviour Rating Scale for Children (CBRSC: (250), Cebu Longitudinal Health and Nutrition Survey (CLHNS: (247), Corsi blocks (265), California Verbal Learning Test (CVLT: (241), Developmental Profile III (DP-3: (242). Go/NoGo (265), House and Pick the Picture (255), Movement Assessment Battery for Children-2nd Edition (MABC-2: (252), M-Stroop (265), Savage system (265), Something is the Same (255), Trail Making Test (TMT: (241), Wechsler Abbreviated

Scale of Intelligence (WASI: (239), Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV: (239).

2.8.4. Violence exposure and cognitive outcomes

A majority of 71% ($n = 12$) of the reviewed studies found a relationship between violence exposure and poor cognitive outcomes in childhood. Detailed findings are described below, grouped according to type of exposure (i.e., maltreatment, IPV and war violence).

1.1.1.1. Maltreatment

1.1.1.1.1. Executive Functions

Four studies compared maltreated children to those without a history of maltreatment in terms of their executive functions, see forest plot in Figure 2.2 A and Table 2.3 (241,251,260). A study of Columbian children aged 8 -12 years found that children who were sexually abused had reduced inhibitory ability, indicated by more errors on the Stroop task, compared to those children who had not been sexually abused regardless of their PTSD status (241). However, there were no group differences observed between children with or without a history of sexual abuse in terms of other executive functions, namely, mental flexibility, perseveration, or set-shifting time. One study (239) found lower average scores on an attention span and working memory test in children with a maltreatment history compared to those without in a Brazilian sample aged 6-12 years. Another study with a sample of Brazilian pre-schoolers (up to 6 years of age) found that children exposed to emotional or physical abuse had lower problem-solving ability than unexposed children (251). Conversely, another study (263) did not find an association between harsh discipline and working memory in a sample of Tanzanian children (mean age = 10.5 years).

Three studies applied correlations to investigate the relationship between maltreatment and executive functions, see forest plot in Figure 2.3 (255,256,266). One study (256) found weak negative correlations between paternal corporal punishment and children's metacognition, behavioural regulation and global executive functioning in Chinese children aged 9–11 years. Regarding maternal corporal punishment, there were weak negative correlations with children's behavioural regulation and metacognition, whilst

moderate negative correlations were found with global executive functions. Another study with a sample of Chinese preschoolers (mean age = 4.8 years) found that paternal corporal punishment showed very weak negative correlations with children's inhibitory control and working memory, and weak negative correlations with children's attention shifting and global executive functions. Maternal corporal punishment was very weakly and negatively correlated with all four executive function measures (255). However, in one study of Brazilian children aged 6-12 there was no strong evidence of correlations between maltreatment and executive functions, namely, spatial working memory, verbal working memory and cognitive flexibility, including planning ability and inhibitory control - both assessed using two distinct measures each (258).

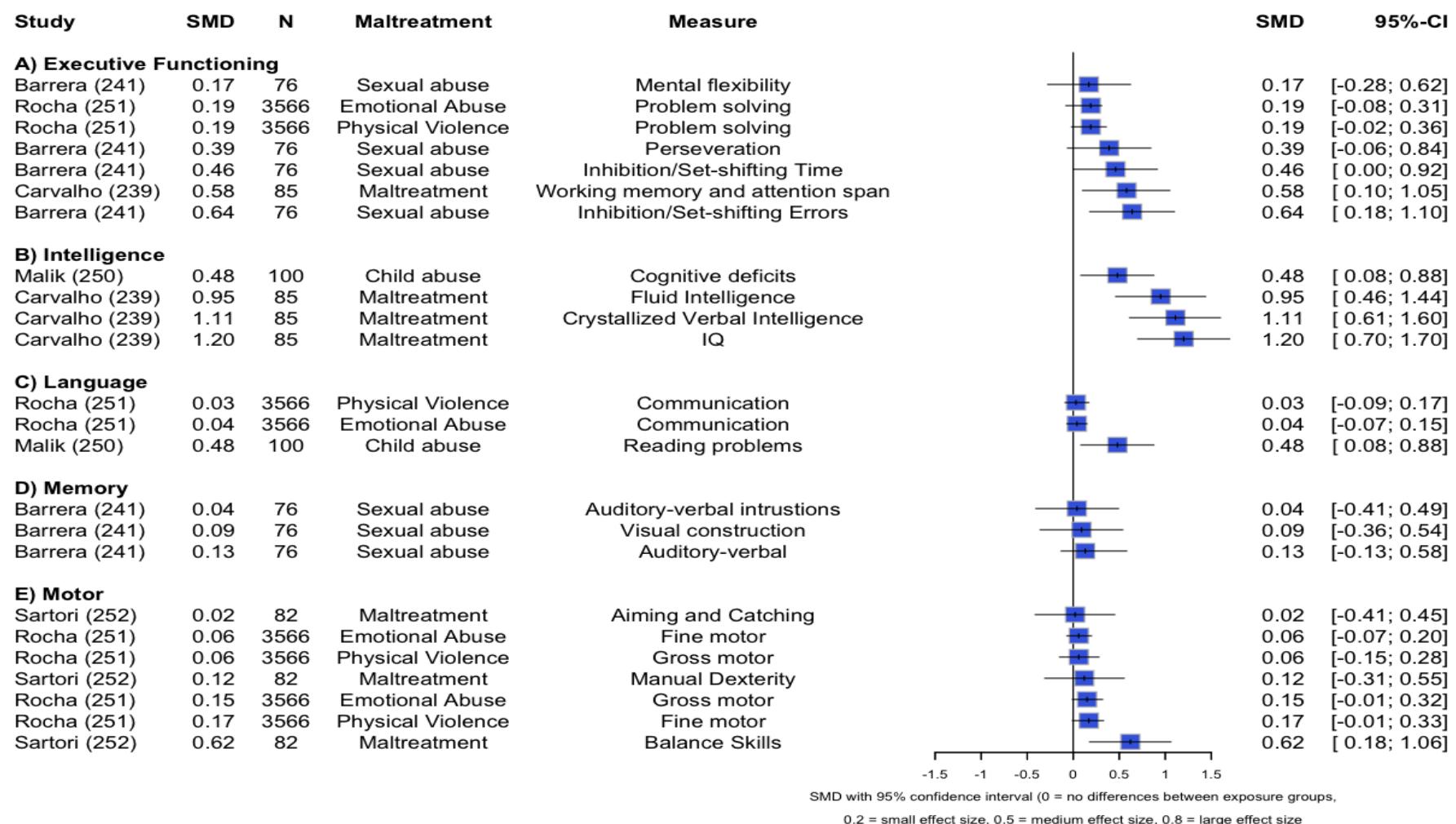


Figure 2.2 Forest plot depicting effect sizes for maltreatment and cognitive outcomes grouped by cognitive domain

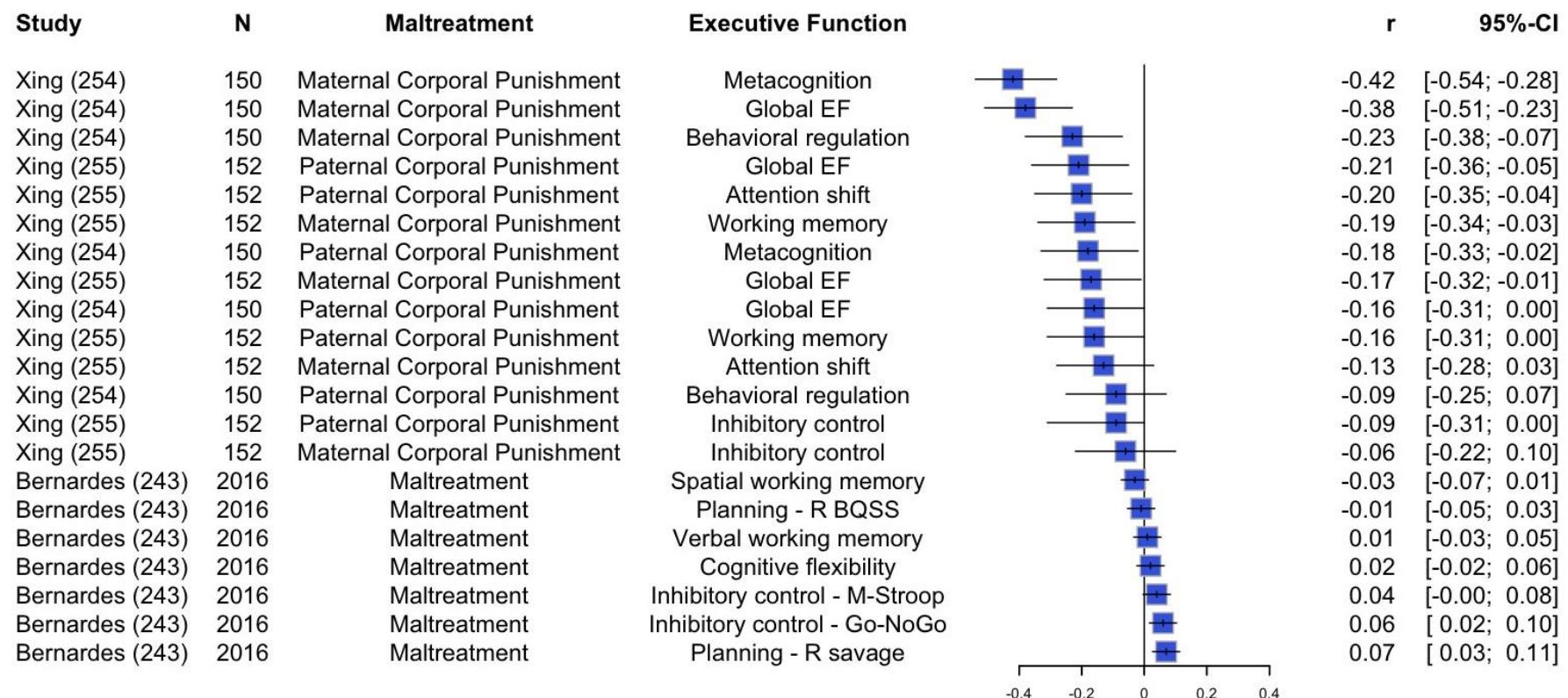


Figure 2.3 Forest plot depicting correlations between maltreatment and executive functions studies. EF = Executive Functions; R BQSS = Boston Qualitative Scoring System

1.1.1.2. General Intelligence

Three studies investigated the relationship between maltreatment and general cognitive functioning, see forest plot in Figure 2.2B and Table 2.4 (239,250). Maltreated Brazilian children (aged 6 -12 years) had lower IQ, verbal and fluid intelligence scores than their non-maltreated counterparts (239). A study based on children aged 8-12 years from Pakistan found that abused children had higher levels of general cognitive deficits than nonabused children (250). Another study conducted in the Philippines found that abused and neglected children (aged 3–12 years) had lower intellectual ability scores than the minimum average standard score on the Developmental Profile III (DP-3)(242).

1.1.1.3. Language

Three studies evaluated the relationship between maltreatment and language abilities, see Figure 2.2C and Table 2.3 (250,251). One study found that among Pakistani children (aged 8 -12 years), those exposed to abuse had more reading problems than nonabused children (250). Another study conducted in the Philippines found that abused and neglected children (aged 3–12 years) had communication (expressive and receptive communication skills, including written, spoken, and gestural language) scores lower than the minimum average standard score on a development measure (242). In contrast, a study in Brazil did not find differences in communication ability between preschoolers (up to 6 years) exposed to either emotional abuse or physical abuse and those unexposed (251).

1.1.1.4. Memory

One study (241) compared Columbian children aged 8 -12 years who had a history of sexual abuse with those who did not (See forest plot in Figure 2.2D) and found no differences in memory abilities, including visual constructional and auditory verbal memory. Additionally, there were no group differences in terms of the number of auditory verbal intrusions during memory recall.

Table 2.3 Results of studies not included in forest plots and studies with mediation and moderation analyses

Study Characteristics		Participant characteristics			Violence Exposure			Cognitive Outcome(s)		Results
Study, year, country	Study Design	Sample size	Age(s)	Sex	Type; reporter	Exposure Age	Tool	Type; reporter	Measure	
Bengwasan & Bancual, 2020 (242), Philippines	CS	206	3 - 12 years	Males and Females	Malreatment: physical abuse, sexual abuse, neglect; Social Workers	at least six months prior to the study	None	Cognitive Development (Intellectual abilities) Communication (expressive and receptive communication skills); Parents, Caregivers, or Guardians	DP-3	Cognitive ($M = 80.971$, $SD = 16.931$), and Communication scores ($M = 76.660$, $SD = 18.703$) were lower than the minimum Average Standard Score, $p < .001$. There were differences between the three types of abuse in relation to the different DP-3 areas, Wilks' Lambda = 0.868, $F(10, 398) = 2.916$, $p < .01$; Sexually abused ($M = 81.356$, $SD = 18.020$) and physically abused ($M = 79.302$, $SD = 16.674$) groups had a higher mean score in Communication compared to neglected group ($M = 69.386$, $SD = 16.766$), $F(2, 203) = 21.604$, $p < .001$, partial $\eta^2 = 0.080$. For Cognitive Development, the sexually abused group ($M = 85.699$, $SD = 16.415$) had a higher mean score than the neglected group ($M = 75.671$, $SD = 17.213$), $F(2, 203) = 21.682$, $p < .001$, partial $\eta^2 = 0.061$.
Diab et al., 2018 (244), West Bank and Gaza Strip	CS	303	Mean 10.94 (10.3 - 13.5) years	Males and Females	War Violence; Children	Not reported	Gaza Traumatic Event Checklist	Academic achievement (language and math scores); Children	Examination s	The direct effects model showed that, exposure to war violence was not associated with children's low academic achievement ($\beta = -0.05$, $t = -0.74$). Parental scholastic involvement and children's motivation and learning strategies mediated between war violence and academic achievement ($\beta = -0.21$, $t = -2.60$, $p < 0.009$): High exposure to war violence was associated with lower levels of encouraging scholastic involvement from parents, which in turn was associated with children's motivational and learning strategies and ultimately with academic achievement. Interaction analyses suggest that war violence was not associated with children's academic achievement, if they had good peer relations ($\beta = -0.10$, $t = -2.09$, $p < 0.04$) and, to some extent, if parents encouraged children's schoolwork ($\beta = -0.10$, $t = -1.89$, $p < 0.054$)
Hecker et al., 2016 (245), Tanzania	CS	409	Mean age 10.50 (6-15) years	Males and Females	Malreatment(Corporal punishment); Children	Lifetime exposure	pediMA CE	School performance and Working Memory capacity; Children	Mathematics , English, Swahili, Science, Corsi blocks	Structural equation modelling, revealed a relationship between harsh discipline and children's internalizing problems ($\beta = .47$), which were in turn associated with poorer working memory ($\beta = -.17$) and school performance ($\beta = -.17$).
Jeong et al., 2020, (246) Benin, Cambodia, Cameroon, Democratic Republic of the	CS	15202	Mean age 47.22 (36 – 59) months	Males and Females	IPV; Mothers	Within the last 12 months prior to the study	CTSPC	ECD; Mothers	ECDI	Reduced maternal stimulation mediated 1.5% of the association between IPV and ECDI z scores ($\beta = -0.001$; $p < 0.055$; bias-corrected bootstrapped 95% CI: -0.002 to 0.000. While paternal stimulation mediated 3.0% of the association between IPV and ECDI z scores ($\beta = -0.002$; $p < 0.001$; bias- corrected bootstrapped 95% CI: - 0.004 to - 0.001).

Study Characteristics		Participant characteristics		Violence Exposure			Cognitive Outcome(s)		Results	
Study, year, country	Study Design	Sample size	Age(s)	Sex	Type; reporter	Exposure Age	Tool	Type; reporter	Measure	
Congo, Honduras, Jordan, Rwanda, Senegal, Timor- Leste, Togo										
Julio et al., 2023 (247), Philippines	CS	1506	10 - 12 years	Males and Females	Domestic Violence: IPV- controlling behaviour; Mothers	Current exposure	CLHNS	Mathematical Ability, English Reading Skills, Native Language Reading Ability, and Nonverbal Intelligence; Children	CLHNS, Philippine nonverbal intelligence local test	Mother's vulnerability to controlling behaviour decreases children's test scores in mathematics (ATE: -3.346, $p \leq 0.01$), English (ATE: -2.289, $p \leq 0.01$), Language (ATE: -1.138, $p \leq 0.05$) and nonverbal reasoning (ATE: -2.103, $p \leq 0.01$). Emotional IPV was not associated with children's test scores: mathematics (ATE: -0.696, $p > 0.05$), English (ATE: -0.758, $p > 0.05$), Language (ATE: -0.003, $p \leq 0.05$) and nonverbal reasoning (ATE: 0.630, $p > 0.05$). Physical IPV was associated with children children's Language test scores (ATE: -0.935, $p \leq 0.05$) but not mathematics (ATE: -1.900, $p > 0.05$), English (ATE: -1.186, $p > 0.05$), and nonverbal reasoning (ATE: -1.409, $p > 0.05$) test scores.
Kohrt et al., 2015, (248) Peru	CS	97	Mean 8.24 (5 - 11) years	Males and Females	Domestic Violence; Mothers	Lifetime exposure	WAST	Cognitive development; Children	Batería III	There was no relationship between domestic violence and cognitive development. Detailed results not provided.
Leyton, 2020 (249), Honduras	CS	2 256	3 - 4 years	Males and Females	Domestic Violence (IPV- controlling, emotional, physical and sexual violent behaviours); Mothers	Lifetime exposure	CTS	ECD; Mothers	ECDI	Developmental delays were more prevalent in children whose mothers had experienced current partner controlling, emotional, and physical violence, in contrast to children of mothers without such violence exposure OR=0.52 (0.32-0.87). Children whose mothers experienced current controlling, emotional, and physical violence had lower odds of achieving developmental milestones in the socioemotional domain of the ECDI than children of women who experienced a pattern of "no violence" 0.52 (0.32-0.86). There were no group differences in other domains, cognition (0.98 (0.32-3.00)) and literacy-numeracy (1.12 (0.53-2.36)). There were no group differences in terms of current emotional violence and being developmental on track on the ECDI (0.87 (0.61-1.25)) or in specific domains, socioemotional (0.79 (0.55-1.15)), cognition (1.91 (0.70-5.20)) and literacy-numeracy (0.66 (0.40-1.10)).

Study Characteristics		Participant characteristics			Violence Exposure			Cognitive Outcome(s)		Results
Study, year, country	Study Design	Sample size	Age(s)	Sex	Type; reporter	Exposure Age	Tool	Type; reporter	Measure	
Rocha et al., 2021 (251), Brazil	CS	3,566	31.8 months	Males and Females	Domestic Violence (IPV); Mothers or head of the household	Within the last 12 months prior to the study	HITS	Child development; Mothers	ASQ-BR	The evidence for an association between emotional abuse (SMD = -0.10, 95% CI= -0.21, 0.01, $p = 0.164$), and physical violence (SMD = -0.08, 95% CI= -0.22, 0.04, $p = 0.189$) with personal social domain scores was weak. There was a negative association between IPV and fine motor (SMD = -0.27, 95% CI= -0.48, -0.06) and personal-social (SMD = -0.15, 95% CI= -0.3, -0.01) domain scores ($p<0.05$). Association between IPV and communication scores (SMD = 0, 95% CI: -0.14, 0.13), gross motor (SMD = -0.18, 95% CI: -0.47, 0.09) and problem solving (SMD = -0.14, 95% CI: -0.32, 0.05) domains ($p>0.05$) were weak.
Vameghi et al., 2016 (253), Iran	CS	750	10.53 (6 - 18) months	Males and Females	Domestic Violence (physical, sexual, emotional violence); Mothers	Lifetime exposure	Domestic Violence Questionnaire	Cognitive Development; Mothers	ASQ	There are no direct effects between Domestic Violence and child development. The path analysis showed that children's development was affected indirectly by domestic violence via depression ($\beta=-0.05278$)
Xing & Wang, 2018 (254), China (People's Republic of)	CS	150	Mean 10.83 (9 - 11) years	Males and Females	Maltreatment (Corporal punishment); Children	Within the last 12 months prior to the study	CTSPC	Executive Function; Mothers and Fathers	BRIEF-Parent Form	Maternal corporal punishment was positively associated with children's behavioural regulation difficulties in the low cortisol decline group (simple slope = 0.07, $t = 3.19$, $p < 0.01$) but not in the high cortisol decline group (simple slope = 0.01, $t = 1.03$, $p > 0.05$). The negative effect of maternal corporal punishment on children's metacognition was greater in the low cortisol decline group (simple slope = 0.09, $t = 4.37$, $p < .001$), compared to the high cortisol decline group (simple slope = 0.04, $t = 3.23$, $p < .01$). There was also a positive association between maternal corporal punishment and children's difficulties in global executive functions for both low and high decline cortisol groups, and the negative effect of maternal corporal punishment on global executive functions was also greater in the low cortisol decline group (simple slope = 0.09, $t = 4.26$, $p < .001$), than the high cortisol decline group (simple slope = 0.03, $t = 2.65$, $p < .01$).
Xing et al., 2019 (255), China (People's Republic of)	L	213	Mean 4.80 years	Males and Females	Maltreatment (Corporal punishment); Mothers and Fathers	Within the past 12 months, measured a year prior to cognitive outcomes	CTSPC	Executive Function; Children	House and Pick the Picture, Something is the Same, Arrow, Pig, and Silly	Cortisol stress reactivity level moderated the relationship between maternal (not paternal) corporal punishment and children's executive functioning. There was a negative association between maternal corporal punishment and global executive functions in the low cortisol stress reactivity level group, $\beta = -0.42$, $t = -3.18$, $p < 0.05$, but not in the high cortisol stress reactivity level group, $\beta = -0.13$, $t = -1.50$, $p > 0.05$. There was also a negative association between maternal corporal punishment and children's working memory in the low cortisol stress

Study Characteristics		Participant characteristics		Violence Exposure			Cognitive Outcome(s)		Results	
Study, year, country	Study Design	Sample size	Age(s)	Sex	Type; reporter	Exposure Age	Tool	Type; reporter	Measure	
								Sounds Game score		reactivity level group, $\beta = -0.39$, $t = -3.01$, $p < 0.05$ but not the high cortisol stress reactivity level group, $\beta = -0.15$, $t = -1.78$, $p > 0.05$.

Note: ASQ-BR = Ages & Stages Questionnaire–Brazil; CS = Cross Sectional; CTSPC = Parent-Child Conflict Tactics Scale; ECD = Early Child Development; ECDI = Early Child Development Index; HITS = Hurt, Insult, Threaten, Scream questionnaire; IPV = Intimate Partner Violence; PPVT = Peabody Picture Vocabulary Test; SMD = Standardized Mean Difference; WAST = Woman Abuse Screening Tool; WRAT = Wide Range Achievement Test

1.1.1.5. Motor development

Two studies compared Brazilian children with a history of maltreatment to those without in terms of motor development, see forest plot in Figure 2.2E (251,252). In their sample of pre-schoolers, one study (251) found evidence to suggest a negative association between exposure to emotional abuse and gross motor but not fine motor abilities. In the same sample, they also found that exposure to physical abuse was associated with worse fine motor but not gross motor abilities. In the second study of 8–9-year-old children (252) it was found that those who experienced maltreatment (sexual, physical, or emotional abuse, and emotional or physical neglect) had lower balance skills than children unexposed to maltreatment. However, there was no evidence to suggest that maltreated children differed from unexposed children in terms of their aiming and catching skills.

1.1.1.6. Social development

A study conducted in the Philippines (242) found that abused and neglected children (aged 3–12 years) had social-emotional development scores lower than the minimum average standard score on a development measure. However, one study with a sample of Brazilian pre-schoolers (251) did not find evidence to suggest that emotional abuse or physical violence was associated with personal social development (see Table 2.3).

1.1.1.7. Academic outcomes

One study did not find an association between harsh discipline and school performance in a sample of Tanzanian children (mean age = 10.5 years: (263).

1.1.1.2. IPV

Five studies investigated developmental outcomes in children whose mothers experienced IPV. The majority of studies reported negative associations between domestic violence and various cognitive outcomes (Table 2.3 and Figure 2.4): Maternal exposure to physical IPV compared to no exposure was associated with lower cognitive development in the fine motor and personal-social domains in Brazilian pre-schoolers (251). In another study with pre-schoolers from 11 LMICs, a negative association was

reported between maternal (physical, emotional, sexual and any) IPV exposure and early child development scores on an index capturing cognitive, literacy, numeracy and socioemotional developmental (246). Using the same index, one study (249) found that a composite measure of maternal experience of current partner controlling behaviour, emotional and physical violence was associated with poor development compared to children whose mothers had no history of IPV in 3-4-year-old Honduran children. The same pattern was found in the socioemotional domain but not in other domains in this construct (cognition, literacy and numeracy). However, there were no group differences in developmental outcomes when looking solely at maternal current partner emotional violence in the same sample. South African children aged 2 years were found to possess lower cognitive, language and motor development scores if their mother had been exposed to emotional IPV (240). In the same study, maternal physical IPV was associated with lower motor scores but not cognitive or language scores. Furthermore, there was no association between maternal sexual IPV and developmental outcomes. A study conducted with children (aged 10 – 12 years) in the Philippines, found that mothers' experience of controlling behaviour from her partner was negatively associated with children's test scores in Mathematics, English and nonverbal reasoning (247). In the same study maternal physical or emotional IPV was not associated with children's test scores.

Two other studies, however, did not find associations between maternal IPV and children's developmental outcomes: One study (253) examined the path association between maternal domestic violence experiences and the development of 6- to 18-month-old Iranian infants. They found no association between maternal IPV and communication, problem solving, personal-social, gross and fine motor development. Similarly, another study (259) found that maternal IPV was not related to cognitive developmental functions such as verbal comprehension, fluid reasoning, and processing speed in their study with children aged 5-11 years in Peru.

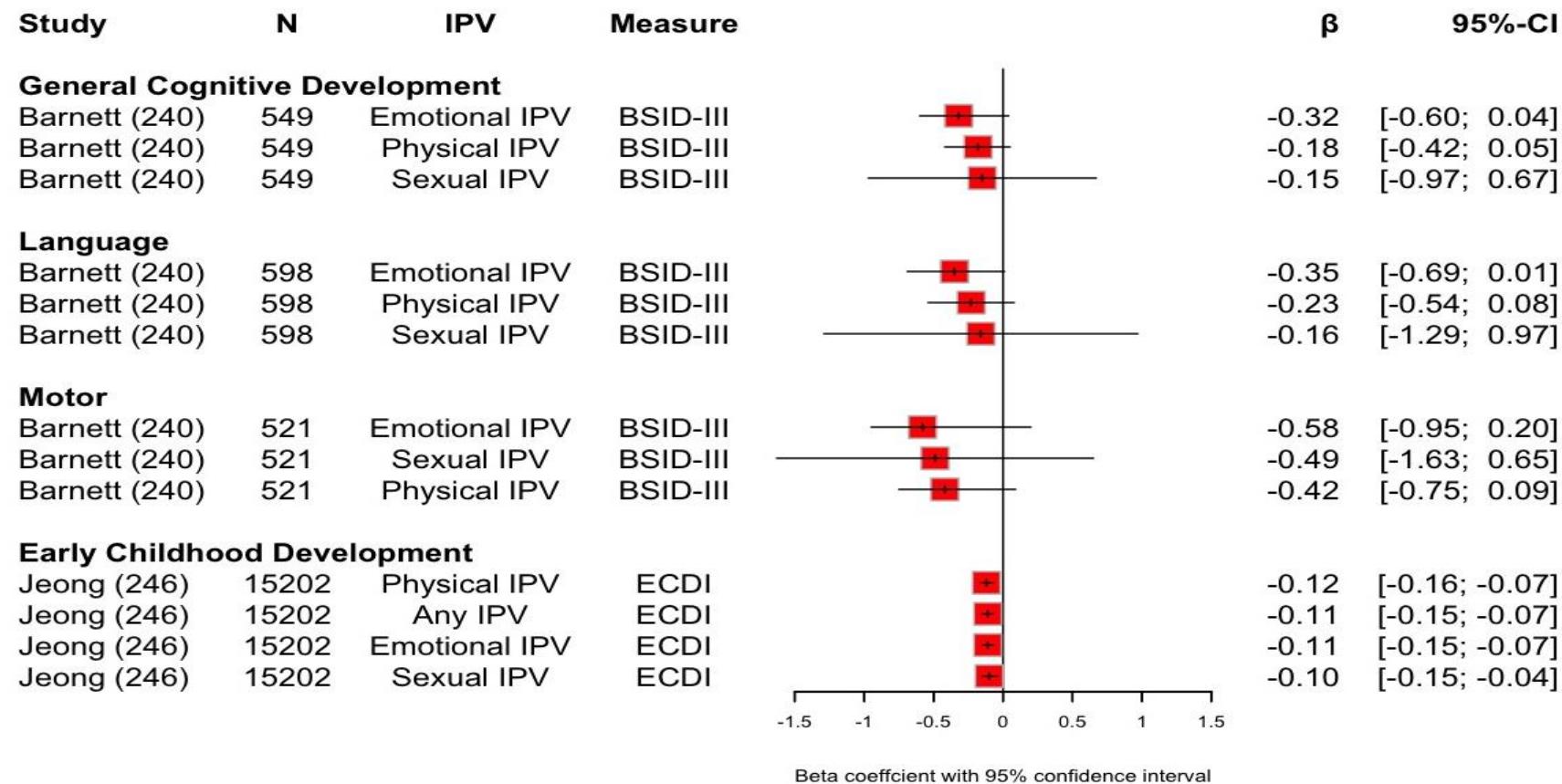


Figure 2.4 Forest plot depicting effect sizes between domestic violence and cognitive outcomes.

Note: IPV = Intimate partner violence, BSID-III = Bayley Scales of Infant and Toddler Development – Third Edition, ECDI = Early Childhood Development Index

1.1.1.3. War violence

Finally, one study investigated the relationship between exposure to war and academic achievement in Palestinian children (mean age =10.94 years) living in the Gaza Strip (244). They found no association between exposure to traumatic war experiences and children's academic achievement including both language and math scores.

1.1.1.4. Mediators and Moderators

Two studies examined whether cortisol moderated the relationship between corporal punishment and executive functions in Chinese children (255,256) and reported similar findings (see Table 2.3). The first study of 9–11-year-olds found that the relationship between maternal corporal punishment and children's executive functions varied based on diurnal cortisol change, but not morning or afternoon cortisol (256). Specifically, the relationship between maternal corporal punishment and children's difficulties with executive functioning was stronger in a low-diurnal decline cortisol group than in a high-decline cortisol group. In the second study, cortisol stress reactivity moderated the relationship between maternal corporal punishment and children's executive functioning in a sample of preschoolers (255). Specifically, past year exposure to maternal corporal punishment was associated with poorer global executive functions and working memory in children with low cortisol stress reactivity but not in those with high cortisol stress reactivity. In both studies, there were no moderation patterns found with paternal corporal punishment.

In a study of pre-schoolers (mean age = 47.22 months) spanning 11 LMICs, the negative relationship between IPV exposure and cognitive development was partially mediated by reduced maternal and paternal stimulation, with independent effects observed for each parent (246). Specifically, maternal and paternal stimulation each mediated 1.5% and 3.0% of the association between IPV and early childhood development scores, respectively.

One study (263) investigated the relationship between harsh discipline, internalizing problems, working memory and school performance in a sample of Tanzanian children (mean age = 10.5 years). They found an indirect association via internalising problems between harsh discipline and poorer working memory capacity and school performance.

Another study (244) found that the negative relationship between children's exposure to war violence and academic achievement was mediated by parental scholastic involvement and children's motivation and learning strategies. Specifically, high exposure to war violence was negatively associated with scholastic involvement from parents, which in turn was negatively associated with children's motivation and learning strategies and finally with academic achievement. In the same study, interaction analyses revealed that war violence was not associated with children's academic achievement if children had good peer relations and, marginally, if parents showed encouragement for children's schoolwork.

Path analyses in one study (253) found that maternal IPV indirectly affected overall development in 6- to 18-month-old Iranian children, with maternal depression as the mediating factor. Specifically, maternal experience of domestic violence was positively associated with mothers' depression, which in turn was negatively associated with children's development.

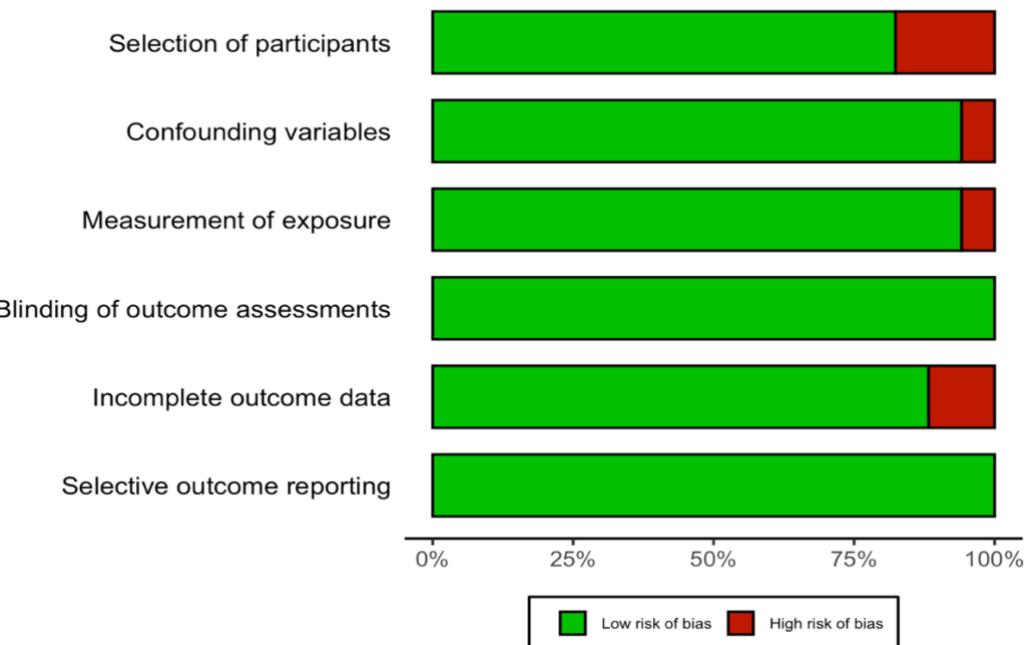
2.8.5. Risk of Bias

Figures 2.5A and 2.5B summarise the overall risk of bias and the risk of bias in specific domains for each included study. While the majority of studies had a low risk of bias in the domain *selection of participants* (selection biases caused by the inadequate selection of participants), approximately 20% had a high risk of bias. Approximately 15% had a high risk of bias in the domain *incomplete outcome data* (attrition biases caused by the inadequate handling of incomplete outcome data). The following are examples of studies rated as having a high risk of selection bias: In one study (250), the abused and nonabused groups of children differed in family characteristics such as household monthly income and parental education. While another study recruited children with histories of sexual abuse from a non-governmental organization and children unexposed to sexual abuse were recruited from a local school (241). Furthermore, there were differences in these groups of children such as the differences in sex distributions as well as family SES, with sexually abused children being predominantly male and from a low SES household. Regarding high risk of bias in the domain *incomplete outcome data*, in one study 15% of the participants were excluded for having missing data, however there is no information provided on whether these participants differed or not in their characteristics in comparison to those with complete data (242). The domains with the lowest risk of bias were *selective outcome reporting* (reporting biases

caused by the selective reporting of outcomes) and *blinding of outcome assessment* (detection biases caused by the inadequate blinding of outcome assessment). Specifically, all studies had low risk of bias in these two domains.

None of the studies had adequate control of confounding variables overall (Figures 2.6A and 2.6B). All the studies had ‘some concerns’ with regards to confounding. The *Sociodemographics* and *Socioeconomics* constructs had the most adequate control, with *Child Age* and *Household Income* as the most controlled variables, respectively. The least adequate control was for the *Caregiver Characteristics* construct, with one study controlling for *Mental Health Status*.

A



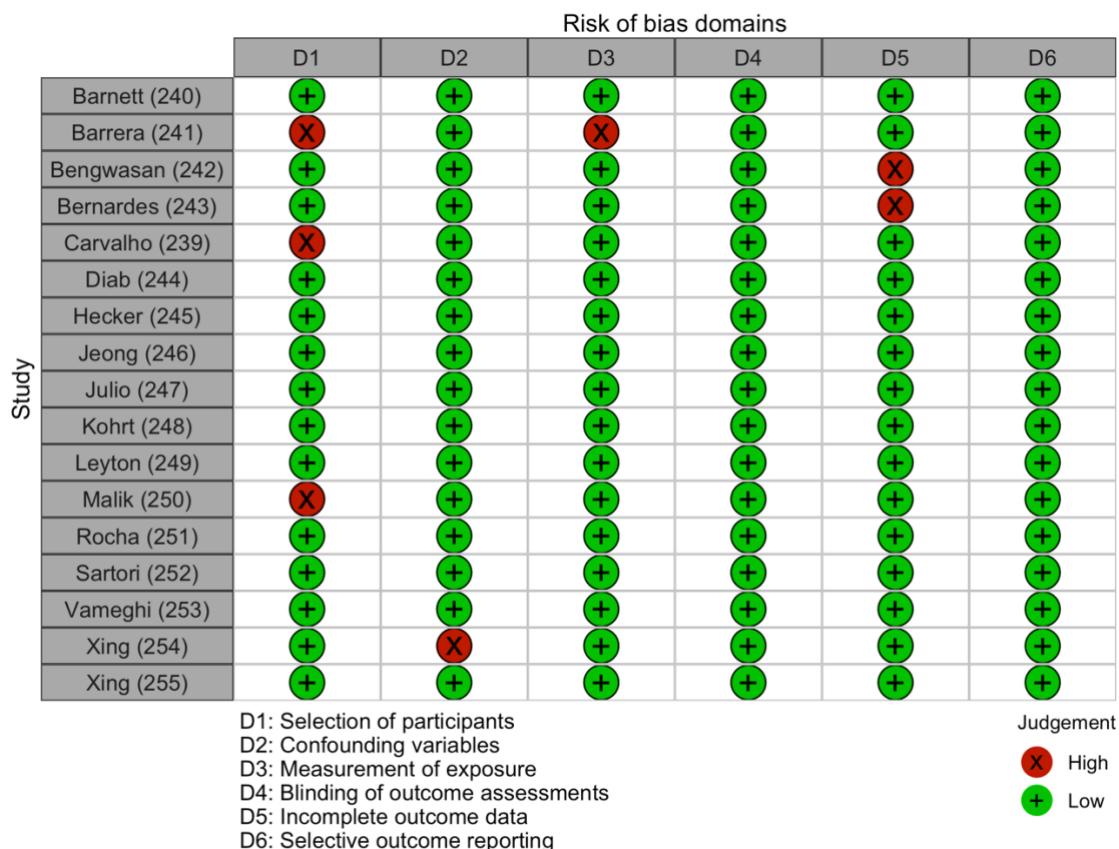
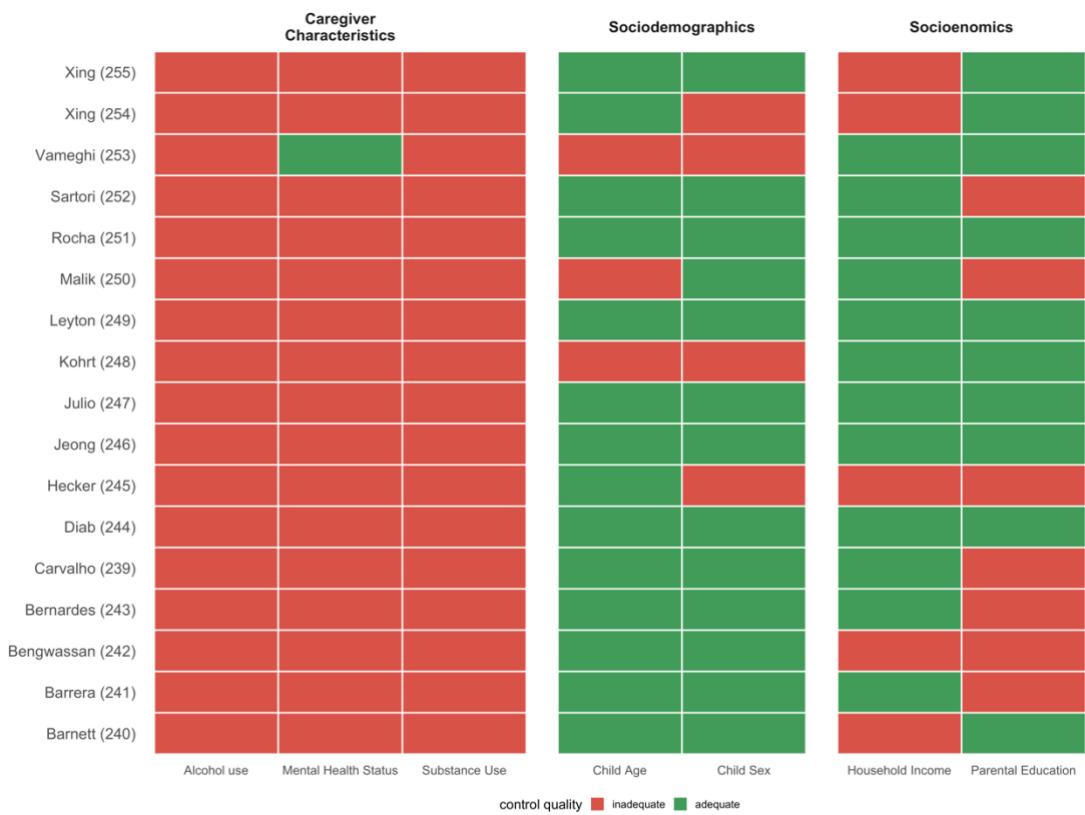
B

Figure 2.5 Risk of bias summary: review authors' judgements about each risk of bias item for each included study. (A) RoBANS risk of bias domain summary; (B) RoBANS study risk of bias summary



A

B

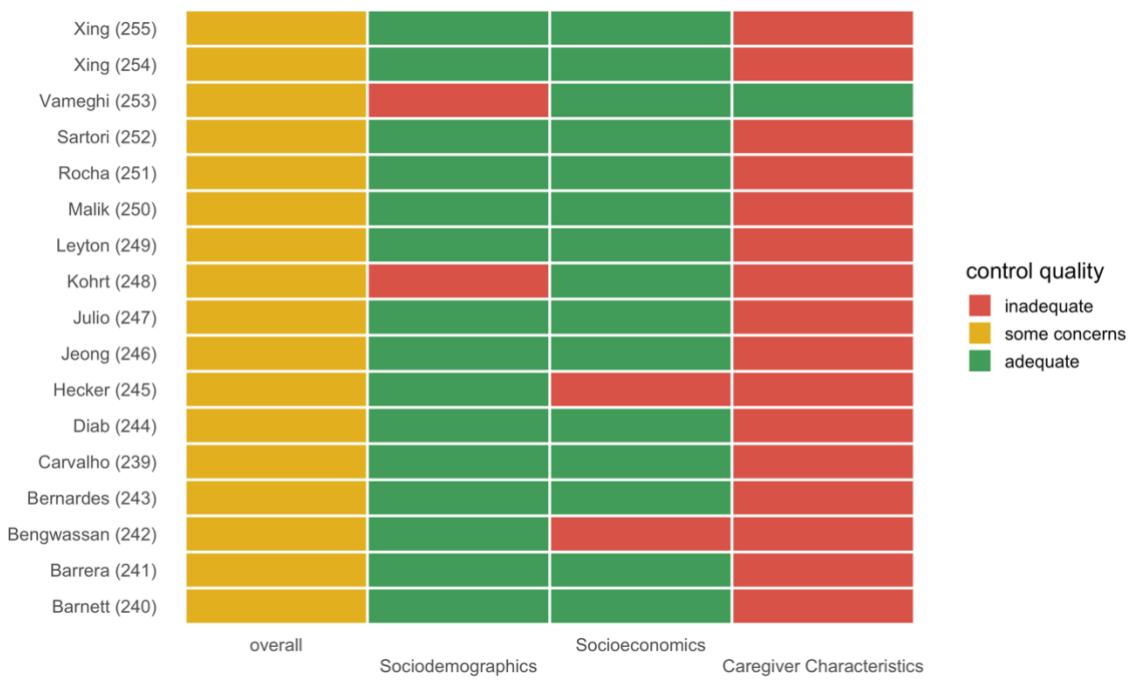


Figure 2.6 Confounder matrix illustrating confounding control of 13 studies by three confounding constructs Sociodemographics, Socioeconomics and Caregiver Characteristics (A) and overall confounding control for each construct (B)

2.9. Discussion

2.9.1. Summary of major findings

Evidence on the relationship between childhood exposure to violence and cognitive outcomes in children aged 11 years and under, residing in LMICs was systematically reviewed and synthesized. A total of 17 studies which encompassed 27 643 children from 20 LMICs were examined. The majority of these studies, as expected, focused on maltreatment but IPV and war violence were also examined. The most frequently studied cognitive functions were early childhood cognitive, socioemotional and motor development, executive functioning, general intelligence/IQ and language ability. Overall, 71% of the reviewed studies found evidence to suggest an association between violence exposure and poor cognitive outcomes in children.

Given that this is an evolving area of research, there is currently little consensus in the literature concerning which cognitive domains are most affected by violence exposure in childhood (20,215). There was evidence suggesting an association between maltreatment and poor cognitive outcomes (executive functions, general intelligence, language and aspects of cognitive development, namely, gross motor and fine motor abilities and social emotional development) in children living in LMICs. The greatest effect size reported was for the effect of maltreatment on general intelligence (239), whereas the strongest correlation observed was between maternal corporal punishment on children's metacognition (254). These findings largely align with those reported by a previous review (20) investigating the influence of childhood maltreatment on later cognitive functioning in children and adults in HICs. Of note, two of their reviewed studies found that maltreated children were more likely to have reduced memory performance than non-exposed groups, whereas the current review found no association between childhood maltreatment and memory ability (241). Other previous reviews reported mixed findings with regards to the association between childhood maltreatment and memory (19,267). Given that only one study in the current review, with a relatively small sample size ($n = 76$), explored these associations, it is plausible that methodological variations among different studies could explain the inconsistencies observed in earlier research. Another possibility is the existence of distinct patterns of associations across various populations. Therefore, further research is necessary to thoroughly examine these associations and clarify these divergent findings.

The majority of reviewed studies found evidence for a negative association between maternal experience of IPV and various aspects of children's cognitive development (240,246,249,251). These findings are largely consistent with a recent review which examined the relationship between IPV and child and adolescent cognitive development primarily in HICs and found evidence to suggest that IPV in childhood was associated with poor cognitive skills in various domains (17). In the current review two other studies (253,259) did not find an association between maternal IPV and children's cognitive development. These discrepancies may be due to differences between studies, for example (259) had a sample size of 97, which may have limited statistical power. Alternatively, discrepancies in findings may suggest the role of other intermediary factors in these associations. Indeed, one study (253) found that maternal depression mediated the relationship between maternal IPV and cognitive development in Iranian infants aged 6-18 months. Despite this, the current review findings, similar to those from a recent review (17), generally suggest the risk of poor cognitive outcomes in children whose mothers experience IPV.

The reviewed studies explored various factors that may influence the relationship between violence exposure and cognitive outcomes in childhood. Two studies found evidence to suggest that cortisol moderated the relationship between maternal corporal punishment and executive functions in Chinese children (255,256). These studies provide insight into the moderation effects of biological stress reactivity in influencing susceptibility to poor cognitive functioning in children exposed to maltreatment. Indeed, it has been suggested that children's exposure to stressful environments can lead to changes in cortisol reactivity, which has been associated with alterations to brain structure and function (268), which, in turn, can impact cognitive functioning (31). However, more research is needed to further understand the specific pathways in which stress and cortisol dysregulation affect cognitive development in the context of violence exposure. Other reviewed studies implicated parental factors such as parental stimulation (246), scholastic involvement (244) and mothers' mental health (253), as well as child factors including academic motivation (244), internalising problems (264) and quality of peer relationships (244) in the associations between violence exposure and cognitive outcomes. Indeed, researchers have highlighted the role that the early psychosocial environment such as family context, community and child characteristics play in shaping development (199). Furthermore, factors in the early psychosocial environment are particularly influential during sensitive periods of development in childhood, when specific

brain regions and corresponding cognitive, and socioemotional functions are extremely responsive to environmental input (269). This may explain the relationship between violence exposure and poor cognition in the review sample. More research is needed to explore the mechanistic role these factors play in the relationship between violence exposure and cognition as they may explain the null findings reported in some of the reviewed studies.

2.9.2. Strengths and limitations

To my knowledge, this systematic review is one of a few examining the emerging body of research investigating violence exposure and cognition in childhood. A key strength of this review is focusing on children living in LMICs, who are known to experience disproportionately higher levels of violence than those in HICs and are widely neglected in previous literature. The reviewed studies were from 20 distinct countries spanning four continents in total, thus providing a diverse sample. Furthermore, investigating these associations in children, meant that I could synthesise the evidence on these relationships during childhood when exposure occurs as opposed to later. As such, the evidence suggests the risk that violence exposure poses on cognition in childhood, another strength in a research area where the majority of the literature has investigated these associations in older populations. Another strength was the inclusion of studies investigating war violence, an exposure that is particularly prevalent in the LMICs and is limited in previous literature. Furthermore, one of the strengths of the study lies in the rigorous risk of bias analyses which revealed that a number of the reviewed studies may be susceptible to attrition biases due to inadequate handling of incomplete outcome data and selection bias. There was also an extensive confounding control assessment which revealed that confounding control was not always adequate. The majority of the reviewed studies did not adjust for covariates related to caregiver characteristics such as mental health. Unfortunately, observational studies are notoriously vulnerable to confounding effects. By conducting the confounding control assessment, I have further highlighted this problem and encourage future research to consider confounding control as a key stage in their study design. Without adequate confounding control, the true relationship between violence exposure and cognitive outcomes may be obscured. As such it is possible that methodological differences, including differential confounding control may contribute to discrepancies in some findings.

These findings should also be considered in the context of several limitations. The number of synthesised studies included was small, which is further indicative of the limited

research being conducted in this crucial area of research. Given that some of the studies (approximately 50%) relied only on secondary reports of violence (i.e., through parents, or caregivers) exposure to violence is likely underreported in these cases, due to social desirability bias. Studies involving preschool samples usually rely on adults to report on children's violence exposure given that young children may be unable to communicate their exposure well and researchers may want to avoid the risk of retraumatizing them. I also found that some studies did not provide detailed definitions of the cognitive outcomes they assessed, thus limiting interpretations. I further acknowledge that the search, being limited to English-language records, may have overlooked studies conducted in other languages and thus reducing the diversity of the samples reviewed. Indeed, conducting the search without the English language restriction resulted in a total of 4782 articles for screening (Embase = 1290, Medline = 1611 and Psychinfo = 1881), approximately 41% more than uncovered with the English language restriction. Despite these limitations, this review fills an important gap in the literature and provides the preliminary steps towards developing a systematic and comprehensive body of literature on the implications of exposure to violence and on cognitive outcomes in childhood.

Of note, of the 17 reviewed studies, only one had a longitudinal design and the rest were cross-sectional studies. This limits the determination of causality or temporality in the relationship between violence exposure and cognition in the review findings. A such, future research implementing longitudinal designs is needed in these investigations. Given the high risk of bias in terms of incomplete outcome data and participant selection in the reviewed studies, I highlight the importance for future research in this area to pay attention to addressing missing data and the selection of participants. Given that there is a lack of consensus regarding the types of measures used for violence exposure assessment, care should be taken into using well-established measures with clear definitions of exposure terms. Furthermore, validity and reliability analyses should be conducted on these measures. Future studies should also consider where possible an exhaustive but appropriate list of covariates including caregiver health characteristics given that this potentially impacts findings. I also suggest the use of larger samples, longitudinal, and multicentre designs in research investigating the effects of violence exposure on children's cognitive outcomes (270)

2.9.3. Implications for Practice and Policy

This study highlights the need for more research investigating the effects of violence exposure on cognition in children living in LMICs, where high rates of interpersonal violence are reported (1). Furthermore, this calls for interventions that tackle the eradication of violence as well as improve the cognitive difficulties affected children face. This is important given that cognitive problems can influence educational outcomes (271) and in turn alter life trajectories (244). Lastly, there is a need for more research investigating factors that mediate or moderate these associations between violence exposure and cognitive outcomes in children to help our understanding of the mechanisms involved and to provide targeted interventions.

2.10. Supplementary

Supplementary Table 2.1 Development assistance committee (DAC) List of official development assistance (ODA) recipients effective for reporting on 2020 flows (LMICS)

Least Developed Countries	Other Low Income Countries (per capita gross national income [GNI] <= \$1 005 in 2016)	Lower Middle Income Countries and Territories (per capita GNI \$1 006-\$3 955 in 2016)	Upper Middle Income Countries and Territories (per capita GNI \$3 956-\$12 235 in 2016)
Afghanistan	Democratic People's Republic of Korea	Armenia	Albania
Angola	Zimbabwe	Bolivia	Algeria
Bangladesh		Cabo Verde	Antigua and Barbuda ²
Benin		Cameroon	Argentina
Bhutan		Congo	Azerbaijan
Burkina Faso		Côte d'Ivoire	Belarus
Burundi		Egypt	Belize
Cambodia		El Salvador	Bosnia and Herzegovina
Central African Republic		Eswatini	Botswana
Chad		Georgia	Brazil
Comoros		Ghana	China (People's Republic of)
Democratic Republic of the Congo		Guatemala	Colombia
Djibouti		Honduras	Costa Rica
Eritrea		India	Cuba
Ethiopia		Indonesia	Dominica
Gambia		Jordan	Dominican Republic
Guinea		Kenya	Ecuador
Guinea-Bissau		Kosovo	Equatorial Guinea
Haiti		Kyrgyzstan	Fiji
Kiribati		Micronesia	Gabon
Lao People's Democratic Republic		Moldova	Grenada
Lesotho		Mongolia	Guyana
Liberia		Morocco	Iran
Madagascar		Nicaragua	Iraq
Malawi		Nigeria	Jamaica
Mali		Pakistan	Kazakhstan
Mauritania		Papua New Guinea	Lebanon
Mozambique		Philippines	Libya
Myanmar		Sri Lanka	Malaysia
Nepal		Syrian Arab Republic	Maldives
Niger		Tajikistan	Marshall Islands
Rwanda		Tokelau	Mauritius
Sao Tome and Principe		Tunisia	Mexico
Senegal		Ukraine	Montenegro
Sierra Leone		Uzbekistan	Montserrat
Solomon Islands		Viet Nam	Namibia
Somalia		West Bank and Gaza Strip	Nauru
South Sudan			Niue
Sudan			North Macedonia
Tanzania			Palau
Timor-Leste			Panama

Togo	Paraguay
Tuvalu	Peru
Uganda	Saint Helena
Vanuatu	Saint Lucia
Yemen	Saint Vincent and the Grenadines
Zambia	Samoa
	Serbia
	South Africa
	Suriname
	Thailand
	Tonga
	Turkey
	Turkmenistan
	Venezuela
	Wallis and Futuna

Supplementary Table 2.2 Database search terms violence and cognition systematic review

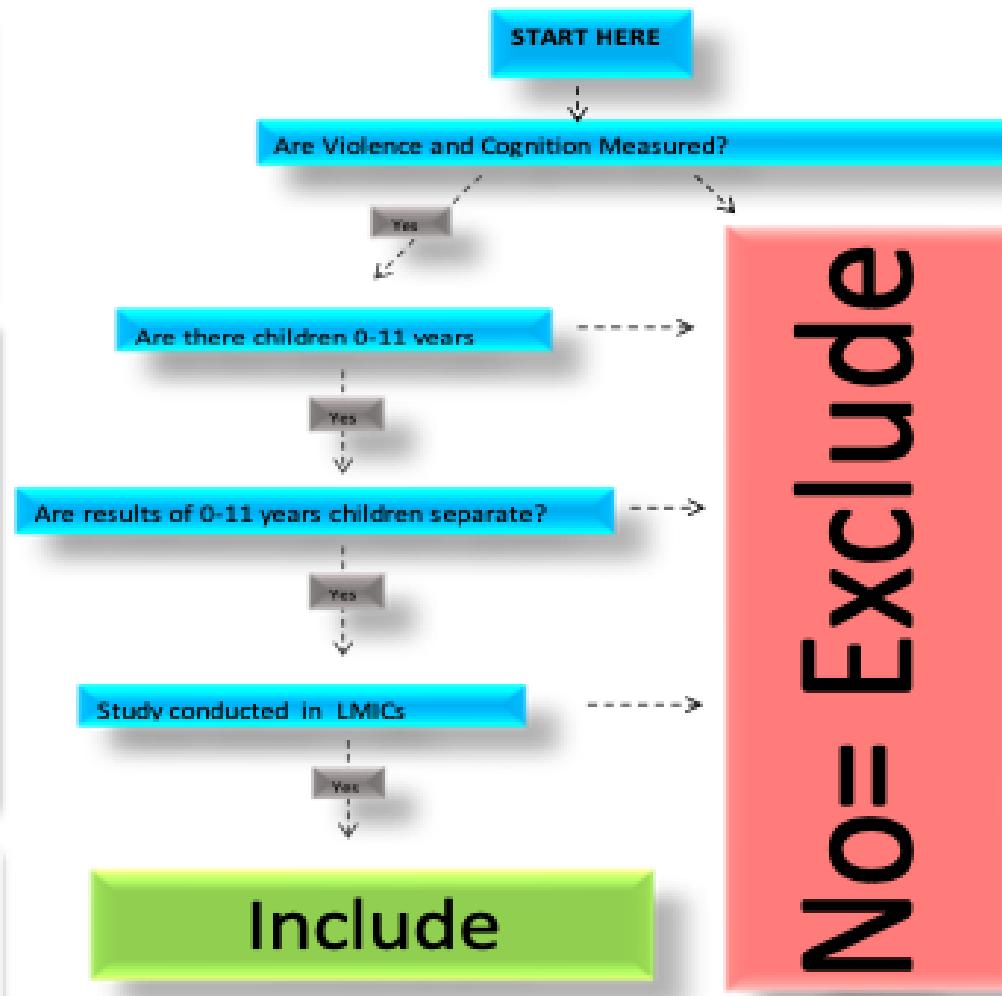
Concept 1: Violence exposure	Concept 2: Children (0-11)	Concept 2: LMICs	Concept 4: Cognitive outcomes
Exposure to Violence Adverse Childhood Experiences Interpersonal violence Violence Trauma Psychological Trauma War-related trauma Child Abuse Physical Abuse Sexual abuse Rape Emotional abuse Maltreatment Child Maltreatment Maltreatment, Child Maltreatment, Physical Physical Maltreatment Neglect Child neglect Spouse Abuse Intimate Partner Violence Parental intimate partner violence Gender-Based Violence Domestic violence Community violence Gun Violence Bullying Bullies Bullied Cyberbullying School violence Victimization	*Appropriate Limiters were used for each database	* Cochrane Effective Practice and Organisation of Care (EPOC) <u>LMIC Filters 2020 were used</u>	Alternate Terms: Cognitive/ Neurocognitive/ Cognition/ Executive Function/ Learning/ Pattern Recognition, Perception/ Psychomotor Performance/ Orientation/ Reaction Time Memory/ Inhibition/ Language/ Problem-solving/ Neuropsychology/ Neuropsychological Tests/ Neurocognitive Disorders/ Cogniti* Disorders// Cognitive/ Neurocognitive/ Intellectual/ Intelligence/ IQ/ Language/ visual-spatial/ memory/ motor/ psychomotor/ attention/ Executive AND Control/ Dysfunction/ Functioning/ Function/ deficit*/ Impairment* Cognitive development/ Neurocognitive development

Notes:

- Only Quantitative studies
- No Literature Reviews BUT Systematic review are okay
- Retrospective studies okay if outcomes are also in childhood
- RCTs okay as we can look at relationships before intervention
- No children with special conditions
- Samples do not have to be from general population

Violence = (1) sexual violence (including unwanted touching, forced sex, attempted unwanted sex, sexual harassment or pressurised/coerced sex), (2) emotional violence (including verbal abuse, psychological abuse), (3) physical violence (including corporal punishment, violent discipline, and physically abusive behaviours), (4) bullying (including physical or verbal bullying), (5) adolescent relationship violence (including dating violence in all forms: physical, verbal, sexual and coercive behaviours), (6) witnessing domestic violence or parental intimate partner violence, (7) witnessing community violence (including sexual assault, burglary, mugging, the sound of gunshots and gang violence) (8) Collective violence committed by larger groups of individuals or by states (including social, political and economic violence).

Cognitive functioning refers to intellectual processes, skills and abilities that involve acquiring and using information such as attention, learning, memory, executive functioning, and verbal ability -should use measurement tool



Supplementary Figure 2.1 Decision making flow chart violence and cognition systematic review

Chapter 3. Violence Exposure and Mental Health Outcomes Among Children in LMICs: a Scoping Review of the Literature

The previous chapter synthesised the available research on the relationships between violence and cognitive outcomes in children up to 11 years of age living in LMICs. It highlighted the risk of poor cognitive functioning associated with violence exposure in children living in these contexts.

In this Chapter, I systematically reviewed the literature on the association between exposure to violence and mental health outcomes in children up to the age of 11 living in LMICs. The objective of this review was to identify prevailing themes and gaps within the existing literature, as well as to examine the methodological approaches used for assessing violence exposure and mental health outcomes and to explore the patterns of associations observed in these relationships.

3.1. Background

Mental health is an important aspect of child development (273) and poor mental health can negatively impact children's developmental trajectories (88). Violence exposure is a risk factor for mental health problems in childhood and contributes to the loss of developmental potential in LMICs (273). However, most existing reviews assessing published work on the impact of childhood violence exposure on mental health, focus on research conducted in HICs; this is shown in recent systematic reviews on childhood violence exposure and mental health outcomes (14,274,275). Other reviewers fail to report the regions or countries in which reviewed studies were based (276–279) leading to an implicit generalisation of their results across different countries and contexts. This omission obscures our ability to understand patterns present in specific environments. Secondly, most reviews primarily focus on maltreatment as the only exposure (14,112,113) or single violence exposure forms such as IPV (116,275,280) and bullying (274,281) as opposed to investigating more than one type of exposure. This is important given that children, especially those in LMICs are known to experience multiple forms of violence (2). Lastly, the majority of the research above has investigated these

relationships in adolescents and adults, neglecting younger children. Emerging findings suggest that young children are particularly vulnerable to the adverse mental health effects of violence exposure (282). Furthermore, recognising and understanding the patterns of these associations in this population is important as it can guide the development of early interventions to mitigate the long-term consequences of violence .

3.2. Methods

Given the above, I conducted a systematic search to identify available evidence. It was clear that the body of evidence investigating associations between childhood violence exposure and mental health outcomes in children up to 11 years of age, living in LMICs was very large. As such a scoping review was conducted with the goals of identifying prevailing themes and gaps within the existing literature; examining the methodological approaches used for assessing violence exposure and mental health outcomes and; exploring the patterns of associations observed in these relationships. Furthermore, the scoping review was conducted to guide the methodologies of Chapter 5 and 6 which investigate the violence exposure patterns of preschoolers from an LMIC and their associations with mental health problems.

3.2.1. Eligibility criteria

This review included observational studies investigating associations between childhood violence exposure and mental health outcomes assessed in children up to 11 years. Studies encompassed those comparing violence exposed and unexposed children as well as those investigating associations between the degree of violence exposure and behavioural or mental health problems. Studies comprised cross-sectional, case-control, and cohort designs. Studies were included if they were in English.

Definitions of different types of violence included in the review are equivalent to those used in the review presented in Chapter 2 and presented in Table 2.1. Acts of violence, as characterized by existing literature (44,225–228,283), encompass a wide range of behaviours. These included (a) sexual violence, such as unwanted touching, forced sex, attempted unwanted sex, sexual harassment, or coerced sex; (b) emotional violence, which involved verbal and psychological abuse; (c) physical violence, encompassing corporal punishment, violent discipline, and physically abusive behaviours; (d) neglect;

(e) bullying, spanning cyber, physical, or verbal forms; (f) exposure to domestic violence or parental IPV; (g) witnessing community violence, which included incidents like sexual assault, burglary, mugging, the sound of gunshots, and gang violence; and (h) collective violence, perpetrated by larger groups or states, covering social, political, war-related, and economic violence. Studies on ACEs were included where experiences that fall under the above scope of violence exposure were reported. In such cases, I reported on the ACEs that fell under this scope, and results were reported separately for each ACE.

Mental health outcomes were operationalised as behavioural problems such as internalising problems (such as depressive and anxiety symptoms) or externalising problems (such as aggression and delinquency) that are commonly assessed in paediatric populations (284). Additionally, studies investigating emotional and/or behavioural problems that encompassed these concepts were included.

The population under review comprised children in LMICs. For the current review, children were defined as people up to 11 years of age. Where studies included children older than 11 years, studies were included if the mean age was 11 years (or younger), or the majority of the sample was under 11 years (i.e. at least 80 percent). Countries were classified as LMICs in accordance with the classification by the OECD in 2020. There was no restriction put on publication date.

3.2.2. Exclusion criteria

Studies were excluded if: they were only conducted in HICs, not in English, consisted of children with special conditions (such as disability or clinical samples), review or discussion articles where results were not from original research, based on qualitative research or presenting health professionals or social workers' views about violence against children. In addition, studies whose measure of violence was indirect such that there was no definite means of determining whether children experienced exposure (e.g., studies that only relied on experts classifying a neighbourhood in which the children live as experiencing violence or not) were excluded. See inclusion and exclusion decision flow chart in supplementary Figure 2.1.

3.2.3. Information sources and search strategy

Three academic databases were searched: Embase, Medline and PsycINFO using the search list in supplementary Table 3.1. Non-peer reviewed literature indexed within these databases were also included. Searches were carried out in November 2021 and updated in May 2023. The reference lists of included studies were examined however, there were no new records uncovered through the process.

3.2.4. Data management and selection

I conducted title and abstract screening. Full-text screening of the articles deemed eligible for inclusion was conducted by myself and another reviewer (LH, as mentioned in Chapter 2) independently with 96% interrater reliability.

3.2.5. Data extraction

LH and I independently extracted study data on authors, publication year, study design, country of study, participant characteristics, (i.e., sample size, age, sex), violence exposure (type, measurement tool, respondents), behavioural outcomes (type, measure) and key results. Due to the nature of the scoping review, quantitative estimates were not extracted.

3.2.6. Risk of bias assessment and confounding control assessment

The review also included a risk of bias assessment. While this goes beyond the conventional parameters of a scoping review, as described in (285), it was conducted to enhance a more rigorous evaluation of the evidence presented. Furthermore, risk of bias analyses offer valuable insights into methodological gaps within the reviewed literature.

LH and I independently conducted risk of bias analyses of included studies as discussed in Chapter 2 using the six domains of the RoBANS (237) : (1) *selection of participants* defined as selection bias caused by inadequate selection of participants, e.g. selection of controls from a different population sampling frame than cases in a case control study; (2) *confounding variables* defined as bias caused by inadequate consideration of confounding variables; (3) *measurement of exposure* defined as information bias caused

by inadequate measurements of exposure; (4) *blinding of outcome assessments* defined as detection bias caused by the inadequate blinding of outcome assessors such that they are aware of the exposure status; (5) *incomplete outcome data* defined as attrition bias caused by the inadequate handling of incomplete outcome data and (6) *selective outcome reporting* defined as reporting bias caused by the selective reporting of outcomes. Risk of bias was rated as *low*, *high* or *unclear* for each domain. The rating ‘unclear risk’ of bias was given when it was uncertain whether there was ‘high’ or ‘low’ risk of bias.

Confounding control assessment was assessed using the list of key confounding variables discussed in Chapter 2 comprising of eight confounding variables grouped into three domains: Sociodemographics (child age, child sex); Socioeconomics (household income, parental education); and Caregiver Characteristics (alcohol use, other substance use and mental health status).

3.2.7. Synthesis

The aim of the review was to provide an overview of the evidence on violence exposure and mental health outcomes in children in LMICs and not to produce a critical synthesis of the results. As such results pertaining to these associations were captured according to authors’ descriptions of whether there statistically significant associations (indicated with “+”) or not (indicated with “0”) in Table 3.1. In the text, results of these associations are grouped by type of exposure to provide an overview of the specific effects of each type of violence on mental health outcomes.

3.3. Results

A total of 22472 studies were retrieved through database searching. Following deduplication, 20543 records remained for title and abstract screening. Following this screening, 19811 records were excluded resulting in full-text screening of 732 records. An additional 674 studies were excluded as they did not meet the inclusion criteria (refer to Figure 3.1). Consequently, the total number of studies included in the synthesis was $n = 58$.

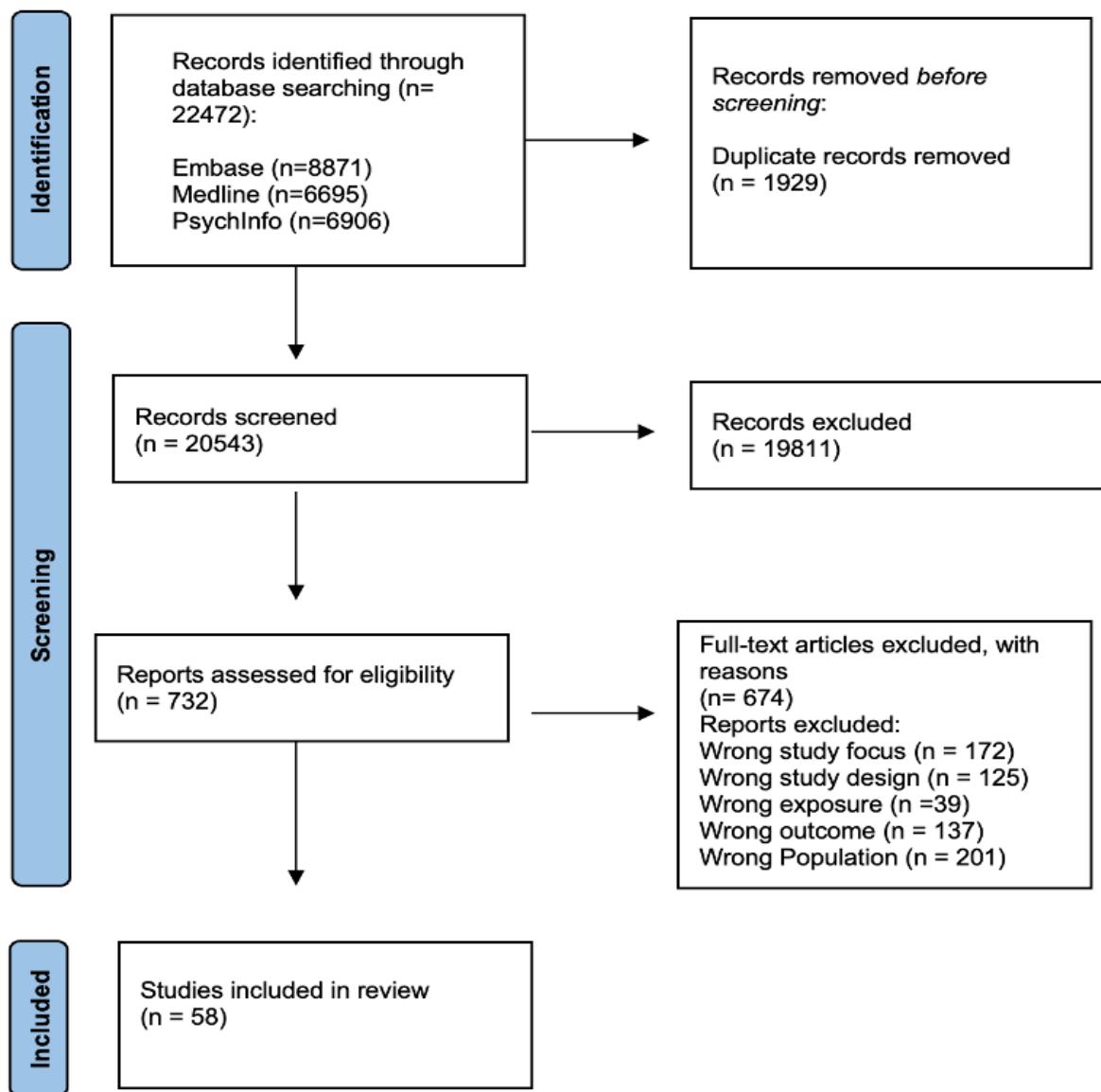


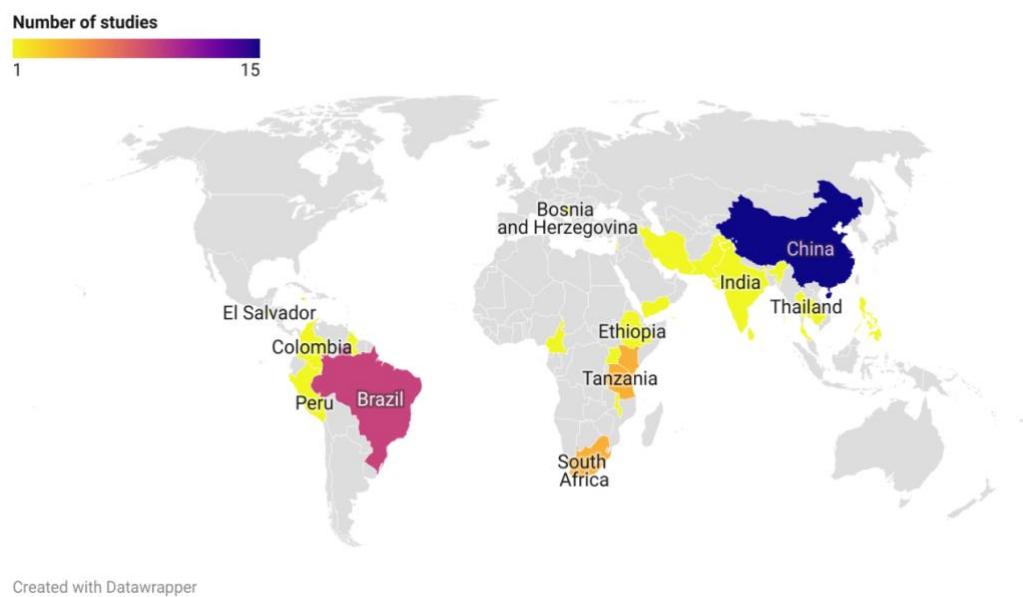
Figure 3.1 PRISMA flow diagram violence and mental health outcomes systematic review

3.3.1. Description of included Studies

A summary of the characteristics of the 58 studies is provided in Table 3.1. Reviewed studies were conducted between 1989 and 2023. Only a few studies (5%, $n = 3$) were grey literature, whilst the rest were published in peer-reviewed journals. A majority of the studies (72%, $n = 42$) were of a cross-sectional design and a smaller proportion (28%, $n = 16$) were longitudinal studies in which violence exposure and mental health outcomes were prospectively measured.

The sample sizes (N) of reviewed studies ranged from 38 to 4270, with a median of 486. The total sample for the review is 66020. Included children were aged 1.5 – 18 years. The majority (43%, $n = 25$) of the samples consisted of school-aged children only, followed by mixed groups with predominantly school-aged children (35%, $n = 20$), preschoolers only (19%, $n = 11$) and mixed groups with predominantly preschoolers (3%, $n = 2$). Only one study included a male only sample (286). Most of the studies used community samples, whilst one study consisted of children living in shelters and institutions (239) and another included children living in refugee camps (287).

Reviewed studies were from 26 LMICs in total, spanning five continents (*Africa*: South Africa, Tanzania, Kenya, Ethiopia, Uganda, Cameroon, Malawi; *Asia*: China (People's Republic of), West Bank and Gaza Strip, Yemen, India, Lebanon, Cambodia, Iran, Philippines, Thailand, Pakistan, Sri Lanka; *South America*: Brazil, Peru, Colombia, Guyana; *North America*: El Salvador, Jamaica, Saint Lucia; *Europe*: Bosnia and Herzegovina). Most of the reviewed studies (24%, $n = 15$) were conducted in China (People's Republic of), followed by Brazil (14.3%, $n = 9$), West Bank and Gaza Strip (10%, $n = 6$), South Africa (6%, $n = 4$), Tanzania (6%, $n = 4$), Kenya (6%, $n = 4$) and Jamaica (3%, $n = 2$), see figure 3.2. The majority were single-country studies with the exception of one multi-country study encompassing samples from China (People's Republic of), Colombia, Kenya, the Philippines, Thailand (288), and another study with children from South Africa and Malawi (47).



Created with Datawrapper

Figure 3.2 Choropleth map of reviewed study distributions in LMICs

3.3.2. Violence Exposure and Outcomes

Reviewed studies investigated maltreatment (42%, $n = 32$), IPV (26%, $n = 20$), war violence (9%, $n = 7$), political violence (8%, $n = 6$), community violence (8%, $n = 6$) and bullying (7%, $n = 5$). The majority of studies (77%, $n = 44$) focused on one type of violence, with a subset of studies investigating two (17%, $n = 10$) or three types of violence (7%, $n = 4$). However, none of these studies investigated polyvictimisation. Generally reviewed studies (71%, $n = 41$) used pre-established questionnaires (i.e. measures previously developed and used in prior research that have undergone reliability and validity testing) to assess exposure to violence, others (16%, $n = 9$) developed questionnaires specifically for their study or asked direct questions to capture violence exposure (12%, $n = 7$). Regarding the studies that asked direct questions, this method involved posing specific, often fewer and shorter questions directly about participants' exposure to violence. Unlike pre-established questionnaires, the questions were not assessed for any psychometric properties. One study, however, did not assess violence exposure owing to their sample consisting of children directly exposed to a terrorist attack (289). Respondents were children (34%, $n = 20$), mothers (24%, $n = 14$), caregivers (23%, $n = 13$), mothers or female caregivers (2%, $n = 1$), a combination of children and caregivers (9%, $n = 5$), children and mothers (5%, $n = 3$) as well as a combination of children, school principal, and a social worker (2%, $n = 1$).

Reviewed studies assessed the following outcomes: internalising and externalising behavioural problems (31%, $n = 18$), emotional and behavioural problems (26%, $n = 15$), aggression (10%, $n = 6$), behavioural problems (10%, $n = 6$), internalising behavioural problems (7%, $n = 4$), externalising behavioural problems (5%, $n = 3$), conduct and emotional problems (3%, $n = 2$), disruptive disorder difficulties (2%, $n = 1$) hostility and somatic symptoms (2%, $n = 1$).

Most studies used pre-established measures of mental health outcomes (95%, $n = 55$), the most common being versions of the CBCL (34%, $n = 20$) and the Strength and Difficulties Questionnaire (SDQ, 34%, $n = 20$). A few studies (5%, $n = 3$) developed measures specific for their study. The majority (93%, $n = 54$) used only one measure to assess mental health outcomes, while a few (7%, $n = 4$) included two measures. Mental health measures were typically administered to children (29%, $n = 17$), any caregivers (22%, $n = 13$) or mothers only (12%, $n = 7$). In some instances a combination of the respondents above were used including, caregivers and teachers (9%, $n = 5$), caregivers and children (7%, $n = 4$), mothers and teachers (3%, $n = 2$), teachers and children (3%, $n = 2$), mothers, teachers and children (2%, $n = 1$), mothers and children (2%, $n = 1$), caregivers and psychologists (2%, $n = 1$), children and researchers (2%, $n = 1$), caregivers, children and teachers (2%, $n = 1$). One study (2%) used mothers or female guardians as respondents.

Table 3.1 Violence and mental health systematic review study characteristics

Study ID	Study Design	Country	Sample size	Age(s)	Sex	Violence exposure type(s)	Measurement Tool	Respondents	Behavioural Outcome(s)	Measure	Results ^a
Alenko, 2020 (290)	CS	Ethiopia	734	Mean 5.35 (3 to 10)	M &F	IPV	HITS	Mothers	Emotional and Behavioural Problems	SDQ	+
Allwood, 2002 (291)	CS	Bosnia and Herzegovina	791	Mean 10.9 (6 to 16)	M &F	War Violence	War Experience Questionnaire	Children	Emotional and Behavioural Problems	CBCL	+
Alyahri, 2008 (292)	CS	Yemen	1196	7to 10	M &F	Maltreatment	Direct Questions	Mothers	Emotional and Behavioural Problems	SDQ	+
Baker-Henningham, 2018 (293)	L	Jamaica	225	Mean 6.92 (3 to 6)	M &F	Maltreatment	CTSPC	Caregivers	Conduct Problems	DPICS (MOOSEs)	+
Barbarin, 2001 (294)	CS	South Africa	625	6	M &F	Maltreatment	Direct Questions	Caregivers	Emotional and Behavioural Problems	CBCL,BPI	+
Basu, 2010 (289)	CS	India	90	1.5 to 5	M &F	Political Violence	None	N/A	Internalizing and Externalizing behaviour	CBCL	+
Bauer, 2022 (295)	L	Brazil	4145	6 to 11	M &F	Maltreatment	CTSPC	Caregivers	Child conduct and emotional problems	SDQ	+
Bernardes, 2020 (243)	CS	Brazil	2016	Mean 9.72(6 to 12) years	M &F	Maltreatment	CTQ	Children and Caregivers	Disruptive Disorder Difficulties	DAWBA	+
Bordin, 2009 (296)	CS	Brazil	480	Mean 11 (6 to 17)	M &F	Maltreatment	The WorldSAFE Core Questionnaire on Domestic Violence	Mothers or female caregivers	Emotional and Behavioural Problems	CBCL	+
Boxer, 2013 (297)	L	West Bank and Gaza Strip	1501	8, 11, 14	M &F	Political Violence, Community Violence	PLE, Exposure to intraethnic community violence scale, Exposure to School Conflict and Violence scale	Children and Caregivers	Aggression	CBCL	+; +

^a + Refers to a statistically significant relationship between violence exposure assessed and mental health; 0, no statistically significant relationship between violence exposure assessed and mental health as reported by authors; results are reported for each type of violence exposure assessed and its associations with mental health in a study

Carvalho, 2017 (239)	CS	Brazil	86	Control Group Mean 9.53, Maltreatment Group Mean 9.64, 6to 13	M &F	Maltreatment	JVQ	Children and Caregivers	Emotional and Behavioural Problems	CBCL	+
Chander, 2017 (298)	CS	South Africa	980	4 to 6	M &F	IPV	Direct Questions	Caregivers	Internalizing and Externalizing behaviour	SDQ	+
Chimienti, 1989 (299)	CS	Lebanon	1039	Mean 6.3(3to 9)	M &F	War Violence	Study Specific Questionnaire	Mothers	Behavioural Problems	Study Specific Questionnaire	+
Durand, 2011 (300)	CS	Brazil	790	5to 12	M &F	IPV	Study Specific Questionnaire	Mothers	Behavioural Problems	Study Specific Questionnaire	+
Eisenberg, 2009 (301)	CS	China (People's Republic of)	697	Mean 8.34 (SD = 0.58)	M &F	Maltreatment	Chinese-PSD	Caregivers	Internalizing and Externalizing behaviour	CBQ	+
Evare, 2018 (302)	CS	Cambodia	100	Mean 9.59 (6to 12)	M &F	IPV	CTS2S	Mothers	Internalizing and Externalizing behaviour	SDQ	+
Flores, 1999 (303)	CS	El Salvador	200	8to 9; 10 to 12	M &F	War Violence	Other- communities were categorised based on exposure type, WREQC, Childhood War Trauma Questionnaire	Caregivers	Behavioural Problems	CBCL	+
Ghasemi, 2009 (304)	CS	Iran	234	Exposure Group Mean 11.32, Control Group Mean 11.53	M &F	IPV, Maltreatment	CTS2	Mothers and children	Hostility and somatic symptoms	SCL-90R	+; +
Gong, 2021 (305)	L	China (People's Republic of)	4180	Mean 9.90(8 – 12)	M &F	Bullying	MPVS, EBQ	Children	Internalizing and Externalizing behaviour	CBCL	+
Gong, 2023 (306)	L	China (People's Republic of)	4270	Mean 9.92	M &F	Maltreatment	Childhood Trauma Questionnaire (CTQ); psychological Maltreatment by Teachers Scale (PMTS)	Children	Internalizing and Externalizing behaviour	CBCL	+

Guo, 2017 (307)	CS	China (People's Republic of)	227	Mean 8.59(6 to 11)	M &F	IPV	AAS	Mothers	Behavioural Problems	SDQ	+
Hayati, 2021 (308)	L	South Africa	1238	3 to 5	M &F	IPV	Direct Questions	Mothers	Internalizing and Externalizing behaviour	CBCL	+
Hecker, 2014 (309)	CS	Tanzania	409	Mean age 10.5 years (SD: 1.89)	M &F	Maltreatment	Direct Questions	Children	Externalising problem behaviour	SDQ, RPQ	+
Hecker, 2016 (245)	CS	Tanzania	409	Mean age 10.5 years (range: 6 to 15)	M &F	Maltreatment	pediMACE	Children	Internalising problems	SDQ	+
Hecker, 2019 (310)	CS	Tanzania	409	Mean 10.5 (6 – 15)	M &F	Maltreatment	pediMACE	Children	Internalizing and Externalizing behaviour	SDQ, RPQ	+
Hermenau, 2011 (311)	L	Tanzania	38	Mean age 8.6 years	M &F	Maltreatment and Community Violence	Direct Questions	Children	Internalizing and Externalizing behaviour	SDQ	++; +
Hesketh, 2011 (312)	CS	China (People's Republic of)	2203	Age groups: 7 to 8 years, 9 to 10 years, 11 to 12 years <12 years	M &F	Maltreatment, Bullying	Study Specific Questionnaire	Children	Child conduct and emotional problems	Rutter Child Scale	; +
Kohrt, 2015 (248)	CS	Peru	97		M &F	Maltreatment	WAST	Mothers	Internalizing and Externalizing behaviour	SSIS	+
Lansford, 2014 (288)	L	China, Colombia, Kenya, the Philippines, Thailand	568	Time 1: Mean 8.30 . Time 2: 9.37). Time 3: 10.40	M &F	Maltreatment	CTSPC	Mothers	Aggression	CBCL	+
Laurenzi, 2020 (313)	CS	Kenya	497	4 and 5 years	M &F	IPV, Maltreatment	WHO Violence Against Women Multi-Country Study Questionnaire, CTSPC	Caregivers	Behavioural Problems	SDQ	; +
Li, 2016 (314)	CS	China (People's Republic of)	528	6 to 13 years	M &F	Maltreatment	CTS, CTQ	Caregivers	Aggression	CBS	+
Li, 2022 (315)	L	China (People's Republic of)	609	Mean 10.65 (9.33to 13.50)years	M &F	Community Violence, Maltreatment, IPV	The Multiple Forms of Violence Scale (MFVS)	Children	Aggression	reactive- proactive questionnaire	; +, +
Maciel, 2013) (316)	CS	Brazil	191	7 to 14 years	M &F	Maltreatment	WorldSAFE, CTQ	Children and Caregivers	Behavioural Problems	SDQ	+

Maldonado, 2022 (317)	CS	Brazil	1292	4 to 5 years	M &F	Maltreatment	Section B of the Brazilian version of the World Studies of Abuse in Family Environments Core Questionnaire (WorldSAFE)	Caregivers	Internalising problems	CBCL	+
Malik, 2010 (250) Martins-Silva, 2023 (318)	CS	Pakistan	100	8 to 12 years	M &F	Maltreatment	CAS	Children	Emotional and Behavioural Problems Conduct Problems	CBRSC	+
	CS	Brazil	3938	4, 6, 11	M &F	Maltreatment, Community violence, IPV	Conflict Tactics Scale (CTSPC); The PTSD section of the Development and Well-Being Assessment	Caregivers	CBCL, SDQ	+; +, +	
Meeks, 2007 (286)	CS	Jamaica	202	Mean age 11.7 years	M	Community Violence, Maltreatment, IPV	Study Specific Questionnaire	Children	Aggression	Study Specific Questionnaire	+; +; 0
Miller, 1999 (319)	CS	West Bank and Gaza Strip	458	6 to 11 years subgroup (ignore sample of youth aged 12+)	M &F	War Violence	Health Reach Modified War Questionnaire	Children	Emotional and Behavioural Problems	OCHS	+
Ong'ayi, 2023 (320)	CS	Kenya	193	Mean (5.11) 4to 6	M &F	IPV	Revised Conflict Tactics Scales (CTS2)	Mothers	Internalizing and Externalizing behaviour	CBCL	+
Perks, 1999 (321)	CS	Saint Lucia	30	Mean age 10 years	M &F	IPV	Direct Questions	School principal, Children and Social Worker	Emotional and Behavioural Problems	RBPC	+
Punamaki, 1989 (322)	CS	West Bank and Gaza Strip	135	Two groups split by age. 8 to 11 years or 12 to 14 years.	M &F	Political Violence	Life Event Scale	Mothers	Emotional and Behavioural Problems	A checklist of 15 psychological symptoms	+
Qouta, 2008 (323)	CS	West Bank and Gaza Strip	640	Mean 10.51 (6–16)	M &F	War Violence	Study Specific Questionnaire	Children and Caregivers	Aggression	OCHS	+

Roopnarine, 2023 (324)	CS	Guyana	196	Boys : mean 4.3 years. Girls mean = 4.4 years	M &F	IPV	The physical assault subscale from the Revised Conflict Tactics Scale	Mothers	Internalizing and Externalizing behaviour	CBCL	+
Saile, 2016 (325)	CS	Uganda	513	Mean age 8.8 years (6 to 13 years)	M &F	War Violence, Maltreatment, IPV	The Violence, War and Abduction Exposure Scale, Other	Children	Internalizing and Externalizing behaviour	SDQ	+; +
Shan, 2019 (326)	CS	China (People's Republic of)	20066	3 to 4 years	M &F	Maltreatment	Study Specific Questionnaire	Caregivers	Emotional and Behavioural Problems	SDQ	+
Silva, 2019 (327)	L	Brazil	614	6 to 9 years old	M &F	IPV	Study Specific Questionnaire	Mothers	Emotional and Behavioural Problems	SDQ	+
Skeen, 2016 (47)	L	South Africa and Malawi	989	Mean age 8.9 years (range 4 to 13 years)	M &F	Maltreatment, IPV, Community Violence	GTEC	Caregivers	Emotional and Behavioural Problems	SDQ	+; +; +
Skinner, 2014 (328)	CS	Kenya	100	7 to 10 years	M &F	Political Violence, Maltreatment	UNICEF survey , CTSPC	Mothers and children	Internalizing and Externalizing behaviour	SDQ	+; +
Sriskandarajah, 2015 (329)	CS	Sri Lanka	359	7 to 11 years	M &F	Political Violence, Maltreatment	Other- adopted from UNICEF's Multiple Indicator Cluster Survey.	Children	Externalising problem behaviour	YSR	+
Sun, 2022 (330)	CS	China (People's Republic of)	150	Mean 10.69 (9to 13)	M &F	Bullying	Study Specific Questionnaire, LEC	Children	Emotional and Behavioural Problems	SDQ	+
Tang, 1997 (331)	CS	China (People's Republic of)	82	6 to 13 years	M &F	IPV	Multidimensional Peer Victimization Scale	Mothers and children	Internalizing and Externalizing behaviour	CBCL	+
Thabet, 1999 (332)	CS	West Bank and Gaza Strip	239	Mean 8.9 (6to 11)	M &F	War Violence	CTS	Children	Internalizing and Externalizing behaviour	CBCL	+
Thabet, 2006 (287)	CS	West Bank and Gaza Strip	309	3 to 6 years	M &F	Political Violence	GTEC	Caregivers	Emotional and Behavioural Problems	Rutter Child Scale	+
Wadji, 2020 (333)	CS	Cameroon	74	Mean age 10 (2 to 18) years	M &F	IPV	CTS2	Mothers	Internalizing and Externalizing behaviour	CBCL	+

Wang, 2018 (334)	L	China (People's Republic of)	1150	Mean age 10.3 years	M &F	Bullying	DBVS-S	Children	Internalising problems	Me and My School Questionnaire	+
Xing, 2011 (335)	L	China (People's Republic of)	454	Mean age 10.7 years	M &F	Maltreatment	CTSPC	Children	Externalising problem behaviour	CBCL	+
Xing, 2013 (336)	L	China (People's Republic of)	486	Time 1: Mean 10.20	M &F	Maltreatment	CTSPC	Children	Internalising problems	CBCL	+
Zhang, 2020 (337)	L	China (People's Republic of)	1535	8.2 years in 2013; 11.9 years in 2017	M &F	Bullying, Maltreatment	Other- based on the Kaiser- CDC ACE Study.	Children	Internalizing and Externalizing behavior	SDQ	+; +

AAS = Chinese Abuse Assessment Screen, BPI = Behaviour Problem Index, CBCL = Child Behaviour Checklist, CBCL-TRF = Child Behaviour Checklist – Teacher Report Form, CBQ = Children's Behaviour Questionnaire, CAS = Child Abuse Scale, CEMS = Children's Emotional Management Scales, CBS = Child Behaviour Scale, CTQ = Childhood Trauma Questionnaire Form, CTSPC = Conflict Tactics Scale Parent-Child, CTS = Conflict Tactics Scale, DBD = Disruptive behavior disorder, DAWBA = Development and Well-Being Assessment, DBVS-S = Delaware Bullying Victimization Scale-Student, ECBI = Eyberg Child Behaviour Inventory, EBQ = Electronic Bullying Questionnaire, GTEC = Gaza Traumatic Event Checklist, HBQ-C = MacArthur Health & Behaviour Questionnaire for Late Childhood and Adolescence, HITS = Hurt, Insult, Threaten, Scream Tool, IPV = Intimate Partner Violence, JVQ = Juvenile Victimization Questionnaire, LEC = Life Events Checklist, MPVS = Multidimensional Peer Victimization Scale, OCHS = Ontario Child Health Scale, PLE = Political Life Events Scale, PSDQ = Parenting Style and Dimension Questionnaire, Chinese-PSD = Chinese-Perceived Stress Questionnaire, RPQ = Reactive-Proactive Questionnaire, RBPC = Revised Behaviour Problem Checklist, SDQ = Strengths & Difficulties Questionnaires, SCL-90R = Symptom Checklist-90-Revised, SIEDCO= Sistema De Información Estadístico, Delincuencial, Contravencional Y Operativo De La Policía Nacional, SSIS = Social Skills Improvement System, SLE = Stressful Life Events, UNICEF = United Nations Children's Fund, UCLA PTSD = University of California at Los Angeles Posttraumatic Stress Disorder Reaction Index, WAST = Woman Abuse Screening Tool, WREQC = War-Related Experiences Questionnaire for Children, WorldSAFE = World Studies Of Abuse In The Family Environment.

1.1.1.1. Maltreatment

Reviewed studies found associations between maltreatment and increased internalising and externalising behaviour problems (306,311,328,337), emotional and behavioural problems (47,250,292), aggression (286,288,315), externalising behaviour problems (309,335), internalising behaviours (301,336), conduct and emotional problems (312), hostility and somatic symptoms (304) in children.

1.1.1.2. IPV

IPV was reported as a risk factor for increased emotional and behavioural problems (47,304,321), aggression (286,315), and hostility and somatic symptoms (304) in children.

1.1.1.3. War violence

There were associations between exposure to war violent experiences and greater aggression (323,338), emotional and behavioural problems (291,319,322), internalising and externalising behaviours (325,328,332) and behavioural problems (299) in children.

1.1.1.4. Community violence

Reviewed studies found that community violence exposure was associated with increased aggression (286,297,315), emotional and behavioural problems (47), as well as internalising and externalising behavioural problems (311) in children.

1.1.1.5. Bullying

Peer victimisation was associated with increased internalising and externalising behaviour problems (305,337), internalising behaviour problems (334), and child conduct and emotional problems (312) in children.

1.1.1.6. Differential associations

A few studies investigated associations based on violence exposure subtypes. One study found that psychological IPV, but not physical IPV was associated with increased internalising behavioural problems in their sample of Kenyan preschoolers (320).

Another study found differential associations between bullying subtypes and mental health problems, observing that physical victimisation but not relational victimisation was associated with increased internalising and externalising behaviour problems in a school-aged sample of Chinese children (330). Another study in a predominantly school-aged sample of Chinese children found that exposure to verbal IPV was associated with increased aggressive behaviour and depressive symptoms, while physical IPV was associated with increased depression, anxiety and aggression in children (331). One study in Brazil investigated the timing of exposure in relation to children's risk of developing mental health problems. Evidence was found to suggest that children most vulnerable to emotional and behavioural problems were those exposed to IPV in their preschool years (before 2 years) as opposed school-age years (327). Furthermore, in a multi-country study, corporal punishment was associated with greater child aggression only in Columbia but not in China (People's Republic of), Kenya, the Philippines and Thailand, suggesting differential associations across the populations sampled (288).

A small number of studies investigated sex differences in the patterns of association between violence exposure and mental health outcomes. One study found that maltreatment (physical or verbal abuse) was associated with increased total internalising behaviour problems in girls but not in boys in Brazilian preschoolers (317). In the same study, maltreatment was associated with increased somatic complaints in boys but not in girls. In a study with Chinese school-aged children, girls and not boys who experienced mild and severe corporal punishment had high levels of externalising behaviour problems 6 months later (335). Lastly, (336) found associations between both parental mild and severe corporal punishment with increased internalising behaviour problems in girls and positive associations between severe corporal punishment with internalising behaviour problems in boys in a Chinese sample of school-aged children.

1.1.1.7. Mediators and Moderators

Some of the reviewed studies investigated factors that mediate (21%, $n = 12$) or moderate (5%, $n = 3$) the associations between violence exposure and child mental health problems. Studies found the following: Maternal mental health was implicated as a moderator in one study in Brazil which found that severe punishment was associated with externalising behaviour problems in children and adolescents not exposed to

maternal anxiety or depression but not in those whose mothers had depression or anxiety (296). Maternal mental health status was found to mediate the relationship between child IPV exposure and aggressive behaviours in a Brazilian sample of predominantly school-aged children in another study (300). Similarly, maternal mental health was found to mediate the relationship between maternal IPV and children's behavioural problems in a Chinese sample of predominantly school-aged children (307). One study found that the associations between physical or verbal violence with total internalising behaviour problems and somatic complaints were separately higher in Brazilian preschoolers whose parents had depression compared to those whose parents did not (317). Children's exposure to political violence was associated with increased microsystem violence (family, community and school violence), which in turn was associated with aggression in school-aged children from the West Bank and Gaza Strip in one study (297) . Impulsivity was found to mediate the relationship between corporal punishment and children's externalising behaviour problems in a Chinese sample of school-aged children (301). Family violence (maltreatment and IPV) was found to partly mediate the relationship between war violence and internalising and externalising symptoms behavioural problems in a sample of predominantly school-aged Ugandan children (325). One study found that maltreated Chinese preschoolers had an increased risk of experiencing behavioural problems if they infrequently interacted with their parents (326). However, there was no evidence of mediation by constructive conflict behaviours in the association between IPV and internalising behavioural problems in a sample of preschoolers from Guyana (324). Another study did not find evidence suggesting that school climate moderated the association between bullying and internalising behaviour problems in Chinese school-aged children (334). Furthermore, there was no evidence to support cognitive flexibility as a moderator or mediator between childhood maltreatment and disruptive disorder difficulties in a Brazilian of predominantly school-aged children (243). Of note, in one study there was a decrease in internalising and externalising behavioural problems in children exposed to community violence or family violence (maltreatment and IPV) over time compared to unexposed children (47). While there was no specific intervention used in the study, the authors suggested that on-going participation by children in the sample in community-based programmes for children affected by HIV/AIDS might have played a role in this reduction in mental health problems, however formal moderation analyses were not conducted.

Two studies with Chinese school-aged samples also found differential patterns of mediation based on child sex. One study found an indirect association between relational victimisation and internalising and externalising behaviour problems via cortisol reactivity among boy but not girls (330). Specifically, in boys, experiencing relational victimisation from peers was associated with blunted cortisol reactivity which in turn was associated with increased internalising and externalising behaviour problems. Locus of control is defined as the extent to which one attributes the outcomes of their actions and their consequences – internal locus of control refers to the belief that one is in control of their own actions and their outcomes and external locus of control refers to the belief that external forces or people are in control of one's actions and outcomes (339). One study found that locus of control moderated the relationship between children's bullying experiences and developmental trajectories of internalising and externalising behaviour problems in boys but not girls (305). Specifically, bullying experiences in boys with an external locus of control was associated with increased internalising and externalising behaviour problems. In contrast, bullying experiences in boys with an internal locus of control were associated with a decreased internalising and externalising behaviour problems.

In sum, all reviewed studies found associations between exposure to bullying, community violence, maltreatment, political violence, war violence and mental health problems in their sample. Almost all studies investigating IPV found associations between IPV and mental health problems save for one study (286). Even though the majority of studies were cross sectional studies, a substantial portion (28%, n = 16) of the evidence came from longitudinal studies.

3.3.3. Risk of Bias and Confounding Control

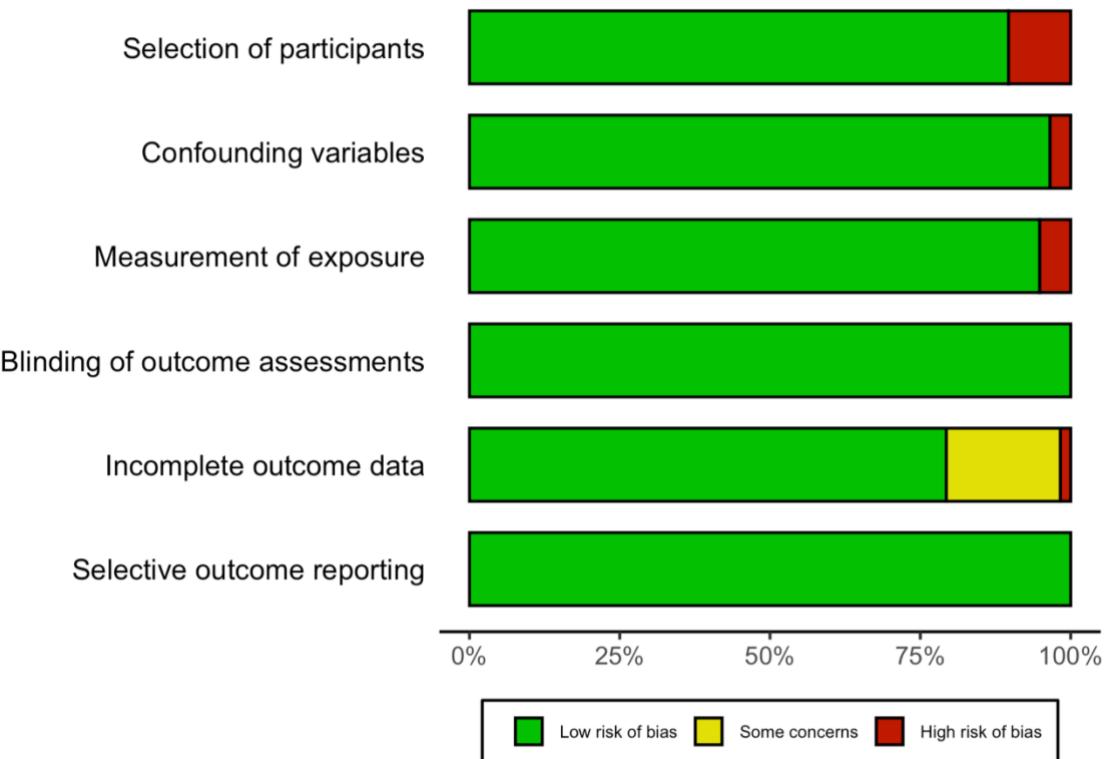


Figure 3.3 RoBANS risk of bias domain summary

Overall risk of bias and risk of bias in specific domains are summarised in figures 3.3 and 3.4 . The domains with the least risk of bias were selective outcome reporting and blinding of outcome assessments. The domain with the most risk of bias was selection of participants (approximately 10% of the studies had a high risk of bias). While risk of bias in the domain incomplete outcome data was low, in some studies, risk of bias was unclear as they did not provide details of missingness patterns. For example, in one study participants in the maltreatment group were recruited from an outpatient clinic, while children with no history of maltreatment were recruited from schools (239). This can introduce selection bias as children in a clinical setting may differ from those in the general population on characteristics other than maltreatment exposure. In another study, there were varying levels of participant retention across ethnic groups (98% and 95% for Palestinian children, 68% and 63% for Israeli Jewish children, and 86% for Israeli Arab children at Waves 2 and 3) which could introduce selection bias (297). Furthermore, *t* test analyses revealed that attrition in Waves 2 and 3 was associated with lower child aggression, less exposure to nonviolent political conflict, and lower parent

education levels in the study in Wave 1, which increases the risk of bias due to incomplete outcome data.

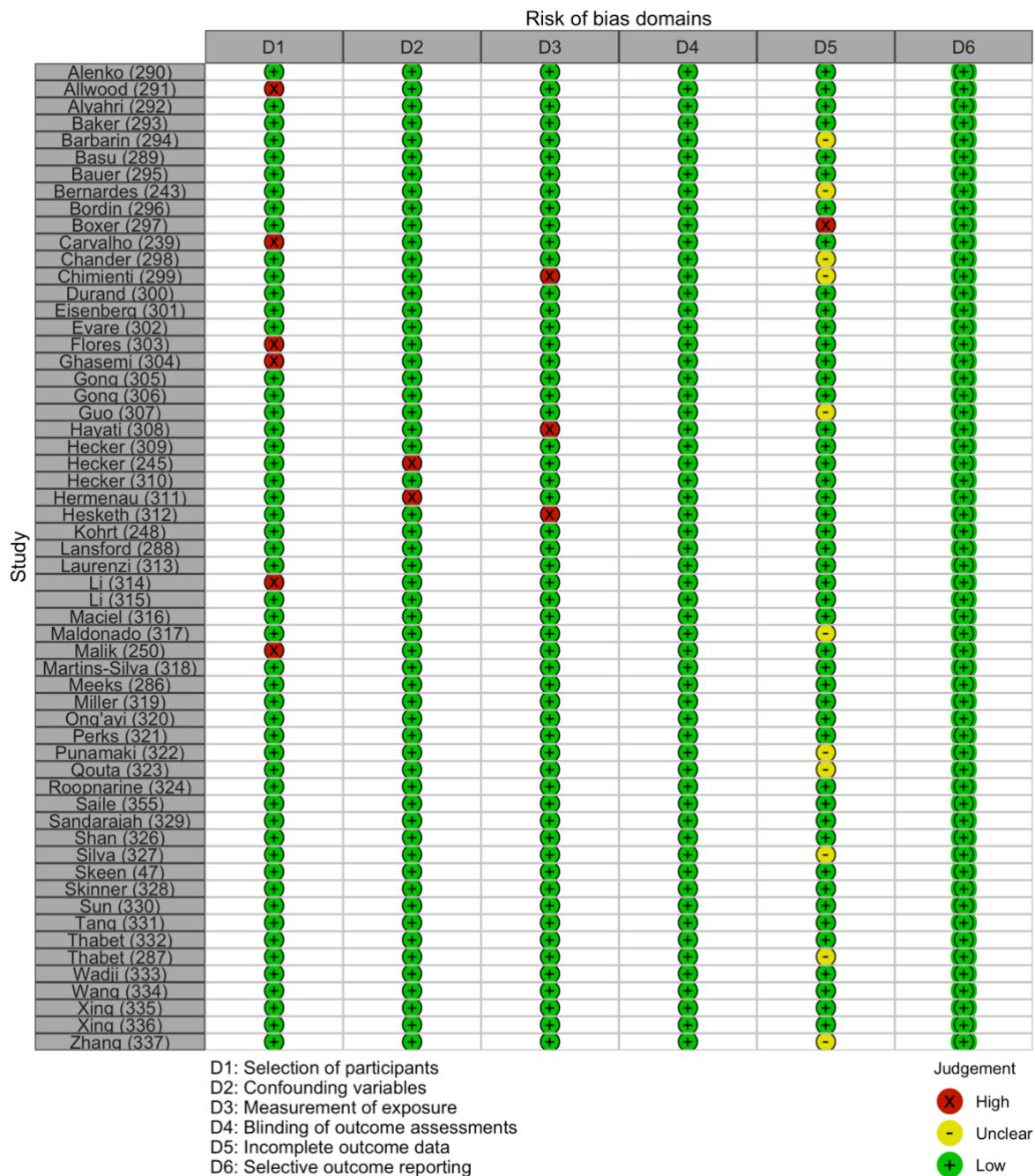


Figure 3.4 RoBANS study risk of bias summary

Twelve of the studies (21%) had adequate control of confounding variables overall (Figures 3.5 and 3.6). Three studies had inadequate control and the remainder (74%, n =

43) had ‘some concerns’ with regards to confounding. The Sociodemographics construct had the most adequate control, with Child Age as the most controlled variable. The least adequate control was for the Caregiver Characteristics construct, with only 14 (24%) studies controlling for at least one variable in this construct. For example, in one study’s (70) multivariable logistic regression analyses investigating associations between IPV and total child behavioural problems, adjusted for child gender, caregiver binge drinking, caregiver PTSD, caregiver depression, and socioeconomic status (298). As such, the following confounders child sex, household income, parental mental health status, and alcohol use were said to have been adequately controlled. Conversely, another study did not adjust for any potential confounders in structural equation models investigating associations between harsh discipline and children’s internalising problems as well as working memory capacity and school performance (245). Similarly, another study did not adjust for any confounders in the investigation of associations between children’s violence exposure and their mental health outcomes (311).

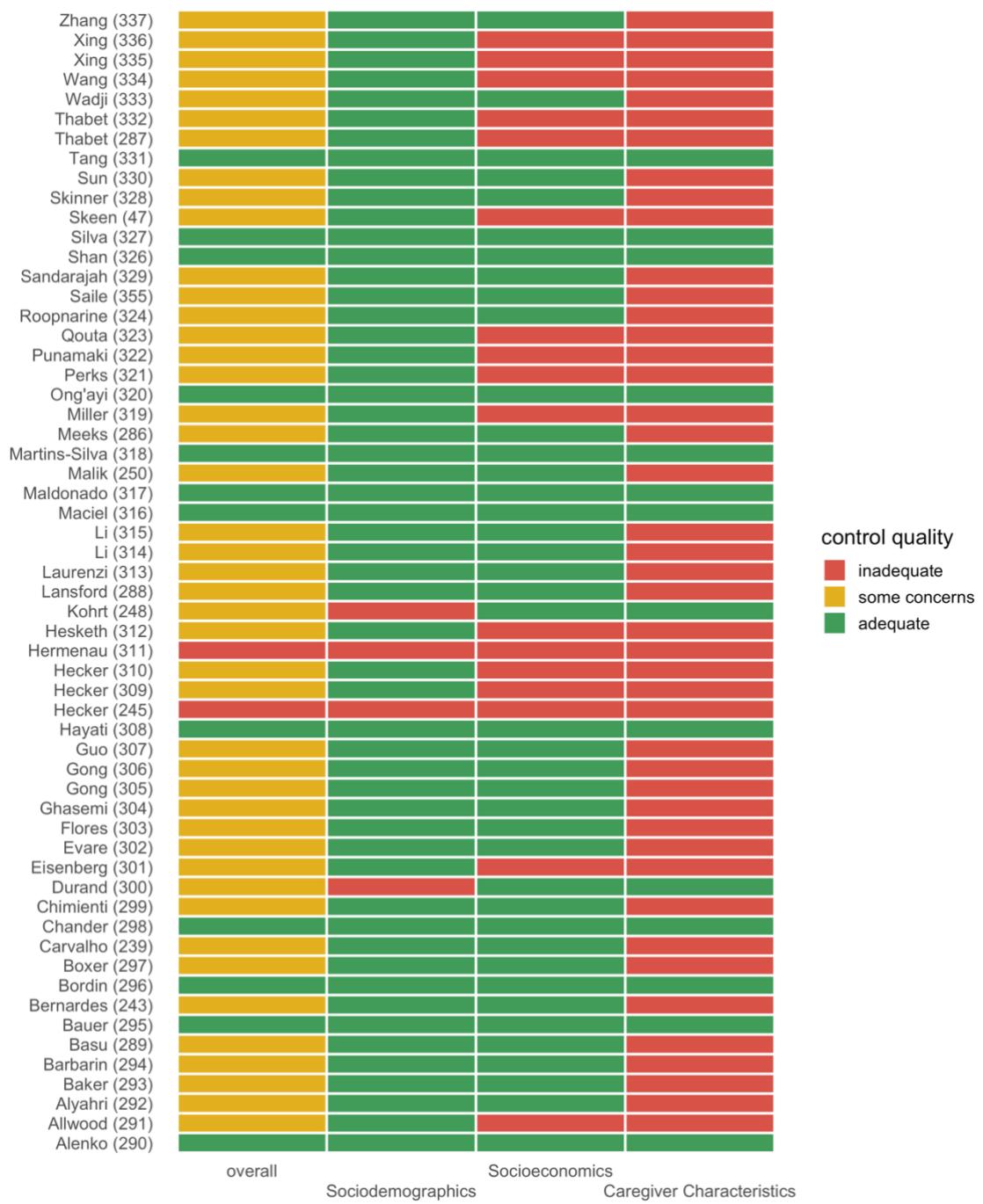


Figure 3.5 Confounder matrix illustrating overall confounding control of the 58 reviewed studies

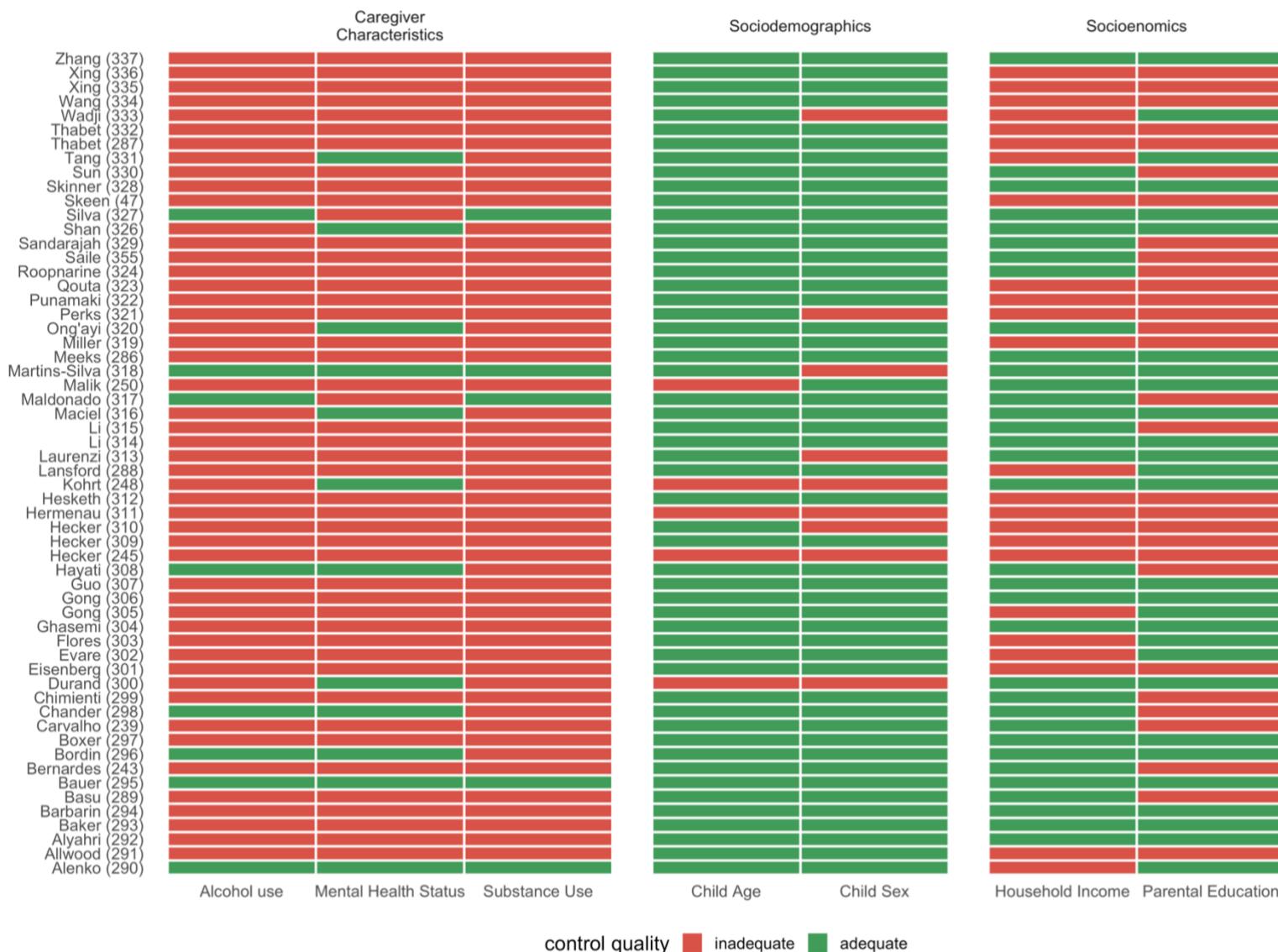


Figure 3.6 Confounder matrix by variable

3.4. Discussion

This review synthesized research investigating the relationship between childhood exposure to violence and mental health outcomes in children aged 11 years and under, residing in LMICs. A total of 58 studies which encompassed 66 020 children from 26 LMICs were reviewed. Findings across different types of violence—including maltreatment, IPV, bullying, community, political, and war violence—highlighted the risk that such exposures pose to mental health in children, similar to the patterns observed in older populations and in HICs (14–16,275,340). Some studies reported differential associations with child mental health based on violence subtypes such as IPV (320) and bullying subtypes (330). A previous review also found differential association patterns with internalising and externalising behaviour problems based on IPV categories (275). Others have found differential effects of other violence subtypes of community violence and maltreatment on children’s psychological adjustment (14,16). These findings call for a more nuanced understanding of the patterns of associations between violence exposure and child mental health outcomes.

Reviewed studies also identified moderating factors such as maternal mental health that could influence the strength or direction of the association between violence exposure and child mental health. Furthermore, factors such as parental mental health, child impulsivity, and concurrent exposure to other types of violence were also found as mediators in these associations. Previous studies investigating collective violence in older samples also found correlations between parental and children’s mental health problems with family environment and parental functioning moderating associations between exposure to collective violence and children’s adjustment (340). Research investigating risk and protective factors for externalising behaviour problems in children exposed to IPV in HICs has also highlighted maternal mental health and parenting quality (117). However, further research is needed to understand the role of these factors play especially in children living in LMICs. Interestingly, one study’s findings suggested that engagement in community programs may reduce mental health problems in children who have experienced violence (47). Indeed, research investigating resilience has documented the protective effects of factors such as community engagement, family and peer support in children exposed to maltreatment, IPV and community violence (203).

Some of the reviewed studies investigated sex differences in the relationship between violence exposure and mental health outcomes in children, with different patterns of associations, mediation, and moderation observed in boys and girls (305,317,330,335,336), suggesting the influence of sex on the experience and impact of violence exposure. Findings from research investigating sex differences in these relationships in other populations have been inconsistent, with some studies investigating maltreatment and IPV in older samples largely in HICs not finding evidence for sex differences (14,275,341). Furthermore, a previous review investigating IPV and children's externalising behaviour problems found mixed findings with regards to sex differences in patterns of association (117). While overall findings in the literature largely suggest the lack of sex differences, discrepancies with the current study findings suggest that sex differences may be context specific.

Other important themes and gaps that emerged from the review are discussed below: While the reviewed studies stemmed from 27 unique LMICs, spanning across five continents, which is suggestive of a comprehensive scope, there was uneven distribution of studies across countries. The majority of the reviewed studies came from China (People's Republic of), and a substantial proportion from Brazil), and smaller numbers from Middle East and Africa. This means that other LMICs were less represented in the findings, limiting our understanding of the patterns of associations between childhood exposure to violence and behavioural outcomes in children across different LMIC contexts. A recent review investigating factors associated with childhood violence exposure in LMICs similarly found an uneven distribution of national-level data (342). It should be noted that given that the search for the current review was limited to English-language records, studies in other languages and thus other LMICs may have been missed, similar to the (342) review. Indeed, conducting the search without the English language restriction resulted in a total of 24862 articles for screening (Embase = 9915, Medline = 7546 and Psychinfo = 7401), approximately 11% more than uncovered with the English language restriction. Of note, the majority of the reviewed studies (72 %, $n = 42$) employed a cross-sectional design, which limits the review's capacity to establish causality and temporality in the associations between violence exposure and mental health outcomes. However, a noteworthy number of studies (28%, $n = 16$) in the review employed a longitudinal design, which offers stronger evidence suggesting that exposure to violence may lead to mental health problems in children.

Reviewed studies typically sampled school-aged children compared to pre-schoolers. This means that the patterns of relationship between childhood exposure to violence and behavioural outcomes remain less understood in preschoolers. Mental health problems in preschool have been found to persist across the life span (112) and can impact a child's academic achievement (343) and cognitive functioning (88). Furthermore, research has found that exposure to violence in the preschool years places children at risk for further violence across childhood (344). Lastly, exposure to violence in the preschool years has been associated with poorer mental health outcomes in adulthood compared to exposure at later ages (345,346).

Reviewed studies tended to investigate maltreatment and IPV, instead of other forms of violence such as community violence or collective violence. This omission is noteworthy given that these forms of violence are particularly prevalent in LMICs (34) and thus neglecting them in the literature limits our understanding of their associations with children's mental health outcomes. Furthermore, research has found increased rates of other forms of violence in settings experiencing collective violence (347–349), as such research into these phenomena can guide interventions for children affected, reducing further harm. Reviewed studies typically investigated exposure to one form of violence when polyvictimisation (exposure to multiple forms of violence) has been established as stronger risk factor for mental health problems, than individual forms of violence (118). This oversight is even more significant given that children in LMICs are known to experience as significantly higher burden of violence (34).

Finding that the majority of the reviewed studies used children as respondents was understandable given that the reviewed sample largely comprised of school going children. In cases where reports were on children's exposure to violence were obtained from secondary reports (i.e. from caregivers), children were typically young (i.e preschoolers). Though this meant that traumatisation of young children was avoided, and accounts of exposure were obtained from individuals with a capacity of understanding the phenomena measured, there is a risk of under reporting due to social desirability bias (350). In a few cases, studies used a combination of reporters which triangulated the data and reduced bias. Even though the majority of the reviewed studies (71%, $n = 41$) used pre-established measures to assess violence exposure, a variety of measures were used which may limit direct comparison across studies and constrain the potential for meta-analytical synthesis in future research. In

studies where the measures used to assess violence exposure were unvalidated (i.e. there was no evaluation of the measures psychometric properties), there is potential for high risk of bias due to inadequate exposure measurement. It is argued that for measures in this field to be useful, they must be reliable, meaning that they consistently capture the same results across different conditions and valid, indicating that they accurately measure the concepts they intended to measure (351,352). Adequate measurement of violence exposure enables accurate assessment of change in intervention research (353). Thus, the ideal would be to employ well-validated instruments in research investigating children's violence exposure, unfortunately this may not always be feasible in low-resource settings typical of the studies reviewed. In such contexts, researchers are likely to assess children's violence exposure by asking a few direct questions or creating their own questionnaires. Indeed, pre-established questionnaires can be time-consuming and costly (352). Furthermore, challenges with cross-cultural adaptations and language translations of pre-established measures may deter researchers in LMICs. As such, an understanding of these factors is needed when considering these issues.

Conversely, reviewed studies (95%, $n = 55$) generally used pre-established measures for assessing behavioural outcomes. The CBCL and SDQ were the most commonly used measures and have been endorsed by previous literature (354). While the main terms used to describe outcomes assessed were 'internalising and externalising behavioural problems' or 'emotional and behavioural problems', studies using the same measures did not always use these terms and instead used variations. Other studies investigated only aspects encompassed by these concepts i.e. aggression and conduct problems. Nevertheless, findings suggest that children with violence exposure are at risk of experiencing some form of mental health problem.

Risk of bias analyses revealed the need for studies in this field to carefully consider issues related to participant selection. Additionally, confounding control was not always adequate in the reviewed studies, with only a small subset of studies (21%, $n = 12$) adjusting for key confounders such as child age, child sex, household income, parental education, parental mental health status, alcohol, and substance use. This suggests the presence of residual confounding in some of the reviewed studies which could potentially affect the accuracy of their findings. As such future research needs to consider adequate confounder adjustment in their research design.

3.5. Implications and future directions

The review highlighted that violence exposure is a risk factor for mental health problems in children in LMICs. It further calls for more studies that investigate these associations in preschool populations which can lead to the development of early interventions, potentially mitigating the long-term mental health problems. Issues related to the methodologies of the reviewed studies emphasise the need for consensus in the terminology used to capture child mental health problems, to enable cross comparisons and effective synthesis of findings. Furthermore, it is important for researchers to harmonize their measures of violence. Although it should be noted that limited resources in LMICs may contribute to the diversity in measures of violence in the reviewed studies. Of note, a small proportion of the reviewed studies investigated mediating and moderating factors in the relationship between violence exposure and child mental health problems. As such further research is needed to investigate the role of the various moderators and mediators implicated in the review as this could contribute to the development of targeted interventions. Discrepancies between current review findings of sex differences in patterns of associations between violence exposure and children's mental health problems and those of reviews in other populations may allude to context-specific patterns warranting further investigation. Findings also highlight the need to consider the nature of violence exposure when investigating associations between violence exposure and children's mental health problems as there may be differential associations based on violence subtypes. This also has implications for interventions. Given the uneven distribution of reviewed studies across LMICs, future research should be conducted in underrepresented LMICs to enhance our understanding of the patterns of associations across a variety of settings (i.e. African countries). Policymakers together with donors should consider collaborating in recognising these gaps and funding research in these countries. Furthermore, to enhance the inclusivity and representativeness of research findings, future studies should consider incorporating research published in languages other than English. This approach would broaden the scope of evidence, particularly increasing the representation of various LMIC contexts.

3.6. Conclusion

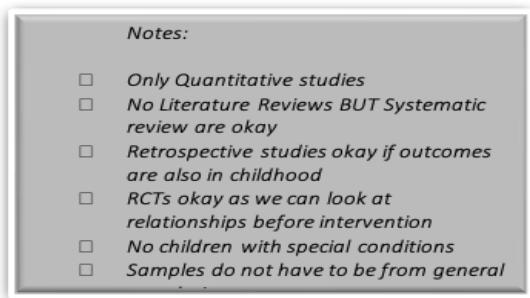
The review highlights violence exposure as a risk factor for child mental health problems in LMICs. Findings emphasise the need for targeted interventions that pay attention to violence

exposure types as well as moderating and mediating factors. There is a clear directive for future research to address gaps and methodological limitations in the literature, by using longitudinal designs, focusing on the less-studied preschool populations, and conducting research in underrepresented LMICs. The findings call for researchers, practitioners, and policymakers alike to collaboratively work towards protecting and nurturing the mental health of the children.

3.7. Supplementary material

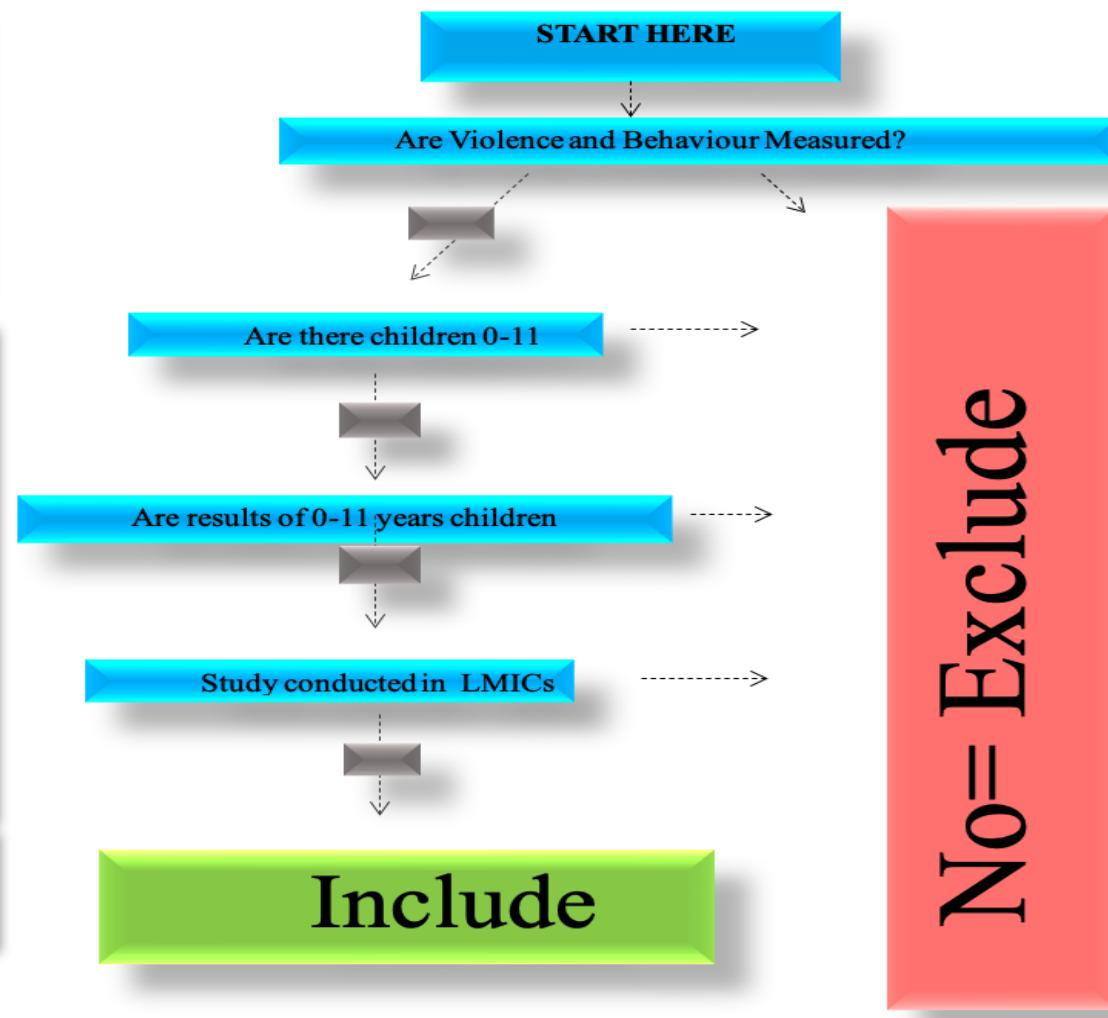
Supplementary Table 3.1 Violence and mental health systematic review search terms

Concept 1: Violence exposure	Concept 2: Children (0-11)	Concept 2: LMICs	Concept 4: Behavioural outcomes
Exposure to Violence	*Appropriate Limiters were used for each database	*EPOC LMIC Filters 2020 were used	Alternate Terms:
Adverse Childhood Experiences			Child Behaviour Disorders
Interpersonal violence			Child Behaviour Checklist
Violence			Internalizing symptoms
Trauma			Internalizing behaviours
Psychological Trauma			Externalising symptoms
War-related trauma			Externalising behaviours
Child Abuse			Anxious - depressed
Physical Abuse			anxious
Sexual abuse			anxiety
Rape			anxiety problems
Emotional abuse			depressed
Maltreatment			depression
Child Maltreatment			somatic complaints
Maltreatment, Child			somatic problems
Maltreatment, Physical			social problems
Physical Maltreatment			thought problems
Neglect			attention problems
Child neglect			ADHD
Spouse Abuse			rule-breaking behaviour
Intimate Partner Violence			aggressive behaviour
Parental intimate partner violence			affective problems
Gender-Based Violence			oppositional defiant problems
Domestic violence			conduct problems
Dating violence			child psychopathology
Community violence			Psychopathology
Gun Violence			Child psychiatry
Bullying			Psychiatry
Bullies			Mental health problems
Bullied			mental illness
Cyberbullying			
School violence			
Victimization			



Violence = (1) sexual violence (including unwanted touching, forced sex, attempted unwanted sex, sexual harassment or pressurised/coerced sex), (2) emotional violence (including verbal abuse, psychological abuse), (3) physical violence (including corporal punishment, violent discipline, and physically abusive behaviours), (4) bullying (including physical or verbal bullying), (5) adolescent relationship violence (including dating violence in all forms: physical, verbal, sexual and coercive behaviours), (6) witnessing domestic violence or parental intimate partner violence, (7) witnessing community violence (including sexual assault, burglary, mugging, the sound of gunshots and gang violence) (8) Collective violence committed by larger groups of individuals or by states (including social, political and economic violence).

Behaviour = Internalising or Externalising behaviours . Measures : Strengths and Difficulties Questionnaire -SDQ, Child Behavior Checklist – CBCL OR other



Supplementary Figure 3.1 Violence and mental health systematic review decision-making flow chart

Chapter 4. Methods

In Chapters 2 and 3 the evidence available investigating cognitive and mental health outcomes in children exposed to violence in LMICs was systematically reviewed. Chapter 2 highlighted the risk for poor cognitive outcomes in the domains of cognitive development, executive functioning, general intelligence and language that children 11 years and under exposed to interpersonal violence such as maltreatment and IPV face in these contexts. Additionally, as documented in Chapter 3, this population is also at risk of experiencing mental health problems (i.e. internalising and externalising behaviour problems). Furthermore, both of these review chapters identified gaps in the literature investigating these associations. Specifically, research investigating violence exposure and cognitive outcomes in general is limited. Furthermore, previous research has typically focused on school-going or older children, neglecting preschoolers. Lastly, the reviews underscored the need for future research to adopt rigorous and thorough methodologies that minimise risk of bias.

These Chapters, inform the methods and study design of the Thesis' results Chapters. This current Chapter sets the scene for the overall PhD project, specifically highlighting the methodology involved. Given the gaps identified in previous literature discussed above, the PhD project was nested within a South African prospective birth cohort study - the DCHS. South Africa is an LMIC plagued by violence and a fitting setting to address the research gaps discussed above. This Chapter describes the methodology of the DCHS. Result Chapters 5, 6 and 7 provide further details on methodologies used within the respective analyses. The methodologies used for the systematic review chapters (2 and 3) are presented separately within each chapter.

Sections of this chapter that describe the DCHS methodology have been published on Wellcome Open Research: Tsunga, L., Lake, M., Halligan, S. L., Malcolm-Smith, S., Hoffman, N., Heron, J., Zar, H., Fraser, A., Donald, K., & Stein, D. J. (2023). Early Childhood Violence Exposure Patterns in The Drakenstein Child Health Study (DCHS). *Wellcome open research*, 8, 36. <https://doi.org/10.12688/wellcomeopenres.18598.2>

4.1. Cohort description

The thesis used data from the DCHS based in South Africa, see map below (355). Data from the DCHS are used in Chapters 5, 6 and 7.

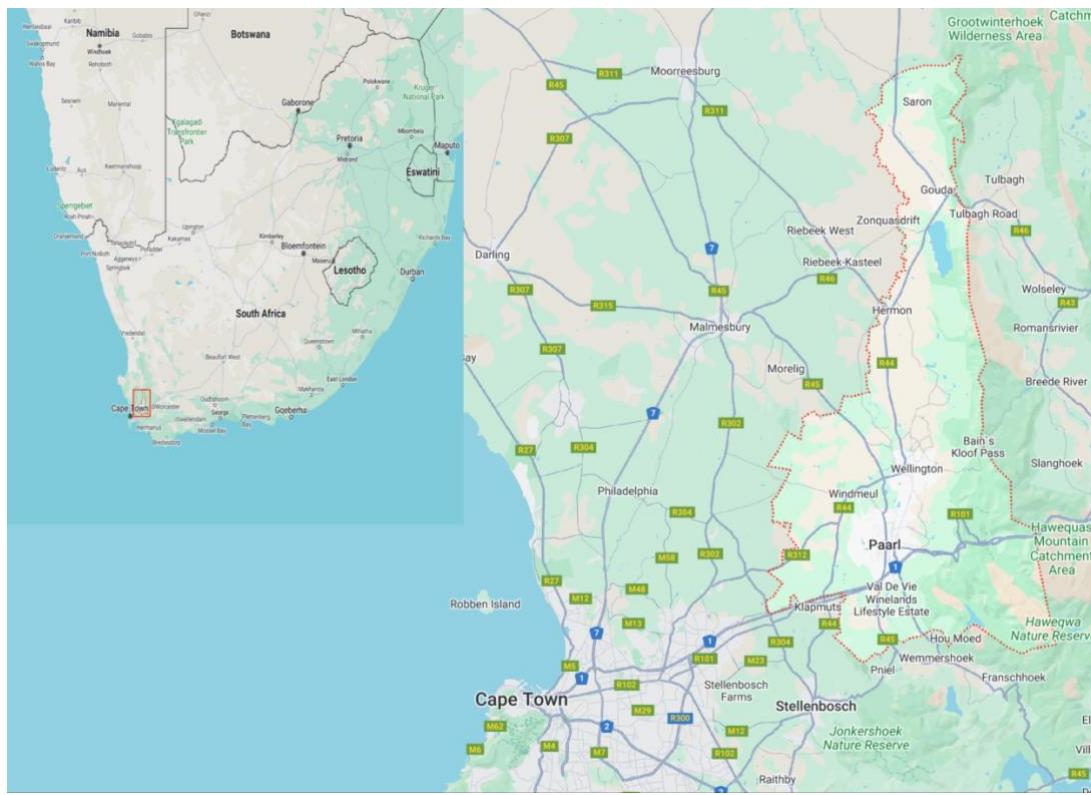


Figure 4.1 Map of the DCHS centred around the Drakenstein Municipality within Western Cape province, South Africa

4.2. Study context:

South Africa is the southernmost country on the African continent. It is comprised of approximately 60 million people (356). The country's capital cities are divided into three, the legislative capital is Cape Town, whilst the executive capital is Pretoria and the judicial capital is Bloemfontein (357). There are nine provinces in total, namely, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West, Eastern, Northern and Western Cape. Out of at least 35 native languages, 12 are officially recognised in South Africa, namely Sepedi (also called Sesotho sa Leboa), Sesotho, Setswana, siSwati, Tshivenda, Xitsonga, Afrikaans, English, isiNdebele, isiXhosa, isiZulu and South African Sign Language (358,359). Most of the population self-identifies as Black African (80%), 9% identify as

mixed ancestry and white respectively and 2.5% identify as Indian/Asian (360). While South Africa is a middle-income country, many of its people still experience extreme deprivation and inequality, especially those living in rural areas and in urban informal settlements (361–363). South Africa has a Gini coefficient (indicator of equality based on income ranging for 0 to 1) of 0.7 (364), one of the highest globally, highlighting the extent of income inequality in the country. Inequality and poverty are correlated with various social ills, that include high levels of violence, illicit drug use and HIV (365–368).

South Africa is ranked as one of the countries with high rates of interpersonal violence in the world. Burden of disease estimates for South Africa have highlighted high rates of homicide, with age-standardised homicide rates (64.8 per 100,000) seven times higher than the global average (49). In 2016 approximately 25% of women surveyed by the South Africa Demographic and Health Survey reported experiencing IPV (369). South Africa's interpersonal violence prevalence rates are rising, for example, in 2016 there was a 5% increase in homicides, sexual violence increased to 142 per day that same year, and assaults, carjackings, robberies and burglaries were the highest ever recorded (370).

Interpersonal violence in South Africa is understood to be rooted in a history of using violence to resolve conflict has fostered pervasive interpersonal violence, shaped by the historical legacies of apartheid-era oppression (371). The apartheid system, established by the National Party in 1948, institutionalised racial segregation and discrimination, subjecting non-white South Africans, particularly Black Africans, to systemic oppression, forced removals, and economic exploitation (372). Resistance to apartheid grew over decades, with widespread political activism and armed struggle. The apartheid government responded with brutal repression, fuelling cycles of political violence and unrest (373). However, the dismantling of apartheid in the early 1990s marked a pivotal moment. South Africa's first democratic elections in 1994, with Mandela elected as president, signalled the end of apartheid and the dawn of a new era of reconciliation and hope (374).

Despite the significant progress made towards democracy, the enduring legacy of apartheid-era violence and oppression is evidenced in the South African society by perpetuating cycles of violence and worsening social inequalities (371,375). The scars of apartheid-era injustices continue to manifest in systemic discrimination, economic disparities, and social divisions, setting the scene for ongoing violence and unrest (371). Furthermore, the failure of institutions to adequately address past injustices and protect vulnerable communities,

particularly women and children, reflects systemic shortcomings in governance, accountability, and the rule of law. Despite the establishment of democratic institutions and the enactment of progressive legislation aimed at promoting equality and human rights, implementation gaps, corruption, and impunity persist, undermining efforts to address historical injustices and promote social cohesion (376–378).

There are variations in poverty across provinces due to economic disparities (379). The Western Cape Province has a population of approximately 6.8 million (380) is plagued by poverty associated with unemployment (381). The unemployment rate in the province was 21.5% in 2019, with youth unemployment particularly high. The majority of the unemployed youth come from socio-economically disadvantaged households (382). There was a rapid expansion of informal settlements post-apartheid in the province, intensifying urbanisation difficulties .There was migration into previous restricted areas from Black Africans, reshaping the province's socio-economic terrain (379). Community violence across South Africa is widespread (383) but the Western Cape Province is disproportionately affected by gang violence (384) and homicide among adolescents (385). According to adolescent reports, an estimated 70% are exposed to violence as witnesses or victims of violence (386). It follows with that polyvictimisation is normative in the province (387,388). Many informal settlements are under-resourced in the Western Cape, with leisure resources scarce and vacant lots often sites of gang activity (389).

4.3. Cohort overview

The DCHS is a multidisciplinary, population-based birth cohort study investigating early-life psychosocial and psychobiological factors that influence child health. Located in the Drakenstein sub-district of South Africa in the Western Cape Province, it encompasses areas around Paarl, the peri-urban hub, situated approximately 60 km from Cape Town. The DCHS is based in two communities in this region, Mbekweni predominantly serves a Black African, Xhosa-speaking community whilst the TC Newman community predominantly consists of Afrikaans-speaking individuals of mixed ancestry (390). Racial classification is a product of the apartheid system that previously existed in South Africa (391) and is not used here for reification. Instead, it is intended that population characteristics of this nature would highlight the enduring health inequalities across South African groups, in relation to race and SES reported globally (392). For example, the DCHS catchment population is mainly of a low

SES, reside in informal settings or crowded conditions (390,393) and experience several psychosocial stressors such as single parent-headed homes, psychological distress, violence, HIV and substance use (390). Notable potentially highly prevalent psychosocial risk factors in the DCHS and comparable ones in the district include high rates of HIV exposure (21%), maternal psychological distress (20%) and depression (24%) (394–396), high prevalence of alcohol use (396–398), high rates violence including IPV (56%) (396,399) and low employment rates and educational achievement with approximately 6% of the mothers in the study having any tertiary education and 73% unemployed at enrolment (396). The population is generally stable, with very few individuals migrating out of the region. A majority (90%) of the residents rely on the public health care system, which makes these communities generalisable to others in South Africa and LMICs.

4.3.1. Screening and recruitment procedures

Pregnant mothers were only eligible for enrolment in the study if they were at least 18 years of age, would receive their antenatal care at either of the two clinics and planned on remaining in the area for at least one year after birth. At enrolment, they provided their informed written consent and further re-consent annually after childbirth. Trained study staff from the community guided the consent process in the mothers' language of choice, isiXhosa, Afrikaans or English. Consent forms covered the study scope and objectives including possible risks and advantages. A total of 1137 mother-child dyads enrolled in the study, from these, four mothers had twins and one had triplets. Therefore, the total number of children who were enrolled in the study is 1143. Given that one of the study's primary aims was to examine risk factors for childhood pneumonia, the sample size was intended to capture at least 550 pneumonia episodes. This sample size provided acceptable statistical power to detect relative associations of at least 1.5 times, for study risk factors, inclusive of cumulative attrition of approximately 20% over a 5-year period (and losses due to child mortality (390) .

Eligibility for enrolment was comprehensive to ensure generalisability of findings and that the cohort reflected the broader population. Most of the births in the area take place at Paarl Hospital, with an annual average of approximately 4800 births (400). DCHS births comprised around 10% of the total births in this catchment area. At enrolment, 1471 pregnant women in the catchment area were excluded on account of age, gestation or failure to attend study clinics. An additional 674 mothers were eligible but uninterested in study enrolment. Records

from the Cape Winelands district showed similar education levels, partnership status and household size with the study population. Retention was exceptionally high. At the 6- year assessment there were 980 active participants (see figure 4.2). The greatest attrition (approximately 50% of those lost) occurred in the first year after birth. The DCHS population characteristics allow generalisability to other similar LMIC settings and enable investigate of the Thesis aims. As such, the full cohort was included in the thesis.

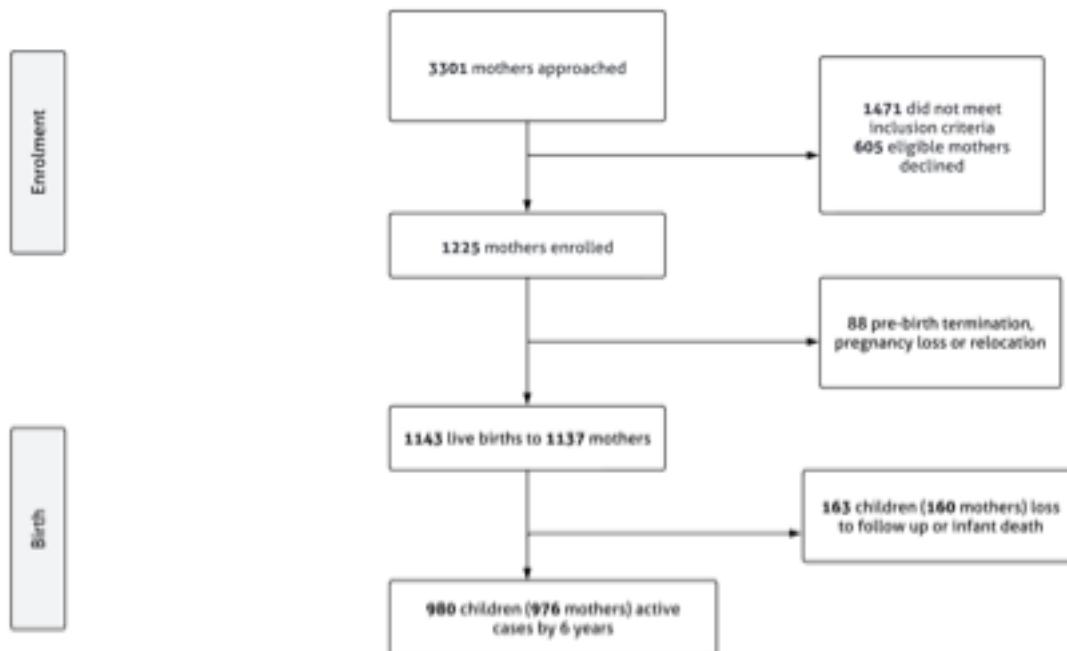


Figure 4.2 Flow chart of the DCHS sample selection

Although the sociodemographic characteristics of the DCHS active sample ($N = 980$) and those lost to follow up ($N= 163$) are largely comparable, those lost to follow up tended to have higher a household income, education level and were more likely to consist of non-smokers compared to the active sample (see Table 4.1 Below). A possible explanation for this lies in the multidisciplinary nature of the DCHS. Participation in the study indirectly offers access to a range of physical and mental health services through research investigations and active referral pathways. Given that the public health care system in South Africa is overwhelmed and under resourced (401), individuals from a low SES may be more motivated to continuously participate in the DCHS, whereas those of a higher SES may be able to afford private health care, which could reduce their motivation for participation. Indeed, the opposite pattern has been observed in longitudinal studies conducted in HICs, where lower SES and educational levels were associated with attrition (402,403). Furthermore, in the

DCHS, mothers who smoked during pregnancy, may have become acutely aware of the risk on their children's health through study assessments of smoking behaviour. Consequently, they may have developed an increased interest in their child's health and recognised the benefits of continued participation, in a study which repeatedly assessed aspects of their child's health. This is even more plausible given that the initial focus of the study was on lung health.

4.3.2. Data collection and management

1.1.1.8. Fieldwork procedures

Assessments were completed antenatally, following childbirth, at 5 time points during the first year of life, and at 6-monthly intervals from 1 to 6 years (400). By attending several study visits antenatally and postnatally, participants completed measures capturing psychosocial and biological determinants of health (e.g. trauma exposure, and substance use). Participants' hospital records provided key infant demographic and health data. Psychosocial, mental health and child cognitive assessments were conducted at community centres near the DCHS study clinics. Figure 4.3 provides a timeline of the assessments used in the Thesis. I, alongside other trained research assistants conducted these assessments, and when needed trained interpreters provided assistance. Assessments were done in the participants' preferred language (ie English, Afrikaans or isiXhosa using translated versions of validated questionnaires and tools. Translation of study measures from English to isiXhosa and Afrikaans, followed the standard forward and backwards approach (404).

Table 4.1 Sociodemographic characteristics of DCHS active sample and sample lost to follow up

		Active sample (N = 980)	Inactive (N = 163)	p- value *
Child Sex	Female	49%	47%	0.636
Household Monthly Income	< R1000 (52.56 USD)	35%	26%	0.025
	R1000-5000	52%	51%	0.813
	>R5000 (258.66 USD)	12%	24%	<0.001
Education	Primary	7%	8%	0.646
	Some Secondary	55%	42%	0.002
	Completed Secondary	32%	40%	0.045
	Any tertiary	6%	11%	0.018
Employment	Unemployed	74%	68%	0.110
Marital Status	Married/cohabitintg	40%	45%	0.229
Prenatal Tobacco Exposure	Exposed	30%	21%	0.019
Prenatal Alcohol Exposure	Exposed	13%	12%	0.724
Child HIV Birth Exposure	HIV exposed uninfected	22%	20%	0.567
Maternal Antenatal Depression	Above clinical threshold	24%	24%	1.000

* Based on Chi-squared tests

1.1.1.9. Data collection measures

The measures used in Chapters 5 – 7 are listed in Table 4.2. Only assessments central to the aims of the proposed study are included; the detailed methodology of the broader DCHS is described in previous publications (390,400,405). At baseline, maternal and family sociodemographic characteristics, maternal depression, tobacco and alcohol use were assessed. Child HIV status was assessed following birth and in the 18-month neonatal period. Children’s exposure to violence was assessed at approximately 3.5, 4.5 and 6 years of age. Children’s cognitive functions were assessed at 3.5 years and 5 years. While children’s mental health was assessed at 4 years and 5 years.

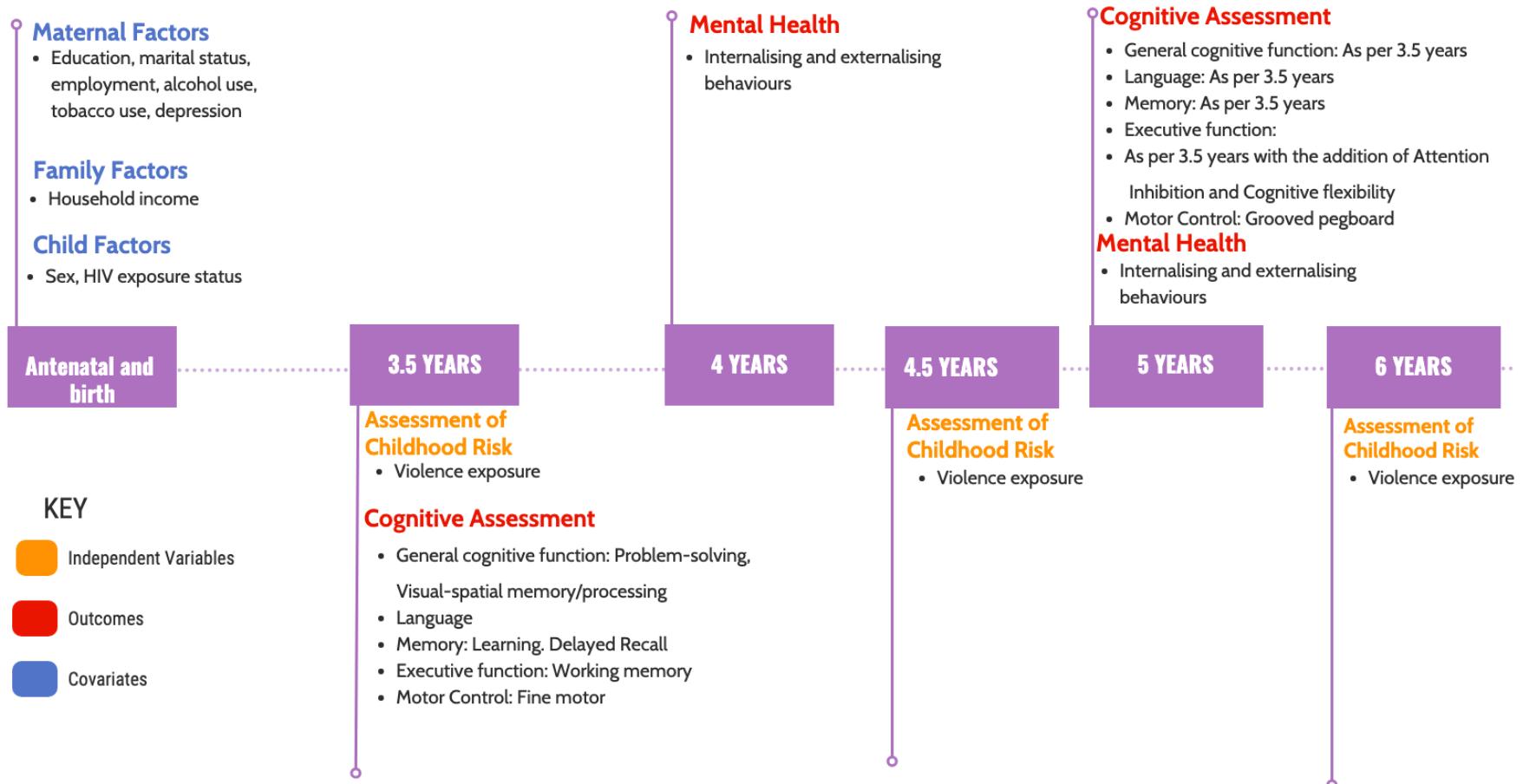


Figure 4.3 DCHS Assessment timeline of thesis measures

Table 4.2. Measures

Domain	Measure
Demographic data	Household income, maternal education, marital status and employment.
Infant health information	HIV exposure status
Maternal depression	Edinburgh Postnatal Depression Scale
Alcohol, nicotine and illicit substance exposure	Alcohol, Smoking and Substance Involvement Screening Test
Trauma exposure	CECV
General development	Bayley Scales of Infant and Toddler Development, Third Edition (Bayley-III), Third Edition (Bayley-III)
General cognitive function	Kaufman Assessment Battery for Children (KABC-II)
Problem solving	KABC-II Conceptual thinking.
Visual-spatial memory/processing	KABC-II Face recognition
Visual-spatial processing and problem solving	KABC-II Triangles
Working memory and motor sequencing	KABC-II Hand movements
Language	
Receptive language	Peabody Picture Vocabulary Test, Fourth Edition
Expressive language	KABC-II Expressive vocabulary
Memory	
Learning	KABC-II Atlantis
Delayed recall	KABC-II Atlantis delayed
Executive function	
Working memory	Wechsler Preschool and Primary Scale of Intelligence, Fourth Edition (WPPSI-IV): Picture memory
Inhibition	Day-night task
Cognitive flexibility	Dimension change card sort
Attention	Test of Everyday Attention for Children, Second Edition (Tea-Ch2): Balloon hunt
Motor control	Bayley-III: fine motor
	Grooved peg board
Internalising and externalising behaviour	CBCL 1.5-5 (CBCL/1.5-5)

1.1.1.9.1. Research ethics and approval

The DCHS was granted ethical approval by the Faculty of Health Sciences Research Ethics Committee, University of Cape Town (401/2009), and by the Western Cape Provincial Research committee (2011RP45). I was provided additional approval to conduct secondary analyses using DCHS data for the thesis by the Faculty of Health Sciences Research Ethics Committee, University of Cape Town (465/2021).

1.1.1.9.2. Data management

The DCHS de-linked all data collected in the study from identifying information and encrypted ensuring confidentiality of participants. Personnel involved in data collection and management were specifically trained in study confidentiality and associated patient protection matters. All electronic records were kept in password-protected files to decrease access by non-study personnel. Further, study documents were kept in locked filing cabinets only accessible to study personnel. Data collection occurred almost exclusively on an online database, REDCap (406,407), requiring strictly enforced limited access, including password protection and restricted access to sensitive data collected. REDCap (Research Electronic Data Capture) is a secure, web-based application created specifically for collecting data in research studies. It provides 1) an intuitive interface for capturing validated data; 2) comprehensive audit trails to monitor data changes and exports; 3) streamlined export features for easy data transfer to popular statistical software; and 4) methods for integrating and interfacing data with external sources. At the data entry stage, the accuracy of information captured on REDCap was verified by comparing it with hard copies completed during study visits, twice. Outliers in the data were identified and addressed at this stage. Data were stored within a firewall-protected Structured Query Language (SQL) server at the University of Cape Town. I received password-protected delinked datasets from the DCHS data team to use for each set of analyses for Chapters 6 - 7. Data were encrypted and sent via a server. I stored datasets on university storage (One Drive).

1.1.1.10. My role within the DCHS

From December 2017 till November 2019, I worked as a research assistant in the DCHS prior to commencement of my PhD. Specifically, I worked 2-3 days a week,

administering cognitive and socioemotional developmental assessments to children at 3.5-, 5-, 5.5- and 6-year visits. I also administered psychosocial questionnaires to caregivers in an interview format. I typically saw two children and their caregivers each day. Each session which encompassed cognitive assessments for the child and an interview with the caregiver, lasted approximately 2 hours. I worked predominantly with participants at the TC Newman Clinic, although at times I worked at the Mbekweni site. The measures I administered encompassed: trauma exposure and symptomatology using the CECV and Paediatric emotional distress scale; theory of mind assessments (Diverse desires, Diverse beliefs, Understanding intentions, Perception-leads-to-knowledge, Location-change false belief, Unexpected contents false belief, Belief emotion, Hidden emotions), emotion recognition (A Developmental NEuroPSYchological Assessment (NEPSY-II): affect recognition), Effortful control/emotion regulation (Snack delay, Gift-in-bag, Whisper, Rydell's emotion questionnaire), Dyadic interaction (Global rating scale), attachment (Brockington postpartum bonding questionnaire), temperament (Rothbart Infant and Early Child Behaviour Questionnaire). I also administered the cognition measures listed in Table 4.2. Through this involvement, I was inspired to investigate the relationship between violence exposure patterns and associated mental health and cognitive outcomes for the thesis, in the DCHS children. Furthermore, during my PhD studies, I was based at the University of Cape Town for approximately 18 months and was involved in data collection in the DCHS again.

I conducted assessments of children's exposure to violence using the CECV and mental health screening using the Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID) with children aged 8-9 years. Assessments also involved heart-rate variability monitoring in the children using a portable heart rate monitor. I was based at the TC Newman study site, where I conducted one weekly session with a child and their caregiver, each session lasting approximately 2 to 3 hours. Since data collection for this visit commenced after I was enrolled in the PhD and was not finalized within the duration of my studies, it falls outside the scope of this thesis.

In my research assistant roles within the DCHS I also conducted quality-checking on the data collected from the assessments above. This process included verifying the accuracy of the data to ensure consistency between the information recorded on paper

and the data entered into RedCap by other research assistants, as well as checking whether all necessary data had been collected. In addition, I played a role in training new research assistants in the administration of the cognitive assessments above. This entailed closely observing their conduct of the assessments and offering targeted feedback and instruction to refine their techniques. I ensured that they adhered to standardized procedures and understood the nuances of each test. My guidance covered key aspects such as the proper use of assessment tools, accurate recording of responses, and effective engagement with participants. Furthermore, I provided insights on managing potential challenges during assessments and maintaining ethical standards throughout the process. This was essential in ensuring the reliability and validity of the cognitive assessments.

Overall, during this period I acquired a substantial amount of experience working directly with the community in which my research was embedded. I have performed direct assessments of violence exposure and both cognitive and mental health outcomes at different ages in this group of children. I therefore worked to understand the data I have used to formulate and answer my thesis questions from assessment, through data quality checking, analysis and write up stages, with additional insights gained from working in this community for many years contributing to my ability to interpret my findings meaningfully in this thesis.

Chapter 5. Early Childhood Violence Exposure Patterns in the DCHS

Final published version:

Tsunga, L., Lake, M., Halligan, S. L., Malcolm-Smith, S., Hoffman, N., Heron, J., Zar, H., Fraser, A., Donald, K., & Stein, D. J. (2023). Early Childhood Violence Exposure Patterns in The Drakenstein Child Health Study (DCHS). *Wellcome open research*, 8, 36. <https://doi.org/10.12688/wellcomeopenres.18598.2>

My contributions and those of my co-authors: I formulated the aims and methodology of the study in partnership with my supervisors Abigail Fraser, Jon Heron and Kirsty Donald. I performed all the analyses, with statistical advice and guidance given by Jon Heron. Marilyn Lake contributed to data management. Sarah Halligan played a key role in conceptualizing and designing the study and provided critical revisions of the manuscript for intellectual content. Heather Zar serves as the principal investigator for the main study. Dan Stein and Nadia Hoffman lead the psychosocial study aspects and participated in revising the manuscript critically for intellectual content. Susan Malcolm-Smith and Kirsty Donald as co-investigators were responsible for implementation, training, and upholding quality assurance of the child assessments. I wrote the first draft of the manuscript, which was then reviewed by all co-authors who contributed conceptual and intellectual insights. Every author played a role in the completion of the final manuscript.

Relevance to the thesis: This chapter addresses the second aim of the thesis, investigating the violence exposure patterns of preschoolers in an LMIC. It describes the patterns of childhood violence exposure in the DCHS, a multidisciplinary, population-based birth cohort study investigating early-life psychosocial and psychobiological factors that influence child health in South Africa as previously described in Chapter 4. DCHS communities are of a low SES and experience highly prevalent psychosocial risk factors such as high rates of HIV exposure (21%), maternal psychological distress (20%) and depression (24%), high prevalence of alcohol use, high rates violence including IPV (56%) and low employment rates and educational

achievement with approximately 6% of the mothers in the study having any tertiary education and 73% unemployed at enrolment. The communities are generalisable to others in South Africa and LMICs. The current Chapter lays the foundation for subsequent analyses of violence exposure and developmental outcomes discussed in Chapters 7 and 8. The Chapter explores the patterns of violence exposure in the DCHS cohort at three timepoints, when the children were 3.5 years ($N = 530$), 4.5 years ($N = 749$) and 6 years of age ($N = 417$). Through careful analyses of the CECV, I was able to conceptualise a means to categorise aspects of violence captured in a meaningful way.

5.1. Background

As previously discussed in Chapter 1, the homicide rates of children under the age of 5 years in South Africa (14.0 and 11.7 per 100 000 for boys and girls, respectively) were more than twice as high as the average for LMICs in 2002 (234). Moreover, the estimated economic burden of violence against children in South Africa is high. In 2015, an estimated 2.3 million disability-adjusted life years (DALYs) were lost in South Africa due to non-fatal violence against children, and 84,287 due to fatal child-focused violence. The estimated economic cost of DALYs lost to violence against children in 2015 was ZAR173 billion (USD 13.5 billion)—or 4.3% of the country’s gross domestic product that year (408).

The causes of violence in South Africa are multifaceted. It is considered to be embedded in the colonial history and legacy of apartheid as under the apartheid government violence was widely accepted and normalised (391,409). Extensive poverty, inequality, high unemployment rates together with a fragile law enforcement system, the rise of urbanisation, poor housing and education outcomes all play a role in the perpetuation of community violence (410,411). Furthermore, IPV and physical disciplining methods such as corporal punishment are widely tolerated and accepted as social norms and are intergenerationally transferred. For example, in one study, 58% of South African caregivers reported having smacked their children at least once and 33% reported using an object such as a belt (412). A cycle of vulnerability to violence may also exist, with maltreatment among mothers in childhood being linked with an increased risk of experiencing IPV in pregnancy, and adulthood (outside of pregnancy) (413). Sex differences in violence exposure types have also been reported, where

teenage boys have a higher risk of becoming victims of homicide and community violence than girls (414).

Despite compelling evidence of substantial violence exposure among South African youth, and in other LMIC populations, substantial gaps exist in our knowledge. First, existing studies have focused on adolescents rather than younger children, with little evidence on preschool children in particular. Second, most work has been cross-sectional, with few longitudinal studies. Understanding how patterns of violence exposure may change with age is relevant to developing targeted prevention strategies. Third, studies have often focused on single forms of violence exposure (e.g., IPV), and there is a need to explore a range of direct and indirect forms of trauma exposure to provide a full picture of the risks to children. Relatedly, there is limited research on polyvictimisation - the phenomenon where individuals are exposed to multiple forms of trauma - despite evidence that polyvictimisation is a particular risk factor for poor child outcomes (119,120,415–418). Finally, little work has described sex differences in exposure to violence, which may be important to consider in the development of targeted intervention strategies. In sum, a better understanding of research investigating the exact patterns of violence exposure in the day-to-day lives of preschool children is needed. This is essential in South Africa where interpersonal violence is particularly high.

I addressed the above research gaps using a longitudinal South African birth cohort, the DCHS, which provides a unique resource for doing so. Previous studies using the DCHS cohort found high levels of IPV and childhood trauma among mothers (390). Here I explored the violence exposure patterns in the DCHS children born to these mothers, who consisted of males and females aged between 3 to 6 years, and where both direct and indirect forms of violence were longitudinally measured across 3 different time points. I also examined sex differences in exposure patterns as well as the extent of polyvictimisation in this young age group.

5.2. Research methods

5.2.1. Study design

As discussed in more detail in Chapter 3, the current analyses were nested in the DCHS, a longitudinal study employing a multidisciplinary approach to investigate the early-life determinants of child health in two peri-urban communities in the Drakenstein sub-district of the Cape Winelands, Western Cape, South Africa (396). Longitudinal measurements of risk factors in seven domains (environmental, infectious, nutritional, genetic, psychosocial, maternal and immunological) are used to investigate child health in addition to maternal and paternal health. The early-life component of the study centres on a wide range of developmental outcomes in domains that include physical health and growth as well as neurodevelopmental, cognitive and psychological health (419). Here I provide an overview of the methods relevant to the current Chapter's objectives .

5.2.2. Study setting

The study population is characterised by SES and multiple psychosocial risk factors are prevalent, such as single-parent households, high rates of psychological distress and violence exposure, HIV and illicit drug use, high levels of violence and IPV (399) and low levels of employment and educational achievement (420). The population is a stable one, with low immigration or emigration and over 90% of the inhabitants use the public health care systems. In view of the factors above, the DCHS cohort can be considered representative of other South African and LMICs peri-urban communities.

5.2.3. Participants

Pregnant women were recruited whilst attending one of the two primary healthcare clinics in the area, between March 2012 and March 2015. Pregnant women were enrolled if they were at least 18 years of age, received their antenatal care at either of the two clinics and planned on remaining in the area for at least one year. Mothers who consented were enrolled at 20–28 weeks' gestation and mother-child dyads have been followed longitudinally; to date, the oldest children are 10 years of age. At enrolment, mothers provided informed written consent and were further re-consented annually after

childbirth. Mother-child dyads attended follow-up visits at the two clinics and Paarl Hospital (420). Trained study staff from the community guided the informed consent process with the mothers in the mothers' language of choice, isiXhosa, Afrikaans or English.

A total of 1137 mother-child dyads were enrolled in the study, from these, four mothers had twins and one had triplets. Therefore, the total number of children who were enrolled in the study is 1143. Due to attrition (see Figure 5.1 for details), the current sample in the DCHS is 980. All the children were born at the main hospital and child sex was established at birth. Here and in the rest of the Thesis results Chapters, sex, classified as female or male, refers to a set of biological attributes in humans linked with physical and physiological features including chromosomes, gene expression, hormone function and reproductive/sexual anatomy (421).

5.2.4. Procedures and data collection measures

1.1.1.1. Sociodemographic characteristics

A questionnaire adapted from the South African Stress and Health (SASH) Study (422) was used to collect data on sociodemographic variables such as household income, employment status and education. The questionnaire was administered by trained study staff in interview format antenatally at 28 to 32 weeks' gestation and during annual study visits.

1.1.1.2. Violence Exposure

The CECV is a parent-report measure comprised of 35 items assessing the children's lifetime exposure to domestic, school and community violence adapted from the Richter's Things I've seen and heard checklist (423).

A standard forward and backward approach (404) was used to translate the measure from English to isiXhosa and Afrikaans. Translations were further cross-checked with study staff based in study communities to ensure that the appropriate dialect was used. The measure was administered by trained research assistants in Afrikaans for the Afrikaans-speaking participants and isiXhosa through the aid of interpreters for the isiXhosa-speaking participants. An interview format was adopted due to the low levels

of literacy in the sample, such that caregivers were afforded the means to request for clarification when needed.

The CECV version used in the study was adapted to more correctly target the South African population (424,425) as well as the study focus. It has shown good psychometric properties such as good internal reliability in previous South African studies such as $r = .93$ (424), $r = .86$ (426) and $r = .85 - .87$ (427). The checklist is coded on a four-point Likert scale rating the frequency of exposure ranging from “0” (never), to “3” (many times). Here I collapsed the responses to create a binary yes/no indicator of exposure for each item by combining exposure to violence ratings “once”, “a few times” and “many times” to indicate “yes” to violence exposure and retained the rating “never” as an indication of no exposure. This was done to create subscales and a total exposure score, that clearly reflect the number of types of violence exposures, as opposed to conflating exposure frequency and type.

The total exposure score (Overall Violence Exposure, $\alpha = 0.88$) was generated from the CECV by summing over the 35 items with high scores indicating a greater frequency of exposure (range 0-35). I also created four subscales from the CECV items to characterise violence exposure patterns in this cohort, namely, *Witnessing Community Violence* (10 items, $\alpha = .72$), *Community Victimisation* (8 items, $\alpha = .75$), *Witnessing Domestic Violence* (6 items, $\alpha = .75$) and *Domestic Victimization* (11 items, $\alpha = .79$) consistent with previous studies that used this measure (426,428). I defined polyvictimisation as a score of 1+ on two or more subscales.

5.2.5. Ethical considerations

All procedures performed were in accordance with the ethical standards of the Medical Research Council in South Africa and with the Helsinki Declaration (2013). The study protocol including consent forms was approved by the Faculty of Health Sciences Research Ethics Committee, University of Cape Town (401/2009), and by the Western Cape Provincial Research committee (2011RP45). Given the content of the CECV scale, a key obligation in the study was to flag instances of abuse, trauma and mental health issues. An active referral system was in place for both mothers and children supported by close relationships between study staff and provincial health staff. Furthermore, all women participating in the study, regardless of specific mental or

physical health problems, were informed about social and support service providers available to them.

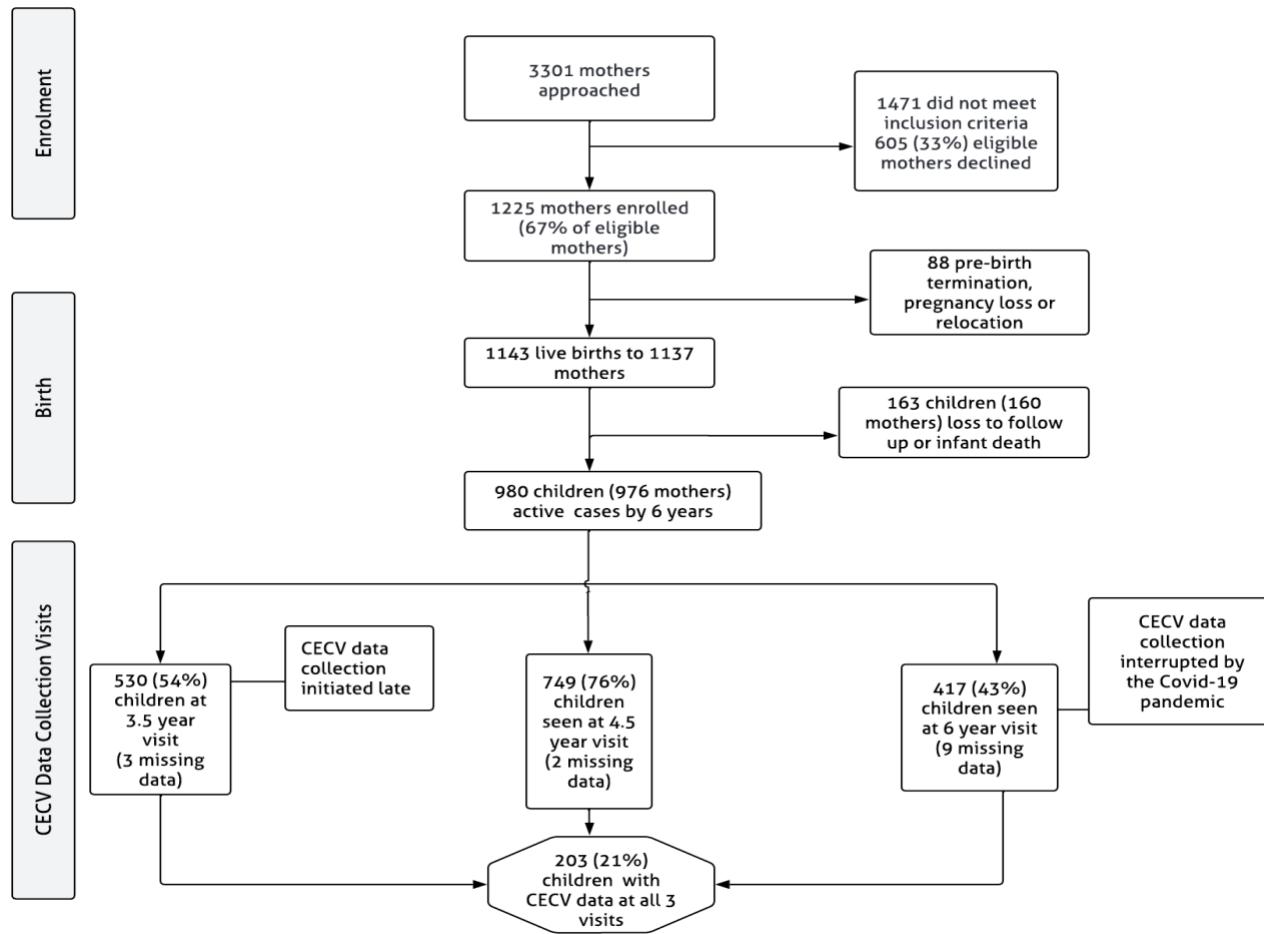


Figure 5.1 DCHS flowchart for CECV data collection

5.2.6. Data analysis

I performed data analysis using R Statistical Software (version 4.0.2) and R Studio (version 1.3.1073) for Mac. Given that the exact timing of violence exposure was not measured, each timepoint was cross-sectionally analysed. Prevalence of *Overall violence Exposure* and subtypes of violence were descriptively summarised using counts and proportions. I examined the distributions of subscales and *Overall violence Exposure* using the Shapiro-Wilk test of normality. The frequency of polyvictimisation was also explored. Chi-square analyses were conducted to explore sex and sociodemographic differences in violence exposure.

1.1.1.3. Missing Data

Item nonresponse occurred on the CECV scale in some of the cases where the CECV was completed at each visit. At the 3.5-year visit ($N = 530$), 3 cases (0.6%) had incomplete data, at the 4.5-year visit ($N = 749$), 2 cases (0.3%) had incomplete data and at the 6-year visit ($N = 417$), 9 cases (2.2%) had incomplete data (Figure 5.1). In these cases, item nonresponse was handled by imputing missing values using the single modal imputation method for each measurement occasion separately. Modal imputation was carried out using Base R functions of R Statistical Software (version 4.0.2)

5.3. Results

The sample sizes at each age/visit differ from the current total DCHS sample ($N = 980$). This is due to late CECV data collection initiation at the first study visit (age 3.5), data collection interruptions at the 6-year visit due to the COVID-19 pandemic, and non-response at any one of the time points. Only 203 children had CECV data at all 3 visits (Figure 5.1). Participants' sociodemographic characteristics are summarized in Table 5.1. Most of the households are from a low SES, with 49% having a monthly household income between 1000-5000 ZAR (62 - 310 USD), and 38% earning less than 1000 ZAR (62 USD) per month. Many children came from single-parent households and lived with on average 4 to 5 people. Furthermore, mothers reported high levels of unemployment and low levels of educational attainment.

Table 5.1 Demographic profiles and baseline descriptive statistics of the sample stratified by visit

	3.5 years (N = 530)	4.5 years (N = 749)	6 years (N = 417)	Subsample(N=203)	Full cohort (N = 1137)
Sex					
Female	262 (49%)	371 (50%)	198 (48%)	95 (47%)	550 (48%)
Average household income per month					
<1000 ZAR (62 USD)	179 (34%)	272 (36%)	162 (39%)	76 (37%)	430 (38%)
1000-5000 ZAR (62 - 310 USD)	282 (53%)	388 (52%)	199 (48%)	97 (48%)	553 (49%)
>5000 ZAR (310 USD)	69 (13%)	89 (12%)	56 (13%)	30 (15%)	154 (14%)
Mother's Education					
Primary	38 (7%)	60 (8%)	42 (10%)	8 (9%)	86 (8%)
Some Secondary	292 (55%)	411 (55%)	213 (51%)	100 (49%)	606 (53%)
Completed Secondary	171 (32%)	235 (31%)	146 (35%)	75 (37%)	372 (33%)
Any tertiary	29 (6%)	43 (6%)	16 (4%)	10 (5%)	73 (6%)
Mother's Employment Status					
Unemployed	388 (73%)	560 (75%)	313 (75%)	149 (73%)	831(73%)
Mother's Partnership status					
Married/cohabiting	223 (42%)	301 (40%)	164 (39%)	77 (38%)	458 (40%)
Number of people in the household					
Median (IQR)	4(3-6)	5 (3-6)	4 (3-6)	4(3-6)	4 (3-6)

The distribution of characteristics was similar in participants who attended the 3.5, 4.5- and 6-year clinics, the 203 children with CECV data at all 3 visits and the cohort overall.

5.3.1. Violence exposure patterns

The proportions of children exposed to any form of violence, as well as subscale scores and item level exposure by age at measurement are presented in Table 5.2. Exposure to any form of violence by each of the visits was 72%, 75% and 76%, at ages 3.5, 4.5 and 6 years respectively. *Witnessing Community Violence* was the most prevalent trauma: (62%, 67% and 69%), followed by *Domestic Victimisation* (24%, 23% and 31%), *Witnessing Domestic Violence* (28%, 24% and 21%) and *Community Victimisation* (9%, 9% and 14%). Similar prevalence rates are reported in the subsample (N = 203) of those participants consistently seen at all visits, see Supplementary Table 5.1.

Looking at all three time points, the most prevalent exposures in the *Witnessing Community Violence* subscale were *hearing gunshots* (38% - 48%) and *seeing someone beaten up in the neighbourhood* (41% - 46%). In the *Community Victimisation* subscale, the most common exposure was *House robbery occurring whilst the child was present* (4% - 8%). *Seeing grownups fighting* (18% - 26%) was the most common exposure in the *Witnessing Domestic Violence* subscale. The most prevalent *Domestic Victimisation* subtypes were the *child being hit by a stick, belt or another hard item at home* (6% - 13%), the *child being shouted at fiercely and loudly by a family member* (8% - 11%) and *child being called horrible names by someone at home* (8% - 13%).

Table 5.3 provides summary statistics (proportion exposed, median, IQR and range) for the overall violence score and subscales by age and sex. The only evidence for sex differences was seen for reported exposure to *Domestic Victimization* by age 4.5, where more boys than girls had reports of exposure (28% vs. 17%).

Table 5.4 provides frequencies of violence exposure by marital status, household income and age. There was no evidence of associations between violence exposure and maternal marital status or social economic status (indicated by household income).

Table 5.2 Prevalence of exposure to specific violence types at each study visit

	3.5 years (N = 530)	4.5 years (N = 749)	6 years (N = 417)
	Exposure at Least Once		
Exposure to any form of violence	383 (72.3%)	562 (75.0%)	318(76.3%)
<i>Witnessing community violence</i>			
Heard gunshots	199 (37.5%)	315 (42.1%)	201 (48.2%)
Seen someone beaten up in the neighbourhood	219 (41.3%)	341 (45.5%)	184 (44.1%)
Seen dead body in the neighbourhood	35 (6.6%)	64 (8.5%)	39 (9.4%)
Seen somebody point a gun at another in the neighbourhood	31 (5.8%)	42 (5.6%)	34 (8.2%)
Seen somebody get shot in the neighbourhood	8 (1.5%)	22 (2.9%)	22 (5.3%)
Seen somebody point a knife at another in the neighbourhood	75 (14.2%)	119 (15.9%)	72 (17.3%)
Seen somebody get stabbed in the neighbourhood	47 (8.9%)	65 (8.7%)	50 (12.0%)
Seen someone forced to do something sexual neighbourhood	3 (0.6%)	1 (0.1%)	7 (1.7%)
Child known someone killed by another	15 (2.8%)	30 (4.0%)	22 (5.3%)
Seen someone being killed by another person elsewhere	7 (1.3%)	11 (1.5%)	9 (2.2%)
<i>Community victimisation</i>			
House robbery child present	24 (4.5%)	27 (3.6%)	34 (8.2%)
Someone threatened to beat up the child at school or creche	12 (2.3%)	14 (1.9%)	22 (5.3%)
Someone threatened to beat up the child elsewhere	12 (2.3%)	15 (2.0%)	13 (3.1%)
Child been beaten up elsewhere	7 (1.3%)	22 (2.9%)	13 (3.1%)
Someone elsewhere threatened to kill the child	1 (0.2%)	3 (0.4%)	4 (1.0%)
Someone at school or creche threatened to shoot or stab the child	2 (0.4%)	1 (0.1%)	7 (1.7%)
Someone elsewhere threatened to shoot or stab the child	2 (0.4%)	1 (0.1%)	5 (1.2%)
Someone shot or stabbed the child elsewhere	2 (0.4%)	1 (0.1%)	4 (1.0%)
<i>Witnessing domestic violence</i>			
Seen grownups at home hit each other	138 (26.0%)	169 (22.6%)	73 (17.5%)
Seen somebody point gun at another at home	10 (1.9%)	5 (0.7%)	10 (2.4%)
Seen someone at home get stabbed	21 (4.0%)	22 (2.9%)	22 (5.3%)
Seen someone at home get shot	3 (0.6%)	2 (0.3%)	5 (1.2%)
Seen someone forced to do something sexual	2 (0.4%)	2 (0.3%)	9 (2.2%)
Seen someone being killed by another person at home	2 (0.4%)	7 (0.9%)	6 (1.4%)
<i>Domestic victimisation</i>			
Someone threatened to beat up the child at home	12 (2.3%)	15 (2.0%)	25 (6.0%)
Child been beaten up at home	12 (2.3%)	16 (2.1%)	15 (3.6%)
Someone at home threatened to kill the child	4 (0.8%)	3 (0.4%)	8 (1.9%)
Family member threatened to shoot or stab the child	1 (0.2%)	1 (0.1%)	5 (1.2%)
Someone shot or stabbed the child at home	2 (0.4%)	3 (0.4%)	4 (1.0%)
Someone made the child do something sexual	5 (0.9%)	6 (0.8%)	10 (2.4%)
Family member shouts at the child fiercely and loudly	60 (11.3%)	60 (8.0%)	39 (9.4%)
Anyone at home used a stick or belt or hard item to hit the child	34 (6.4%)	50 (6.7%)	54 (12.9%)
Anyone at home hit the child so hard they were hurt	19 (3.6%)	26 (3.5%)	23 (5.5%)
Anyone at home said the child would be sent away or kicked out	12 (2.3%)	17 (2.3%)	31 (7.4%)
Anyone at home called the child horrible names	43 (8.1%)	66 (8.8%)	53 (12.7%)

5.3.2. Prevalence of Polyvictimisation

Table 5.5 reports rates of polyvictimisation in the sample by each visit. By the age of 6 years, 49% of participants who were exposed to some form of violence, were exposed to multiple types of violence. Furthermore, sex differences were observed at the 4.5-year visit, where more boys (37%) experienced significantly more lifetime polyvictimisation than girls (31%).

Table 5.3 Prevalence of forms of violence by each visit stratified by sex

3.5 Years (N = 530)			4.5 Years (N = 749)			6 Years (N = 417)		
Female (n = 262)	Male (n = 268)	p-value	Female (n = 371)	Male (n = 378)	p-value	Female (n = 198)	Male (n = 219)	p-value
Overall Violence Exposure								
Exposed	179 (68%)	203 (77%)	0.07	273 (74%)	288 (76%)	0.46	148 (75%)	164 (75%)
Min / Max	0 / 35	0 / 15		0 / 14	0 / 35		0 / 34	0 / 35
Med (IQR)	1 (0;3)	2 (1;3)		1 (0;2)	2(1;3)		1(1;3)	2(1;4)
Witnessing Community Violence								
Exposed	153 (58%)	175 (65%)	0.12	237 (64%)	261 (69%)	0.16	129 (65%)	154 (70%)
Min / Max	0 / 10	0 / 8.0		0 / 6	0 / 10		0 / 9	0 / 10
Med (IQR)	1 (0;2)	1.0 (0;2)		1(0;2)	1 (0;2)		1 (0;2)	1 (0;3)
Community Victimisation								
Exposed	19 (7%)	24 (9%)	0.58	28 (8%)	39 (10%)	0.23	19 (10%)	32 (15%)
Min / Max	0 / 8	0 / 3.0		0 / 2	0 / 8		0 / 8	0 / 8
Med (IQR)	0 (0;0)	0 (0;0)		0 (0;0)	0 (0;0)		0 (0;0)	0 (0;0)
Witnessing Domestic Violence								
Exposed	66 (25%)	80 (30%)	0.27	82 (22%)	96 (25%)	0.33	39 (20%)	41 (19%)
Min / Max	0 / 6	0 / 4		0 / 4	0 / 6		0 / 6	0 / 6
Med (IQR)	0 (0;1)	0 (0;1)		0 (0;0)	0 (0;1)		0 (0;0)	0 (0;0)
Domestic Victimization								
Exposed	54 (21%)	69 (26%)	0.19	64 (17%)	104 (28%)	0.001	51 (26%)	73 (33%)
Min / Max	0 / 11	0 / 6		0 / 5	0 / 11		0 / 11	0 / 11
Med (IQR)	0 (0;0)	0 (0;1)		0 (0;0)	0 (0;1)		0 (0;1)	0 (0;1)

p-value: Chi-square test

Table 5.4 Violence exposure by marital status and household income (*p*-value: Chi-square test)

	Overall Violence Exposure		Witnessing Community Violence		Community Victimization		Witnessing Domestic Violence		Domestic Victimization	
					3.5 years (N = 530)					
	Exposed (n = 382)	<i>p</i> -value	Exposed (n = 328)	<i>p</i> -value	Exposed (n = 43)	<i>p</i> -value	Exposed (n = 146)	<i>p</i> -value	Exposed (n = 123)	<i>p</i> -value
Mother's Marital Status										
Married/cohabiting (n = 223)	170 (76%)	0.09	143 (64%)	0.41	22 (10%)	0.27	65 (29%)	0.55	54 (24%)	0.72
Single (n = 307)	212 (69%)		185 (60%)		21 (7%)		81 (26%)		69 (22%)	
Household Income										
< R1000/m (n = 179)	133 (74%)	0.59	121 (68%)	0.15	10 (6%)	0.15	46 (26%)	0.62	40 (22%)	0.54
R1000-5000/m (n = 282)	198 (70%)		167 (59%)		24 (9%)		78 (28%)		70 (25%)	
>R5000/m (n = 69)	51 (74%)		40 (58%)		9 (13%)		22 (32%)		13 (19%)	
4.5 years (N = 749)										
	Exposed (n = 561)		Exposed (n = 498)		Exposed (n = 67)		Exposed (n = 178)		Exposed (n = 168)	
Mother's Marital Status										
Married/ cohabiting (n = 301)	230 (76%)	0.49	202 (67%)	0.83	23 (8%)	0.37	78 (26%)	0.30	61 (20%)	0.28
Single (n = 448)	331 (74%)		296 (66%)		44 (10%)		100 (22%)		107 (24%)	
Household Income										
< R1000/m (n = 272)	207 (76%)	0.82	185 (68%)	0.65	26 (10%)	0.50	58 (21%)	0.49	64 (24%)	0.09
R1000-5000/m (n = 388)	287 (74%)		252 (65%)		36 (9%)		97 (25%)		77 (20%)	
>R5000/m (n = 89)	67 (75%)		61 (69%)		5 (6%)		23 (26%)		27 (30%)	
6 years (N = 417)										
	Exposed (n = 312)		Exposed (n = 283)		Exposed (n = 51)		Exposed (n = 80)		Exposed (n = 124)	
Mother's Marital Status										
Married/ cohabiting (n = 164)	125 (76%)	0.68	113 (69%)	0.80	19 (12%)	0.87	30 (18%)	0.81	50 (30%)	0.87
Single (n = 253)	187 (74%)		170 (67%)		32 (13%)		50 (20%)		74 (29%)	
Household Income										
< R1000/m (n = 162)	118 (73%)	0.21	103 (64%)	0.17	22 (14%)	0.77	29 (18%)	0.61	41 (25%)	0.16
R1000-5000/m (n = 199)	156 (78%)		144 (72%)		22 (11%)		42 (21%)		68 (34%)	

	Overall Violence Exposure		Witnessing Community Violence		Community Victimization		Witnessing Domestic Violence		Domestic Victimization	
>R5000/m ² Polyvictimisation	38 (68%)	3.5 years (N = 530)	36 (64%)	4.5 years (N = 749)	17 (17%)	9 (16%)	6 years (N = 417)	15 (27%)		
	Female (n = 262)	Male (n = 268)	p-value	Female (n = 371)	Male (n = 378)	p-value	Female (n = 198)	Male (n = 219)	p-value	
Any Polyvictimisation	80 (31%)	99 (37%)	0.14	105 (28%)	145 (38%)	0.00	64 (32%)	91 (42%)	0.06	
Number of different types of violence exposure										
None	82 (31%)	65 (24%)	0.32	98 (26%)	89 (24%)	0.01	48 (24%)	51 (23%)	0.25	
One type	98 (37%)	104 (39%)		168 (45%)	143 (38%)		84 (42%)	72 (33%)		
Two types	52 (20%)	60 (22%)		75 (20%)	91 (24%)		42 (21%)	56 (26%)		
Three types	24 (9%)	32 (12%)		27 (7%)	41 (11%)		18 (9%)	29 (13%)		
Four types	6 (2%)	7 (3%)		3 (1%)	14 (4%)		6 (3%)	11 (5%)		

Table 5.5 Prevalence of polyvictimization stratified by sex

p-value: Chi-square test

5.4. Discussion

In this South African birth cohort, I found that a large proportion of children (72%-75%) were exposed to direct and indirect violent experiences in their homes as well as in the community from a very young age with substantial numbers experiencing polyvictimization. Boys and girls were similarly exposed to violence overall, but there was some evidence that boys were more vulnerable to *Domestic Victimization* and polyvictimization by age 4.5 years of age.

By the age of 3.5 years, 72% of the children in this cohort had been exposed to some form of violence with *Witnessing Community Violence* as the most prevalent form of violence reported. This is consistent with the reports of high homicide rates and gang-related violence in the Western Cape region (429). Other studies with older children in the Western Cape also reported high exposure to community violence. One study found that 98.9% of their sample (aged 12-15 years) had witnessed community violence (428) whilst another found that 84.1% of their sample (*Mean* age = 14.2 years) had been exposed to violence (430). A study providing national estimates of trauma exposure in South African adults also found high levels of witnessing violence (431), suggesting that this form of trauma is potentially pervasive across the life span in some South African contexts.

Domestic violence was also commonly reported, consistent with earlier reports on IPV during pregnancy in this cohort (432). Similar prevalence estimates (20% - 31%) were reported on average for both witnessed domestic violent acts as well as violent acts directed at the child at home. Finding that reports of witnessed domestic violence decreased with age, unlike the other forms of violence, may however suggest underreporting of IPV. IPV and domestic violence are typically considered private matters and rely on people feeling able to divulge this sensitive information. Nonetheless, child exposure to IPV is limited, despite its occurrence; or many caregivers may be of the impression that their children are not being exposed to violence in the home, nor attending to or being affected by the incidences of IPV and domestic violence in the family. Furthermore, children's social-emotional and cognitive development becomes more apparent to caregivers as the children grow older such that parents may appreciate the impact of domestic violence on the children and as such

underreport children's exposure to it. Additionally, it is possible that caregivers underestimate the extent to which young children are aware of the violence occurring in parts of the home or after the child has gone to bed. Indeed previous studies have found discrepancies between parent and child reports of domestic violence exposure (433,434). Alternatively, it is also possible that children in the DCHS sample were witnessing less violence with age, given that younger children require more attention which places strain on caregiver relationships subsequently resulting in domestic violence. As such children may be at a greater risk of witnessing domestic violence at younger ages.

Although *Community Victimisation* is the least prevalent form of reported violence exposure in these early years, it is likely to increase in prevalence as the children get older and spend more time outside the home. Indeed other studies conducted in South Africa in older children found this type of violence highly prevalent in adolescents (435,436). The finding that a majority of children were exposed to community violence from as young as 3.5 years of age is particularly concerning, given associations between community violence exposure and later aggression (437), other mental health problems including posttraumatic stress disorder (PTSD) and internalising and externalising behavioural problems in children and adolescents, respectively (438).

Polyvictimisation was reported in this cohort, especially at the 6.5-year visit, where 49% of the children were reported to have been exposed to more than one type of violence, while at the 3.5- and 4.5-year visits the prevalence rates were 34% and 33% respectively. The higher prevalence at the later visit is possibly a result of older children being exposed to different settings beyond the family home such as school and the community where they may experience violence in these contexts in addition to that in the domestic environment. Indeed, even higher polyvictimisation prevalence has been reported in older children, for example, 93% of adolescents aged 12-15 years reported experiencing polyvictimisation in a Cape Town study (428) whilst another more recent national South African study reported polyvictimisation in 64% adolescents aged 15 - 17 years (439). Finding high rates of polyvictimisation in this sample of such young children is important, given that research has shown that polyvictimisation may contribute to the experience of cumulative stress, aggravating later health outcomes and potentially altering developmental trajectories (440,441). Furthermore,

polyvictimisation has been found to be a stronger risk factor for mental health problems than single forms of victimization (see review (442).

More boys than girls in this cohort were reportedly exposed to polyvictimisation by age 4.5 years. Studies have reported mixed findings regarding the relationship between sex and children's exposure to violence. While the current study used parent reports, other studies using self-report measures also found that older boys reported more exposure to violence than girls (428,436,443,444) whilst others found no differences in reported exposure to violence (341,415,445). Although research on sex differences in polyvictimization prevalence patterns is very limited, one other study also found that polyvictimization was higher in boys in their sample of adolescents aged 12–15 years living in Cape Town (428). Differential socialization of the sexes may explain this discrepancy as boys may be less protected than girls allowing them to spend more time outside the home, making them more vulnerable to other forms of violence. There was also some evidence in the study that boys experience more domestic victimisation, suggesting there could also be differences in parental perceptions of the suitability of harsh discipline practices for boys versus girls. Some studies have shown that boys are punished more frequently than girls due to differences in gender roles and expectations between the two sexes (see review: (446)). Here, gender refers to the socially constructed roles, behaviours and identities of female, male and gender-diverse people (421).

South Africa's political history of oppression and the structural and socioeconomic inequalities that have persisted in society are likely to contribute to the high levels of violence in these communities. These rates of violence exposure may not be generalisable to all South African communities. However, this cohort is representative of many communities in LMICs, with high rates of poverty, unemployment, and low levels of educational attainment among women. Given that the majority of studies reporting on children's exposure to violence have mostly used samples of older children (428,436,443,444,447,448) finding that violence exposure is common in this sample of pre-schoolers suggests that many children experience the persistent threat of violence throughout the life course and importantly, during early formative years.

Finding no evidence of associations between violence exposure and maternal marital status or socioeconomic status in this cohort suggests that children in the current study

are similarly exposed to violence regardless of their background. This may be expected given that the DCHS children live in similar contexts where community violence is a common phenomenon. Furthermore, certain types of violence such as IPV and corporal punishment are widely accepted in the South African society (449). As such, children in this sample are exposed to similar rates of domestic violence regardless of their mother's socioeconomic context.

Notably, violence exposure in early childhood occurs during sensitive and critical periods of development lasting from infancy to adolescence and can disrupt brain development and consequently impacting affective and neurocognitive systems (105). Young children such as those in the DCHS sample experiencing violence during this period have increased risk of short term and long term poor developmental outcomes such as impaired socio-emotional development, mental health problems, poor cognitive functions and physical health problems in adulthood (see reviews: (16,19,40,215)). Previous research has highlighted the early childhood period as a key developmental stage where violence exposure occurring here is associated with greater health problems than violence occurring in other periods (275,450,451). This is important given that existing literature investigating violence exposure has focused particularly on adolescents and adults, neglecting young children. As such, this, together with the current study's findings, emphasize the need for closer attention to be paid to young children such as those in the DCHS, whose development is taking place in violent contexts. Notably, this descriptive study has provided context for future research to investigate the relationships between violence exposure and socio-emotional, mental health and cognitive outcomes in young children in the DCHS and similar settings.

The findings of this study should be considered in view of some methodological limitations. Firstly, only a subsample of children was consistently seen at all three visits, such that the sample sizes differ at each visit and comprise different children. Secondly, there is no information about the exact timing of exposure to violence. Thirdly, given that violence exposure relied on caregiver reports and recall; exposure was likely underreported due to social desirability biases. This is a common limitation of studies that examine trauma exposure or maltreatment in children given that young children are unlikely to be developmentally capable of understanding the concept of a 'violent act' and reporting it adequately (452). Furthermore, obtaining reports of violence exposure

from young children may risk re-traumatising them. The high prevalence rates of violence exposure reported are particularly important given the likelihood of underreporting in some domains. Fourthly, given that the 6-year visit had the smallest sample, the power to detect sex differences in polyvictimisation exposure patterns is limited. Lastly, the study did not capture racial discrimination, another type of violence children in the DCHS communities may be experiencing given the persistent occurrence of racial discrimination in South Africa (453). Future research is needed to investigate the prevalence of this phenomenon in young South African children.

5.5. Conclusion

These findings further highlight the high levels of violence exposure in South African children. They indicate that many pre-schoolers in the DCHS sample experience a pervasive threat of danger in their homes and communities. Interventions aimed at the community, family and individual levels, are crucial, not only to stop the cycle of violence but to help children deal with this trauma. Interventions aimed at building resilience in children may help them adapt psychologically. Over and above this, systematic factors that likely contribute to this picture such as poverty, socioeconomic inequality, high unemployment rates, low levels of educational attainment and weak police enforcement need to be mitigated to change this picture.

5.6. Supplementary

Supplementary Table 5.1 Prevalence of violence exposure in subsample

	3.5 years	4.5 years	6. years
N = 203			
Subscales			
Overall Violence Exposure	153 (75.4%)	148 (72.9%)	146 (71.9%)
Witnessing Community violence	132 (65.0%)	136 (67.0%)	134 (66.0%)
Community victimisation	12 (5.9%)	16 (7.9%)	26 (12.8%)
Witnessing Domestic Violence	56 (27.6%)	46 (22.7%)	36 (17.7%)
Domestic Victimisation	49 (24.1%)	45 (22.2%)	59 (29.1%)

Values indicate proportions of those with reports of violence exposure only

Chapter 6. Exposure to Violence and Mental Health Outcomes Among Preschoolers in a South African Birth Cohort

Manuscript submitted to Research on Child and Adolescent Psychopathology,

Tsunga, L., Heron, J., Lake, M., Halligan, S. L., Malcolm-Smith, S., Hoffman, N., Zar, H., Fraser, A., Stein, D. J., & Donald, K.A. Exposure to Violence and Mental Health Outcomes Among Pre-schoolers in A South African Birth Cohort.

My contributions and those of my co-authors: I formulated the aims and methodology of the study in partnership with my supervisors Abigail Fraser, Jon Heron and Kirsty Donald. I performed all the analyses, with statistical advice and guidance given by Jon Heron. Marilyn Lake contributed to data management. Sarah Halligan contributed to concept and design and revising the manuscript critically for intellectual content. Heather Zar serves as the principal investigator for the main study. Dan Stein and Nadia Hoffman lead the psychosocial study aspects and participated in revising the manuscript critically for intellectual content. Susan Malcolm-Smith and Kirsty Donald as co-investigators were responsible for implementation, training, and upholding quality assurance of the child assessments. I wrote the first draft of the manuscript, which was then reviewed by all co-authors who contributed conceptual and intellectual insights. Every author played a role in the completion of the final manuscript.

Relevance to the thesis: This chapter addresses the third aim of the thesis, investigating the relationship between exposure to various forms of violence and mental health problems in preschoolers in an LMIC. The previous Chapter explored the violence exposure patterns of children in the DCHS, finding high prevalence of violence, especially witnessing community violence and sex-differences in exposure to domestic victimisation. In the current Chapter, I used multiple linear regression analyses to investigate associations between the types of violence captured in the previous chapter using CECV at age 4.5 years and internalising and externalising behaviour problems at age 5 years, measured using the CBCL in the DCHS.

6.1. Background

As detailed in Chapter 1-3, Exposure to violence has been found to be associated with poor mental health among school-aged children, adolescents and adults living in HICs. A large body of research has linked domestic victimisation (i.e. maltreatment) to both internalising (e.g., depression, anxiety) and externalising (e.g., aggressive behaviours) behaviour problems (14,112,454). Childhood exposure to IPV has been linked to behavioural problems (see reviews: (116,455) in children and adolescents. A meta-analysis investigating the relationship between community violence and mental health across individuals aged 3 – 25 years, found a stronger association between community violence and externalising behaviour problems than internalising behaviour problems (16). Findings from the review in Chapter 3 also indicated that different subtypes of violence potentially have differential associations with mental health problems in childhood.

Studies investigating the relationship between exposure to domestic victimisation, IPV or community violence and both internalising and externalising behaviours in children, have however neglected pre-schoolers, especially those living in LMICs. For example, of the 114 studies reviewed by a previous review (16), only six studies assessed mental health outcomes in pre-schoolers, and only one of these studies was conducted in a LMIC setting. This pattern is also observed in the review in Chapter 3. This omission is important, as studies investigating time-dependent effects of violence exposure across the lifespan have highlighted the preschool years as a sensitive developmental period where domestic victimisation predicts later mental health problems (345,456,457). Importantly, children in LMICs may experience a significantly higher burden of violence than those living in HICs (458,459).

Existing studies have demonstrated that polyvictimisation, i.e. exposure to multiple types of violence, further increases the risk for subsequent psychopathology (118). Furthermore, a dose-response relationship has been found between the number of forms of violent experiences (i.e., domestic victimisation, IPV, peer victimisation) and psychopathology indicators, including overall psychological distress, externalising, and internalising behaviour problems (see reviews: (118,119)). However, again, the evidence mainly focuses on older children and adolescents from HICs. Out of the 22 studies reviewed by one of the reviews, eight included pre-schoolers and only one was

conducted in an LMIC (118). In a review of studies investigating polyvictimisation in children and adolescents in LMICs, only three studies were conducted with a preschool sample (119).

In this study, I therefore examined associations between lifetime exposure to violence in early childhood (assessed at 4.5 years of age) and mental health at 5 years of age in participants of the DCHS. It was observed in Chapter 5, that children in the DCHS experience a high burden of violence.

First, I examined associations of lifetime general violence exposure and exposure to specific types of violence assessed at 4.5 years of age with internalising and externalising behaviour problems at 5 years of age. Based on observations from older children and adolescents, I hypothesised that there would be an association between all forms of violence exposure by 4.5 years and both internalising and externalising behaviour problems at age 5. I also hypothesised that associations between exposure to witnessing community violence and mental health would be stronger for externalising than internalising behaviour problems according to previous literature. Second, I investigated whether there were linear dose-response relationships between polyvictimisation (i.e., the number of types of violence experienced) and internalising and externalising behaviour problems in the preschool sample.

6.2. Method

6.2.1. Population

The broader methods of the DCHS are detailed in Chapter 4. Here I briefly describe the DCHS methods relevant to the current analyses. The DCHS is a prospective birth cohort, that applies an interdisciplinary approach to understanding factors that influence child health and development in the Drakenstein sub-district of the Cape Winelands, Western Cape, South Africa (393). Pregnant women were recruited between 2012 and 2015 at 20–28 weeks' gestation and mother-child dyads were prospectively followed up until at least the child was 10 years old. Here, I focussed on children's lifetime exposure to violence assessed at age 4.5 years and internalising and externalising behaviour problems at 5 years of age. Currently, 980 children and 970 mothers are active in the cohort (see Figure 6.1).

6.2.2. Measures

DCHS maternal and child measures have been previously described (400,460) and included the following:

1.1.1.1. Child Exposure to Violence

Violence exposure was assessed using the CECV which captures lifetime exposure to community and domestic violence (423) as previously described in Chapter 5. The CECV version used in this study has been adapted to fit a South African context and has shown good reliability in previous studies (388,424,461). The CECV was translated from English to Afrikaans and isiXhosa using a forwards and backwards approach. The translations were cross-checked by DCHS staff fluent in the relevant languages, based in the study communities, to ensure that a suitable dialect was used. Furthermore, the translation team, consisting of at least 3 mother-tongue speakers for each language, discussed translations during a meeting in order to reach consensus. Trained research assistants administered the questionnaires to caregivers in either Afrikaans or isiXhosa, and trained interpreters were used for isiXhosa-speaking respondents. Interpreters were native isiXhosa speakers and fluent English speakers. Caregivers were asked to report on 35 items assessing their child's lifetime exposure to violence when their child was approximately 4.5 years old. The CECV response items have four levels that rate exposure frequency between "0" (never) and "3" (many times).

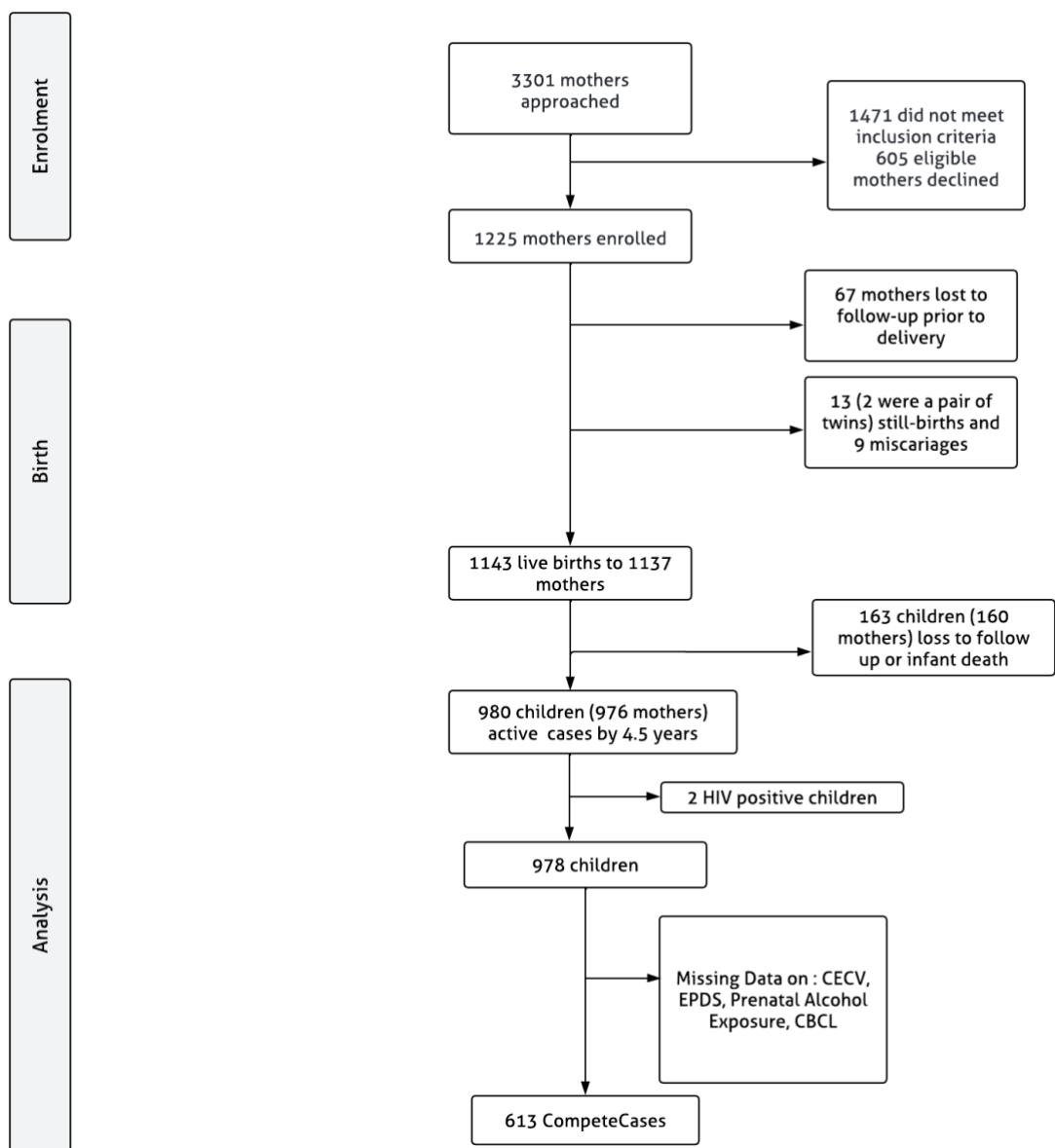


Figure 6.1 Flow chart of DCHS participation and missing data in assessment of violence exposure and mental health outcomes

For the analyses I simplified the responses by combining responses above “0” into a “yes” category, indicating violence exposure, while keeping the “0” rating as an indicator of no exposure as described in Chapter 5. I used the CECV Total (sum of all 35 items, range = 0 – 35, Macdonald’s Omega [ω] = 0.91) reflecting overall violence exposure as well as four additional subscales that were previously created in Chapter 5 to capture community or domestic violence that is either witnessed by the child or directed at the child (461), namely, *Witnessing Community Violence* (10 items, ω = 0.77), *Community Victimisation* (8 items, ω = 0.90), *Witnessing Domestic Violence* (6 items, ω = 0.85) and *Domestic Victimization* (11 items, ω = 0.76). Finally, I created a continuous polyvictimisation variable that captures whether a child experienced between 0 and 4 distinct types of violence, consistent with previous studies (388,462,463). I used continuous scores for analyses and categorical exposure status for descriptive purposes. The latter allowed me to capture prevalence patterns across varying numbers of violence types. I introduced an additional data cleaning step for the Child Exposure to Community Violence Checklist (CECV) in Chapter 6 and 7 by cross-referencing the data collected at the 4.5-year visit with that from the 3.5-year visit to ensure consistency. In cases where there were discrepancies in violence exposure reports—specifically, if on a CECV item, exposure was recorded as “exposed” at the 3.5-year visit but “unexposed” at the 4.5-year visit—I updated the 4.5-year data to align with the 3.5-year response. This approach was based on the assumption that caregivers might have forgotten previous exposures and considering that the CECV measures lifetime exposure, a child’s exposure status cannot revert to “unexposed” once there was reported exposure.

1.1.1.2. Child Mental Health

Mental health was assessed when the child was approximately 5 years old using the parent-report version of the CBCL for children aged 1.5–5 years (CBCL 1.5–5; (68). The CBCL consists of ninety-nine questions asking about child emotional and behavioural problems in the past 6 months on a 3-point Likert scale (0 = not true; 1 = somewhat or sometimes true; 2 = very true or often true). I used two subscales representing second-order categories of syndromes: internalising behaviour problems (36 items measuring withdrawn behaviour, somatic complaints and symptoms of anxiety/depression, score range = 0 - 72, ω = 0.92) and externalising behaviour problems (24 items measuring rule-breaking behaviour and aggressive behaviour, score

range = 0 - 48, $\omega = 0.93$). Raw scores were converted into *t*-scores with a mean of 50 and a standard deviation of 10. I used continuous *t*-scores for each subscale as is standard practice, and computed clinical classifications where non-clinical symptoms are indicated by a *t*-score ≤ 59 , subclinical symptoms are indicated by *t*-scores between 60 and 64 and clinical symptoms are indicated by a *t*-score ≥ 65 (464). I used continuous scores for analyses and clinical categories for descriptive purposes.

1.1.1.3. Sociodemographic characteristics

A questionnaire adapted from the South African Stress and Health (SASH) Study was used to gather data on household income, maternal educational background, employment status, and marital status (422). The questionnaire was administered antenatally at 28 to 32 weeks' gestation and during annual study visits. Child biological sex was established at birth.

1.1.1.4. Antenatal maternal depression

Antenatal maternal depression was assessed at 28–32 weeks' gestation using the Edinburgh Postnatal Depression Scale (EPDS), comprised of 10 items assessing recent symptoms of depression (465). Responses were scored on a 4-point Likert scale ranging from 0 (*never*) to 3 (*yes, most of the time*), where the highest score possible was 30. I used continuous scores for analyses and clinical thresholds for descriptive purposes, classified as *Above Clinical Threshold* for scores ≥ 13 and *Below Clinical Threshold* for scores <13 .

1.1.1.5. Prenatal substance use

The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) was used to measure prenatal substance use (466). Alcohol use and smoking were captured by seven items indexing: lifetime use (1 item: yes/no); frequency of alcohol/smoking use in the past 3 months (3 items: using a 5-point Likert scale where responses range from rated from 0 (“never”) to 4 (“daily”); family or friends’ concern about use (1 item) and attempts to quit (1 item), responses for both items were on a 3-point Likert scale ranging from 0 (“never”) to 2 (“yes in past 3 months”). The ASSIST was administered at 28 to 32 weeks of gestation to capture alcohol and tobacco use during the past 3 months (week 14 to week 18 of pregnancy).

Mothers were further asked about their prenatal alcohol use during postpartum assessments at 3-6 weeks and 2 years. I combined the information from these three sources to create a composite indicator of prenatal alcohol use. For the current analysis, prenatal exposure to alcohol or smoking is characterised by 'exposure' vs. 'no exposure'. 'Exposure' refers to any reported alcohol or tobacco use during pregnancy, while 'no exposure' indicates no reported alcohol or tobacco use during pregnancy.

1.1.1.6. HIV Exposure

Maternal HIV status was assessed prenatally at enrolment through self-report and by routine HIV testing for prevention of mother-to-child transmission, with retesting of those mothers who tested negative every 12 weeks during pregnancy, following local guidelines. HIV-exposed children (based on maternal HIV status) were repeatedly tested for HIV at 6 weeks, 9 months and 18 months, or following cessation of breastfeeding when it occurred past 18 months. Two HIV-positive children were excluded from the sample. For the HIV-negative children, I used a dichotomous child HIV exposure variable that captures whether a child was exposed to HIV or not (HIV unexposed vs. HIV exposed uninfected).

6.2.3. Statistical Analysis

I used descriptive statistics to describe participants' demographic characteristics as well as violence exposure and mental health outcomes. I used multivariable linear regression models to examine the relationship between lifetime violence exposure assessed at age 4.5 and mental health at 5 years, adjusting for, household income, maternal education, maternal employment status, maternal marital status, prenatal smoking exposure, prenatal alcohol exposure, maternal antenatal depression and child HIV exposure. This is because existing literature has highlighted the role that prenatal, environmental, child and maternal factors play in increasing the risk for or providing protection against mental health problems during development, with previous work having focused on HIV exposure (467), alcohol (468) and tobacco exposure (469), and maternal depression during pregnancy (469,470), and prenatal family socioeconomic indicators (469,471). There was no strong evidence for interactions with child sex in the associations between violence exposure and mental health outcomes, see sex stratified

analyses in the Appendix. All analyses were conducted in R .2.3 GUI 1.79 High Sierra build (8198) and RStudio Version 2023.03.0+386 (2023.03.0+386).

1.1.1.7. Missing data

Of the 16 (confounder, exposure and outcome) variables used in the analyses, half had some degree of missing data, resulting in 613 cases with complete data from 978 dyads (see the study flow chart presented in Figure 6.1 and Supplementary Figure 6.1).

I conducted multiple imputation via fully conditional specification to address missing data on the CECV, CBCL, ASSIST and EPDS using the "mice" R package (472). Missing values on the CECV and CBCL were imputed at subscale level. A total of 25 variables were used in the imputation model, including six auxiliary variables; four CECV subscales capturing lifetime violence exposure at 3.5 years of age and two CBCL subscales capturing internalising and internalising behaviour problems at 4 years of age. All variables with missing data were imputed. I ran 100 imputed datasets. The resulting analysis sample consisted of 978 participants. Data were only imputed for participants who remained actively engaged in the study beyond the baseline assessment (i.e. not lost to follow up/inactive). Model parameter estimates were an average of the results across the 100 imputed datasets, following Rubin's rules for Multiple imputation (473).

Table 6.1 Sociodemographics, violence exposure and mental health descriptive statistics in imputed data (N = 978)

Variable	Distribution	
		Proportion/ Mean (SD)
Child Sex	Female	49.1%
Household Monthly Income	< R1000 (52.56 USD)	35.2%
	R1000-5000	52.5%
	>R5000 (258.66 USD)	12.3%
Maternal Education	Primary	7.3%
	Some Secondary	55.4%
	Completed Secondary	31.7%
	Any Tertiary	5.6%
Employment	Currently Unemployed	73.8%
	Currently Employed	26.2%
Marital status	Single	60.4%
	Married/Cohabiting	39.6%
Prenatal Tobacco Exposure	Unexposed	70.4%
	Exposed	29.6%
Prenatal Alcohol Exposure	Unexposed	87.0%
	Exposed	13.0%
Child HIV Exposure	HIV Unexposed	78.0%
	HIV Exposed Uninfected	22.0%
Maternal Antenatal Depression	Above Clinical Threshold	23.6%
	Below Clinical Threshold	76.4%
Any Violence	Exposed	82.5%
Witnessing Community Violence	Exposed	73.8%
Community Victimisation	Exposed	13.1%
Witnessing Domestic Violence	Exposed	32.3%
Domestic Victimisation	Exposed	31.0%
Polyvictimisation	None	17.5%
	1 type	37.7%
	2 types	25.8%
	3 types	15.0%
	4 types	4.0%
Internalising Behaviour Problems	Mean (SD)	43.7 (13.0)
	Subclinical problems	5.6%
	Clinical symptoms	10.3%
	Non-clinical symptoms	84.1%
Externalising Behaviour Problems	Mean (SD)	41.3 (10.4)
	Subclinical symptoms	2.9%
	Clinical symptoms	3.6%
	Non-clinical symptoms	93.5%

6.3. Results

6.3.1. Descriptive Statistics

Table 6.1 shows sample characteristics for the 978 participants in the current study. At the antenatal visit, 88% of the children came from households whose monthly income was below or equal to R5000 (258.66 USD). Only 6% of the mothers had tertiary education, 26% were currently employed and 60% were single. Thirty percent of the children were exposed to tobacco, and 13% were exposed to alcohol prenatally, through maternal use. Approximately 22% of the children were HIV exposed but uninfected. Approximately 24% of the mothers had depressive symptoms above the clinical threshold during pregnancy. By the age of 4.5 years, 83% of the children were exposed to some form of violence. The most prevalent violence exposure type was *Witnessing Community Violence* (74%), and the least common violence type was *Community Victimisation* (13%). With regards to exposure to domestic violence, *Domestic Victimization* (31%) and *Witnessing Domestic Violence* (32%) each affected around one-third of children. Approximately 26% of the children were exposed to two forms of violence, 15% were exposed to three forms of violence and 4% were exposed to all four violence subtypes. Approximately 10% of the children had internalising behaviour problems in the clinical range and approximately 4% had externalising behaviour problems in the clinical range. A similar pattern of results was observed across imputed and observed datasets (Supplementary Table 6.1).

6.3.2. Violence Exposure and Mental Health

Table 6.2 presents unadjusted and adjusted multivariable linear regression results for the associations between violence exposure and mental health. In adjusted models, there was an association between *Overall Violence Exposure*, *Witnessing Community Violence* and *Domestic Victimization* and both internalising and externalising behaviour problems in children. By contrast, there was no evidence of associations of *Witnessing Domestic Violence* or *Community Victimization* with internalising or externalising behaviour at this age in this cohort.

Table 6.2 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in imputed data

		Internalising Behaviour Problems				Externalising Behaviour Problems			
		β	SE	95% CI	p-value	β	SE	95% CI	p-value
Overall Violence Exposure	Unadjusted	0.70	0.18	0.33, 1.06	<0.001	0.77	0.15	0.48, 1.06	<0.001
	Adjusted*	0.55	0.20	0.16, 0.94	0.005	0.53	0.15	0.23, 0.84	0.001
Witnessing Community Violence	Unadjusted	0.94	0.29	0.37, 1.51	0.001	1.04	0.24	0.57, 1.50	<0.001
	Adjusted	0.77	0.32	0.15, 1.39	0.016	0.68	0.25	0.19, 1.18	0.007
Community Victimisation	Unadjusted	1.12	1.14	-1.13, 3.35	0.326	0.96	0.90	-0.81, 2.72	0.286
	Adjusted	0.72	1.14	-1.52, 2.97	0.527	0.68	0.88	-1.06, 2.41	0.442
Witnessing Domestic Violence	Unadjusted	1.09	0.80	-0.48, 2.66	0.175	1.89	0.64	0.62, 3.16	0.004
	Adjusted	0.63	0.82	-0.97, 2.24	0.439	1.23	0.65	-0.04, 2.50	0.058
Domestic Victimization	Unadjusted	1.67	0.49	0.70 , 2.64	<0.001	1.62	0.39	0.86 , 2.38	<0.001
	Adjusted	1.28	0.51	0.28, 2.27	0.012	1.14	0.39	0.37, 1.90	0.004
Polyvictimisation	Unadjusted	1.30	0.45	0.42, 2.18	0.004	1.60	0.35	0.91, 2.28	<0.001
	Adjusted	0.87	0.47	-0.06, 1.80	0.066	1.02	0.37	0.30, 1.73	0.005

Note: All adjusted models were adjusted for sex, household monthly income, maternal education, maternal employment status, maternal marital status, prenatal smoking exposure, prenatal alcohol exposure, maternal antenatal depression and HIV exposure. $p = p$ -value. $N = 978$.

Every additional type of violence to which children were exposed was associated with a 0.87-point higher score on internalising behaviour problems, though the CI spanned the null value (95% CI = -0.06, 1.80). There was an association between polyvictimisation and externalising behaviour, where each additional type of violence experienced corresponded to a 1.02-point increase in externalising behaviour problem score.

Linear regression models based on complete case analysis with a sample of 613 participants were similar to the models based on multiple imputation (estimates were of a similar magnitude, see Supplementary Table 6.2 for unadjusted and adjusted models in observed data).

6.4. Discussion

I examined the relationship between lifetime exposure to violence assessed at 4.5 years and mental health outcomes evaluated at 5 years in a sample of South African preschoolers and found that overall violence exposure as well as specific forms of violence namely, *Witnessing Community Violence* and *Domestic Victimisation* were associated with both internalising and externalising behaviour problems after adjusting for confounding variables. Further, I found an association of polyvictimisation with externalising behaviours, with weaker evidence for an association with internalising behaviour problems. There was no evidence for the association between *Witnessing Domestic Victimisation* or *Community Victimisation* and mental health in the sample at this age.

A majority (83%) of children in the DCHS sample had a lifetime history of exposed to violence at the age of 4.5, with *Witnessing Community Violence* (74%) being the most prevalent form of exposure. Similarly, a previous study found that, witnessed traumatic events were one of the most common forms of trauma in a sample of South African adults (474). Furthermore, there was evidence of polyvictimisation in this young sample, with 45% of the children being exposed to at least two subtypes of violence by 4.5 years. Overall, the high rates of violence exposure observed in this sample are similar to those reported in studies conducted in South Africa and other LMICs with older children (313,387,475). Lower rates of *Community Victimisation* here than in other studies in South Africa (387,476) are likely due to the young age of children in the DCHS sample – at an earlier age, children are less likely to be unaccompanied in the community

and so may be more protected. These findings highlight the burden of violence among South African children from representative peri-urban communities.

The finding of an association between *Witnessing Community Violence* and both internalising and externalising behaviour problems is similar to the results reported in a previous meta-analysis (16). Associations between community violence and both internalising and externalising behaviour problems were documented across individuals aged 3 to 25 years, largely from HICs and skewed towards older age groups compared to preschoolers. Whereas it was found that the association of exposure to community violence with externalising behaviour problems was more robust than with internalising behaviour, here I found a comparable association with both outcome groups.

Similar to the finding that *Domestic Victimisation* was associated with mental health problems (both internalising and externalising behaviour problems), many studies have established childhood domestic victimisation as a risk factor for mental health problems in school-going children, adolescents and adults (112,113,454,477). However, these studies primarily included populations living in HICs. The widespread normalisation of corporal punishment as a disciplinary tool in the home in South Africa is therefore of concern (371).

Whilst evidence for the association between *Witnessing Domestic Violence* exposure and externalising behaviour problems was less robust in this cohort, prior work has found more consistent evidence for this relationship (see review: (117)). Given the established link between witnessing domestic violence and internalising symptoms (see review: (275)), the failure to find evidence of this association in the DCHS sample may reflect difficulties in recognizing or reporting such behaviours, or the emergence of such behaviours later in childhood.

The relationship between polyvictimisation and child behaviour problems at age 5 years, highlights the role that exposure to multiple types of violence plays in increasing the risk of psychopathology. These findings are suggestive of the added impact of an increased burden of violence on children's mental health, similar to the findings of a previous review (118). These authors described a strong association between polyvictimisation and various psychopathology indicators, including externalising and internalising behaviour problems in children aged 0 – 17

in their review, largely consisting of children from HIC settings. Furthermore, polyvictimisation emerged as a stronger risk factor for mental health problems than individual types of victimisation. Another review focusing on children and adolescents up to 19 years of age in LMICs, similarly found a link between polyvictimisation and an increased risk of mental health problems (119). Nevertheless, their sample largely consisted of children much older than those in the current sample. Polyvictimisation likely increases allostatic load, such that the body experiences cumulative physiological damage in response to multiple stressors over time. This results in dysfunction of various regulatory systems including behavioural functioning (478). Furthermore, a previous study conducted in the USA identified four pathways to polyvictimisation, including the presence of emotional problems in young children (< 9 years) and living in dangerous communities, high-adversity homes, and violent and conflict-ridden families in children 10 – 17 years old. Furthermore, polyvictimisation onset was associated with starting elementary and high school (479). These findings highlight the substantial burden of violence experienced by children in the DCHS sample in comparison, with polyvictimisation occurring by age 4.5 in the context of low socio-economic indicators and violent settings.

The rates of clinically significant psychopathology in the sample were lower than those found in a previous meta-analysis investigating the effects of family violence on children's behaviour (341). They found that 28% - 50% of the children aged 4 – 14 years fell within the clinical range of behaviour problems. There are several possible explanations of this inconsistency. It is plausible that the low rates of clinically significant psychopathology observed in the present study are a true finding, emphasizing that children exposed to traumas may be resilient (480). Whilst, similar to the present study, a previous metanalysis (341) used caregiver reports to assess children's mental health problems and found that 31% of the reviewed studies used state records to assess children's exposure to violence. This contrasts with the current study's sole use of caregiver reports to assess children's violence exposure. This variation in data sources potentially explains the different findings. It is also possible, however, that in the DCHS sample there are difficulties in recognizing or reporting such behavioural problems given the sample's young age (481), or that such behaviours emerge later in childhood (482). Indeed, the metanalysis' (341) reviewed sample predominantly comprised of school-going children and adolescents.

This study has a number of strengths including the use of a prospective longitudinal birth cohort sample from South Africa, with high retention rates. This allowed me to contribute to the literature in LMICs where children experience high levels of violence but are underrepresented in the literature. Furthermore, the current study examined the associations between violence exposure and mental health outcomes in early childhood, while the majority of the previous research focused on these associations later in life. This allowed me to identify the effects of exposure to violence in early childhood when it occurs. I also captured direct and indirect exposure to domestic and community violence, providing comprehensive findings. Investigating polyvictimisation allowed me to capture this prevalent phenomenon (483,484). I also adjusted for several important potential confounding factors.

However, the results of the study should be considered within the context of several limitations. The loss of participants to follow-up resulted in a smaller sample size. This reduction in statistical power may make it harder to detect a true association between violence and mental health, even if one exists. Selection bias is also a potential concern. Those lost to follow-up were more likely to come from families with higher socioeconomic status and lower smoking rates as demonstrated in Chapter 4. These characteristics might be associated with lower exposure to violence or better mental health outcomes. This could lead to an underestimation of the true association between violence exposure and mental health in the entire population. Furthermore, missing data on violence exposure or mental health for some participants can introduce bias, especially if the data is missing for reasons related to the variables being studied. However, I addressed this through multiple imputations with an adequate number of datasets and capitalised on auxiliary variables available through the repeated measures design of the DCHS. In addition, the exclusion of adolescent mothers from the study limits the generalizability of the findings. The experiences and challenges faced by adolescent mothers might differ from those in the study population, potentially leading to different associations between violence exposure and mental health for their children. Reports of children's exposure to violence and their behaviour were given by the same caregiver, typically the mother. This may have led to shared rater bias, where obtaining information on exposure and outcomes from the same reporter may inflate the associations between the variables. Caregivers may have underreported children's violence exposure and mental health problems due to social desirability bias (485). Having caregivers as

reporters is common in this age group given that young children may be unable to adequately describe their traumatic experiences nor have insight into their behaviours. However, the widespread normalisation of certain forms of violence in South Africa, such as the use harsh disciplinary practices (371), mean that social desirability bias may have impacted the reporting of some but not all types of violence measured. Although I adjusted for various potential confounders in the analyses, residual confounding cannot be excluded. Lastly, I note that given that the violence exposure subscales differ in the number of CECV items they comprise, it limits their comparability to each other in their associations with mental health outcomes in terms of magnitude of effect size estimates.

These findings emphasize the need for strategies that prioritise interventions aimed at both reducing the burden of violence on children living in these contexts as well as therapeutic interventions for those affected. This is especially important for younger children who have not yet entered school. Poor mental health may affect capacity to cope with academic demands at school (22) which in turn has been linked to poor educational trajectories and is a long-term contributor to poverty (25,27,486).

Exposure to violence in South African communities may be rooted in socioeconomic inequalities as well as a colonial past that fostered domestic and community violence (371,391,487).

Interventions targeted at the societal level are needed to tackle these systemic problems and stop the cycle of violence in these communities. Notably, the mothers of the children in this sample reported high rates of exposure to trauma in their own lives (432). Furthermore, associations between domestic victimisation and poor mental health outcomes in this young sample emphasize the need for parenting interventions to eradicate the use of harsh discipline. Future research needs to also investigate protective factors in children living in contexts such as the Drakenstein with the aim of understanding how to boost resilience.

6.5. Conclusion

I found associations between lifetime exposure to domestic victimisation, witnessing community violence, and polyvictimisation assessed at age 4.5 years and internalising and externalising behaviour problems at age 5 years in the DCHS. Study findings emphasise violence exposure as a human rights and public health issue in young children in LMICs. I also highlight the

importance of investigating protective factors that contribute to resilience in children exposed to violence.

6.6. Supplementary

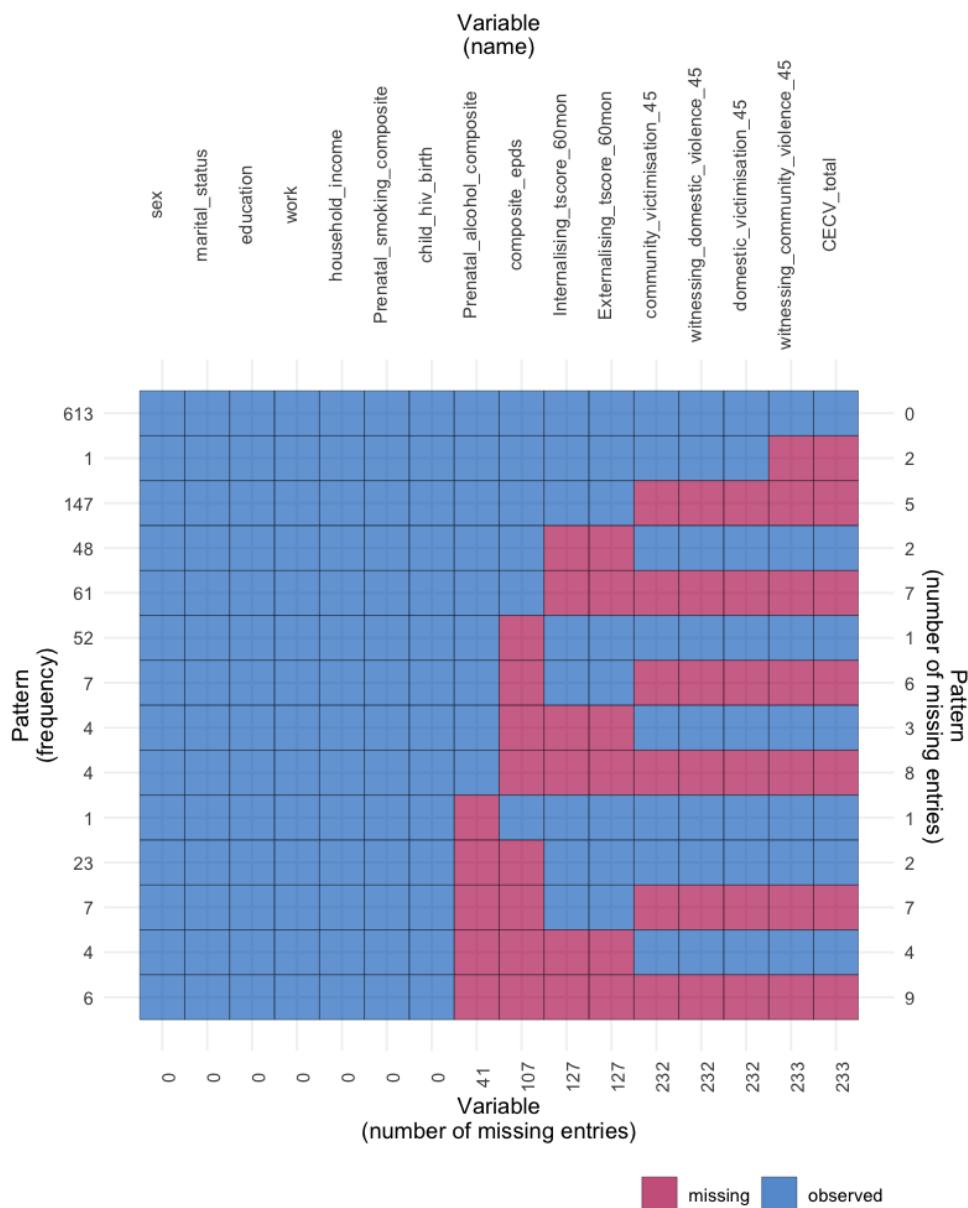
Supplementary Table 6.1 Descriptive statistics and comparison between observed and imputed samples

	Variable	n (%) data missing	Proportion	
			Observed data	Imputed data
Prenatal alcohol	No exposure	41 (4.2%)	87.1%	87.0%
	Exposure		12.9%	13.0%
Maternal Antenatal Depression	Above clinical threshold	107 (10.9%)	23.8%	23.6%
	Below clinical threshold		76.2%	76.4%
Any Violence Exposure	Unexposed	233 (23.8%)	17.6%	17.5%
	Exposed		82.4%	82.5%
Witnessing	Unexposed	233 (23.8%)	25.5%	26.2%
	Exposed		74.5%	73.8%
Community Violence Victimisation	Unexposed	232(23.7%)	87.3%	86.9%
	Exposed		12.7%	13.1%
Witnessing Domestic Violence	Unexposed	232(23.7%)	67.3%	67.7%
	Exposed		32.7%	32.3%
Domestic Victimization	Unexposed	232(23.7%)	68.6%	69.0%
	Exposed		31.4%	31.0%
Polyvictimisation	1 type	233 (23.8%)	37.9%	37.7%
	2 types		24.7%	25.8%
	3 types		15.4%	15.0%
	4 types		4.4%	4.0%
	None		17.6%	17.5%
Internalising behaviour problems	Borderline clinical	127 (13.0%)	5.6%	5.6%
	Clinical		10.3%	10.3%
	Healthy		84.0%	84.1%
Externalising behaviour problems	Borderline clinical	127 (13.0%)	2.9%	2.9%
	Clinical		3.6%	3.7%
	Healthy		93.4%	93.5%

Supplementary Table 6.2 Results of linear regression analyses examining violence exposure on internalising and externalising behaviour problems with observed data

		Internalising Behaviour Problems				Externalising Behaviour Problems			
		β	SE	95% CI	p-value	β	SE	95% CI	p-value
Overall Violence Exposure	Unadjusted	0.55	0.2	0.16, 0.94	0.005	0.69	0.16	0.38, 1.00	<0.001
	Adjusted*	0.45	0.21	0.03, 0.87	0.035	0.47	0.17	0.14, 0.79	0.005
Witnessing Community Violence	Unadjusted	0.60	0.32	-0.03, 1.24	0.061	0.78	0.26	0.27, 1.28	0.003
	Adjusted	0.51	0.35	-0.18, 1.19	0.146	0.45	0.27	-0.09, 0.98	0.101
Community Victimisation	Unadjusted	1.10	1.2	-1.25, 3.46	0.358	0.88	0.96	-1.01, 2.77	0.362
	Adjusted	0.55	1.20	-1.81, 2.92	0.647	0.44	0.95	-1.42, 2.30	0.641
Witnessing Domestic Violence	Unadjusted	1.00	0.83	-0.63, 2.62	0.228	2.02	0.66	0.72, 3.31	0.002
	Adjusted	0.66	0.85	-1.00, 2.32	0.434	1.39	0.66	0.08, 2.69	0.037
Domestic Victimization	Unadjusted	1.60	0.52	0.58, 2.61	0.002	1.70	0.41	0.89, 2.52	<0.001
	Adjusted	1.26	0.53	0.22, 2.31	0.018	1.23	0.42	0.41, 2.05	0.003
Polyvictimisation	Unadjusted	1.00	0.48	0.06, 1.95	0.038	1.50	0.38	0.74, 2.25	<0.001
	Adjusted	0.64	0.51	-0.36, 1.64	0.208	0.93	0.4	0.15, 1.71	0.019

Note: *Each model is adjusted for sex, household monthly income, maternal education, maternal employment status, maternal marital status, prenatal smoking exposure, prenatal alcohol exposure, maternal antenatal depression and HIV exposure. N = 613



Supplementary Figure 6.1 Missing data patterns

Note: sex (Child sex), marital_status (Maternal marital status), education (Maternal Highest Level of Education), work (Maternal Employment Status), household_income (Household Income), Prenatal_smoking_composite (Prenatal Smoking Exposure), Prenatal_alcohol_composite (Prenatal Alcohol Exposure), child_hiv_birth (Child HIV Exposure), composite_epds (Maternal Antenatal Depression), Internalising_tscore_60mon (Internalising behaviour problems), Externalising_tscore_60mon (Externalising behaviour problems), community_victimisation (Community Victimisation), witnessing_Domestic violence (Witnessing Domestic Violence), domestic_victimisation (Domestic Victimisation), witnessing_Community violence (Witnessing Community Violence), CECV_total (CECV Total Score)

Chapter 7. Violence Exposure and Cognitive Outcomes Among Pre-schoolers in A South African Birth Cohort

The previous chapter investigated associations between lifetime violence exposure at 4.5 years and mental health outcomes at 5 years in children using data from the DCHS. Findings revealed that that *Witnessing Community Violence*, *Domestic Victimization* and polyvictimisation were risk factors for poor mental health in the cohort. The current chapter addresses the fourth and final objective of the thesis by investigating the relationship between lifetime exposure to various forms of violence at 4.5 years and cognitive outcomes at 5 years in preschoolers, using the same cohort. I used multivariable linear regression analyses to investigate associations between lifetime exposure to violence (overall violence exposure, *Witnessing Community Violence*, *Community Victimization*, *Witnessing Domestic Violence*, *Domestic Victimization* and polyvictimisation) by 4.5 years of age and cognitive outcomes (general intelligence, executive functions, language development, memory, and motor control) at age 5.

7.1. Background

As discussed in detail in Chapter 1, early childhood is a sensitive developmental period, where for a limited time brain areas and corresponding neuropsychological systems are extremely responsive to the environment (105). Violence exposure in childhood is a stressor that can potentially influence early brain development and consequently neurocognitive functioning (488). Understanding the relationship between violence exposure and cognitive functions in early childhood can help us understand the possible effects of psychological trauma on brain development and guide early interventions.

Studies have documented the associations between childhood maltreatment and poor cognitive outcomes in the domains of general intelligence, literacy and numeracy and executive functions including attention and working memory and language ability (215,267). However, many of these studies were conducted in HICs, while children in LMICs experience a disproportionately higher burden of violence (458). Furthermore, existing studies predominantly investigated cognitive outcomes in school-aged children, adolescents and adults. Investigating outcomes in preschoolers is important given that violence exposure in early childhood can alter developmental trajectories through

impaired cognition, increasing the risk of low educational attainment (25) and poor socioeconomic outcomes in adulthood (37).

A recent systematic review similarly documented associations between childhood exposure to IPV and poor cognitive functioning (general intelligence, verbal abilities, memory, executive functioning) across all childhood developmental periods (17). However, a limited number of the studies in the review were from LMICs, and even fewer investigated these relationships in preschoolers. Moreover, there has been a tendency to focus on violence occurring in the home, with research investigating associations between community violence and cognitive outcomes in children being particularly limited. A few studies conducted in the USA with samples aged 6 to 9 years found that community violence was associated with lower reading ability, deficits in general intelligence, poor selective attention and vocabulary (216,489,490). Given that LMICs experience high crime levels (491), which increases the risk of children's exposure to community violence, further research is particularly needed into these associations in pre-schoolers living in these contexts. The systematic review in Chapter 2, investigated the relationship between violence exposure and cognitive outcomes in children living in LMICs and found similar patterns. Specifically, 17 studies were reviewed, encompassing 27 643 children from 20 LMICs. Children were exposed to maltreatment, IPV, and war. Cognitive outcomes assessed included cognitive development ($n = 9$), executive functioning ($n = 6$), general intelligence ($n = 2$), language ($n = 2$) and memory ($n = 1$). A majority (71%) of the studies found a relationship between violence exposure and poor cognitive outcomes in childhood, but none of the reviewed studies investigated community violence. Furthermore, the reviewed sample predominantly consisted of children of a school-going age (mean age = 8 years).

Finally, there is also evidence that the cumulative burden of childhood trauma has an impact on child cognitive development. One review (18) investigated the cognitive outcomes of children with "complex trauma", comprising multiple or repeated exposure to interpersonal trauma. In their meta-analyses of longitudinal studies, complex trauma was related to poor overall cognitive functioning (i.e., general intelligence, language, visuo-perceptual and spatial ability, memory, and executive functioning). However, while several of the included studies examined these association in early childhood,

none of the reviewed samples were from LMICs. Moreover, the majority of studies focused on maltreatment, with the impact of other forms of polyvictimisation (i.e., exposure to multiple violence types) being little studied. Indeed, similarly, none of the reviewed studies in the systematic review in Chapter 2 investigated polyvictimisation.

In light of the above, the current study examined associations between violence exposure and cognitive functions in early childhood. Specifically, the study investigated associations between lifetime exposure to violence by 4.5 years of age and cognitive outcomes (general intelligence, executive functions, language development, memory, and motor control) at age 5. These relationships were investigated in the DCHS, where levels of violence and other adversities are high as detailed in Chapter 4-5. I explored whether any associations are specific to subtypes of violence and/or specific cognitive functions. I also tested for a dose-response relationship between violence exposure and cognitive functioning, using an index of polyvictimisation, where I was expected to observe an association between an increase in violence exposure subtypes and lower cognitive scores. Given the research above, I hypothesized that there would be a negative association between violence exposure (especially maltreatment and domestic violence) and general intelligence, language and executive functions (especially attention and working memory).

7.2. Methods

7.2.1. Population

The current study was nested in the DCHS as detailed in Chapter 4. Here, I focussed on children's lifetime exposure to violence assessed at age 4.5 years and cognitive functions at 5 years of age.

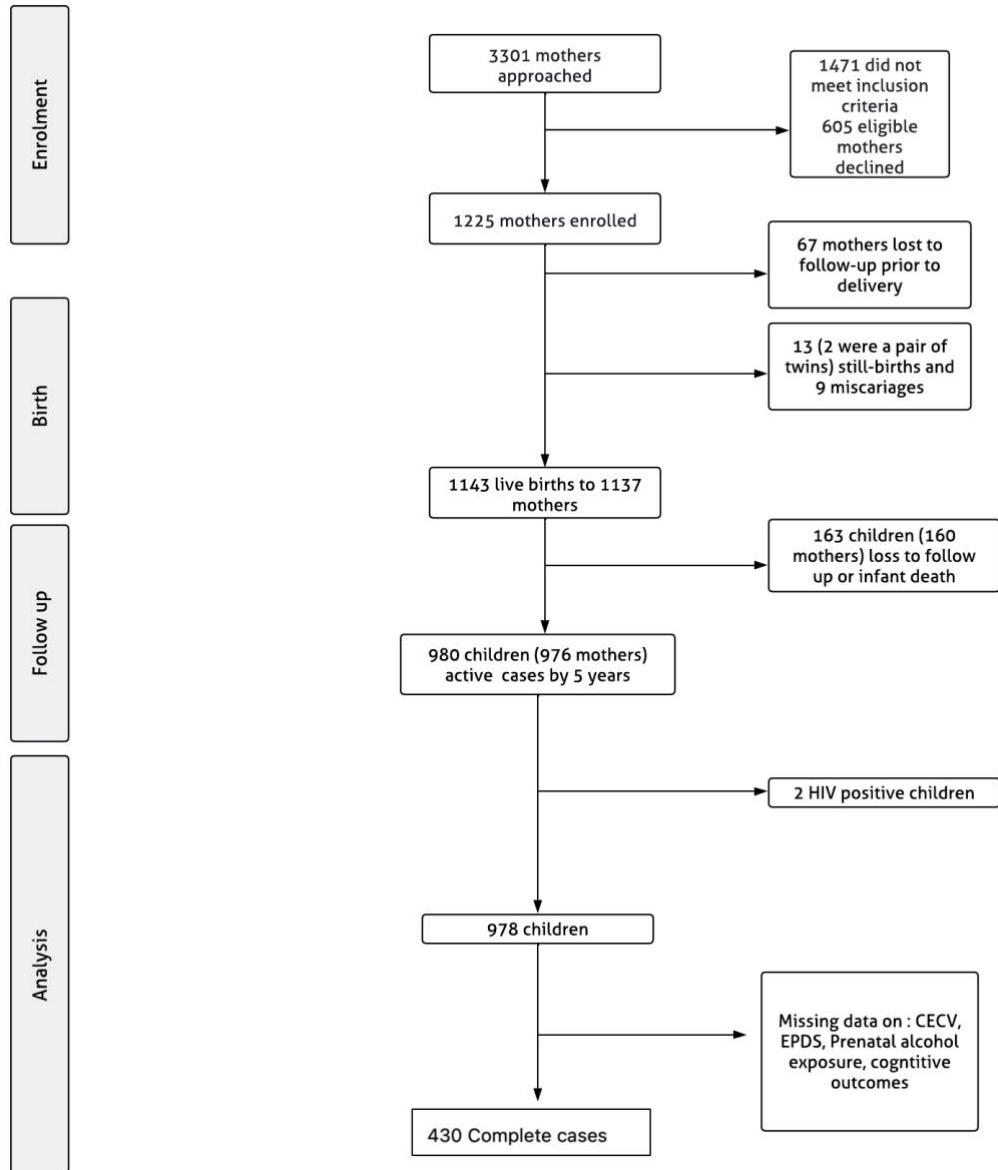


Figure 7.1 Flow chart of DCHS sample and missing data patterns

7.2.1. Measures

Full maternal and child measures from the DCHS have been detailed elsewhere (400,460) The current study encompassed the following aspects:

1.1.1.8. Violence Exposure

The CECV was used as described in Chapter 6, specifically: I used the CECV Total ($\omega = 0.91$), *Witnessing Community Violence* (10 items, $\omega = 0.77$), *Community Victimization* (8 items, $\omega = 0.90$), *Witnessing Domestic Violence* (6 items, $\omega = 0.85$) and

Domestic Victimisation (11 items, $\omega = 0.76$), and polyvictimisation variables as detailed in Chapter 6.

1.1.1.9. Cognitive Outcomes

Cognitive assessments were conducted when the children were 5 years by trained researchers at two community centres near the primary health clinics. The following were assessed:

1.1.1.9.1. Nonverbal General Intelligence

The Non-verbal index (NVI) of the Kaufman Assessment Battery for Children, second edition (KABC-II) was used as measure of general intelligence at 5 years (492). Given that the DCHS is multilingual, the NVI was a fitting global index measure of general cognitive function that reduces the impact of language on testing (493). The NVI has been used in other LMIC contexts (494,495). Although it has been argued that excluding language abilities from general intelligence assessments may overestimate abilities, this exclusion was considered necessary given that the children were preschoolers. The NVI used for this age group consisted of 5 subtests: Hand movements (which assesses working memory and motor sequencing), Triangles (assessing visual-spatial processing and problem solving), Conceptual Thinking (assessing problem solving), Face Recognition (which assesses visual-spatial processing) and Pattern reasoning (assessing nonverbal abstraction and perceptual reasoning). NVI was analysed using age-standardised scores, where a mean score of 100 and SD of 15 are typical (492).

1.1.1.9.2. Language

Receptive language was assessed using the Peabody Picture Vocabulary Test, fourth edition (PPVT-IV; (496). The PPVT-IV used in the DCHS was translated from English into Afrikaans and isiXhosa and has demonstrated good psychometric properties in other South African contexts (497,498). Research assistants read out a word and children were asked to choose the corresponding picture amongst an array of four pictures. The task is untimed, typically lasting 10 – 15 minutes. The PPVT was administered only up to item 60 as there were no available translations for the rest of the

items given the difficulty in matching those items to the South African context. As such a raw score out of 60 was used in the analyses.

Expressive language was assessed using the KABC-II Expressive Vocabulary subtest (492). Children were provided a set of pictures and asked to verbally name each object presented. The KABC-II Expressive Vocabulary has not been widely used in non-Western contexts due to concerns about cultural fairness (494). I included it in the current study given the limited availability of culturally adapted expressive language tests in the South African context and the need of assess this domain in the sample. A previous study based in Uganda managed to use the KABC-II battery including the expressive vocabulary subtest successfully in school-aged children (499). In the current study, raw scores were converted to scaled scores, where the mean score is typically 10 with an SD of 3.

1.1.1.9.3. Learning and Memory

The KABC-II Atlantis 1 and Atlantis 2 subtests were used to assess learning and recall, respectively. A psychometric evaluation of the Atlantis subtests found them appropriate for use in a sample of rural South African primary school children (500). In Atlantis 1, children were presented with a series of pictures paired with nonsense words. They were then presented with a word and asked to point at the corresponding picture. An overall score was determined based on how many items were correct. Atlantis 2, repeated the task after a 15 – 20-minute delay. Both raw scores from the tasks were converted to scaled scores for the analyses as above.

1.1.1.9.4. Executive functions

Selective Attention. The Balloon Hunt subtest from the Test of Everyday Attention for Children 2nd edition (TEA-Ch-II) was used to assess children's selective attention abilities. Children were provided with target pictures and asked to cross as many as they could in an array, there were two trials with distractors, and two without. Children are initially administered a practice trial prior to the four test trials. Typically the practice trial is half a stimulus page, however, for the study purposes, a full page was used instead, to allow children in the sample a comprehensive practice. Due to this

modification, a raw score was used in the analyses which reflects the amount of correct items identified in the allocated time (15 seconds per trial) across all four test trials.

Working memory. The Picture Memory subtest from the Wechsler Preschool and Primary Scale of Intelligence, fourth edition (WPPSI-IV) was used to assess visual working memory (501). The Picture Memory task has demonstrated good test-retest reliability and excellent internal consistency (502). Other South African studies have successfully used earlier editions of the WPPSI to assess children's cognitive abilities (503,504). Children were presented with picture items of increasing length and asked to select these from an array of distractors. Raw scores are converted to scaled scores, where the mean score is typically 10 with an SD of 3, similar to the KABC-II tests.

Inhibition. A Stroop-like Day-Night task was used to assess children's cognitive inhibition (505). The test assesses the ability of children to suppress their instinct to respond with the appropriate name of a picture by providing the opposite response. Previous studies have demonstrated that the Day-Night task has good psychometric properties (506–508). In the original task, children are presented with pictures depicting a sun and requested to say "day" then a moon and requested to say "night". After this response is learned over repeated trials, they are then asked to learn the reverse, by responding with "day" for moon and "night" for sun instead. An initial administration of this task with children in the DCHS revealed that they were unfamiliar with the two concepts (day vs night) and as such would have had to be taught the concepts first. Consequently, a decision was made to use different pictures with concepts they were familiar with i.e. dog and banana. Congruent and incongruent scores were obtained out of 10 based on the 10 trials administered for each component. A raw score for the incongruent component was used for the analyses, capturing the total number of correct trials during the inhibition trials.

Cognitive flexibility. The Dimensional Change Card Sort (DCSS) was used to assess cognitive flexibility (509,510). The DCSS resembles the Wisconsin Card Sorting Test (WCST: (511)). Children were tasked with sorting a series of cards that featured two salient features or dimensions (e.g., colour and shape). Initially, they were instructed to sort the cards based on one dimension and subsequently asked to sort them based on the other dimension. The DCCS was used due to its suitability for a broad age range and its

strong convergent validity and test-retest reliability, as demonstrated in previous research (512,513). Children were administered six trials for each dimensional sorting category (12 in total). A total score out of six trials for the second dimensional sorting (capturing capacity for cognitive flexibility) was used in the analyses.

1.1.1.9.5. Motor control

The Grooved Pegboard (514) was used to assess children's motor control abilities, specifically manipulative dexterity in both dominant and non-dominant hands. In this task, children were presented with a board with 10 grooved holes in 2 rows. They were required to insert as well as retrieve the 10 pegs into these holes as fast as they could. Reliable test-retest performance for both hands and notable concurrent validity have been reported for the Grooved Pegboard test within a 3-9 year old sample (515). It has also been used in research involving a South African sample (516). Total peg insertion times for each hand were used as indicators of motor control in the analyses, where higher times indicate poorer abilities.

1.1.1.10. Confounders

I considered the following potential confounders as detailed in Chapter 6: Prenatal HIV exposure (467), prenatal alcohol exposure (517), maternal antenatal depression (518), prenatal tobacco exposure (519), prenatal household socioeconomic indicators (517,520) and child sex (521), parental cognitive functioning (522), maternal education and household income.

Sociodemographic data were captured antenatally at 28 to 32 weeks' gestation using a questionnaire adapted from the South African Stress and Health (SASH) Study (422). Child biological sex was determined at birth. The Edinburgh Postnatal Depression Scale (EPDS) was used to assess maternal antenatal depression at 28–32 weeks' gestation (465). The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST; (466)) was used to measure prenatal substance use at 28 to 32 weeks of gestation to capture alcohol and tobacco use during the past 3 months (week 14 to week 18 of pregnancy). Maternal HIV status was assessed during the prenatal phase at enrolment, using both self-report and standard HIV testing for the prevention of mother-to-child transmission. Mothers who initially tested negative underwent retesting every 12 weeks throughout their pregnancy, in alignment with local guidelines. Children who were

HIV-exposed (determined by maternal HIV status) underwent multiple rounds of HIV testing at 6 weeks, 9 months, and 18 months following birth.

7.2.2. Statistical Analysis

Descriptive statistics described participants' demographic traits, violence exposure, and cognitive outcomes. Multivariable linear regression analyses were used to investigate the association between lifetime violence exposure by 4.5 years and cognitive outcomes at 5 years. All models were adjusted for confounders. There was no strong evidence for interactions with child sex in the associations between violence exposure and cognitive outcomes. See sex stratified analyses in the Appendix. All analyses were conducted in RStudio Version 2023.03.0+386.

1.1.1.11. Missing Data

Of 978 mother– child dyads eligible for inclusion in this study (defined as those for whom all contact was not lost), 430 had complete data on all exposures, outcomes and confounders. I therefore used multiple imputation via fully conditional specification to address potential selection bias due to missing data using the “mice” R package (472). In addition to all variables in the substantive model, I included data on the four CECV subscales capturing lifetime violence exposure by 3.5 years of age and seven measures of cognition at 3.5 years of age (NVI, receptive language, expressive language, learning, memory, inhibition, working memory) in the imputation model. 100 imputed datasets were created. Figure 1 presents the study flow chart and Supplementary Table 1 provides the amount of missing data for each variable. Missing values on the violence exposure variables were imputed at subscale level.

I created a continuous CECV total variable by summing the imputed subscales and a continuous polyvictimisation variable by adding the binarised CECV subscales following imputation. Model parameter estimates were derived by averaging results across the 100 imputed datasets using Rubin’s rules (473).

7.3. Results

7.3.1. Descriptives

1.1.1.12. Maternal and child demographic characteristics

Characteristics of participants are presented in Table 7.1. Variable distributions in the observed and imputed datasets were similar (see Supplementary Table 2 for descriptive statistics in observed data).

Boys and girls were evenly distributed in the sample. Only about 12.3% of the families had a monthly household income over R5000 (264.39 USD), the majority of the households (52.5%) earned between R1000-5000 (52.88 USD - 264.39 USD) per month and over a third earned under R1000 (52.88 USD) per month. Regarding education, 7.3% of the mothers had only primary education, 55.4% some secondary school education, 31.7% completed secondary school, and 5.6% had tertiary education. A majority (73.8%) of the mothers were unemployed. Mothers were mostly single (60.4%). Antenatal tobacco use was reported by 29.6% of the mothers and alcohol use by 12.9%. Approximately 22.0% of the children were HIV Exposed Uninfected. Approximately 23.8% of the mothers had antenatal depression symptoms above the clinical threshold.

1.1.1.13. Violence exposure

Eighty-three percent of the children were exposed to some kind of violence by age 4.5, whilst 75% had experienced *Witnessing Community Violence* and 13% had experienced *Community Victimisation*. Thirty-three percent were exposed to *Witnessing Domestic Violence* and 31% experienced *Domestic Victimization*. Forty-five percent of the children experienced polyvictimisation, with 26% experiencing at least two types of violence, whilst 15% had experienced three types of violence and 4% had experienced all four types of violence by age 4.5.

Table 7.1 Sociodemographics and violence exposure descriptive statistics in imputed data, N = 978

Variable		Proportion
Child Sex	Female	49.1%
Household Monthly Income	< R1000 (52.56 USD)	35.2%
	R1000-5000	52.5%
	>R5000 (258.66 USD)	12.3%
Education	Primary	7.3%
	Some Secondary	55.4%
	Completed Secondary	31.7%
	Any Tertiary	5.6%
Employment	Currently Unemployed	73.8%
Marital status	Married/Cohabiting	39.6%
Prenatal Tobacco Exposure	Exposed	29.6%
Prenatal Alcohol Exposure	Exposed	12.9%
Child HIV Exposure	HIV Exposed	22.0%
	Uninfected	
Maternal Antenatal Depression, median [IQR]	9.0 (6.0 - 12.0)	
	Above Clinical Threshold	23.8%
CECV Total, median [IQR]	2.0 [1.0 - 4.0]	
Any Violence	Exposed	83.0%
Witnessing Community Violence, median [IQR]	1.0 [0 - 2.0]	
	Exposed	74.5%
Community Victimisation, median [IQR]	0 [0 - 0]	
	Exposed	12.9%
Witnessing Domestic Violence, median [IQR]	0 [0 - 1.0]	
	Exposed	32.8%
Domestic Victimisation, median [IQR]	0 [0 - 1.0]	
	Exposed	31.4%
Polyvictimisation	None	17.0%
	1 type	37.8%
	2 types	25.9%
	3 types	15.4%
	4 types	4.0%

1.1.1.14. Cognitive tests scores

Table 7.2 Descriptive statistics of cognitive scores in imputed data

	Mean (SD)	Minimum	Maximum
Nonverbal intelligence (standard scores)	76.2 (12.6)	48	115
Expressive language (scaled scores)	6 (1.3)	1	11
Learning (scaled scores)	7.3 (2.8)	2	15
Memory (scaled scores)	9.8 (1.9)	3	16
Working Memory (scaled scores)	7.6 (2.2)	1	16
	Median [IQR]		
Receptive language (raw scores)	41 [36.3 - 45]	9	58
Inhibition Stroop (no. of trials)	9 [5.6 - 10]	0	10
Selective Attention (no. of targets)	30 [25.1 - 36.1]	9	68
Dominant Motor (time in mins)	1.4 [1.1 - 2.2]	0.3	5
Nondominant Motor (time in mins)	1.6 [1.2 - 2.8]	0.2	5
Cognitive Flexibility (no. of trials)	0 [0 - 5]	0	6

Table 7.2 presents descriptive statistics for the cognitive test scores, based on imputed data. KABC-II nonverbal intelligence had a mean standard score of 76.2 with a standard deviation (SD) of 12.6, and scores ranged from 48 to 115. KABC-II Expressive Language scaled scores had a mean of 6 (SD = 1.3), with a range of 1 - 11. KABC-II Atlantis 1 (learning) scaled scores had a mean of 7.3 (SD = 2.8), and a range of 2 - 15, while KABC-II Atlantis 2 (memory) scaled scores had a mean of 9.8 (SD = 1.9) and ranged from 3 - 16. WPPSI-IV Picture Memory (working memory) scaled scores had a mean of 7.6 (SD = 2.2) and ranged from 1 to 16. On the PPVT (receptive language), the sample had a median raw score of 41 with an interquartile range (IQR) of 36.3 to 45, and scores ranged from 9 to 58. On the Inhibition Stroop task the sample had a median of 9 trials correct (IQR = 5.6 to 10), out of a possible 10 trials. Children identified a median of 30 targets on the Balloon Hunt test for selective attention (IQR = 25.1 to 36.1), with total targets identified ranging from 9 to 68. On the Grooved Pegboard task, the median insertion time using the dominant hand was 1.4 minutes (IQR = 1.1 to 2.2), and in the nondominant hand -1.6 minutes (IQR = 1.2 to 2.8), both with times ranging from less than a minute to 5 minutes. Cognitive Flexibility was assessed by the number of correct trials, with a median of 0 correct trials and an IQR of 0 to 5, out of a possible 6 trials.

1.1.1.15. Association between violence exposure and cognitive outcomes

Figures 7.2 – 7.4 show the adjusted multivariable linear regression models for the associations between violence exposure variables and cognitive outcomes (see Supplementary Figures 7.1 – 7.3 for unadjusted associations). Results are similar to those observed in the observed data, see Supplementary figures 7.4 – 7.9.

7.3.2. Community violence

Figure 7.2 presents forest plot estimates of associations between community violence and measures of cognitive function: *Witnessing Community Violence* was associated with lower selective attention. There was evidence for an association with greater expressive language ability, although the effect size was small. There was no evidence of associations with other cognitive functions.

There was no evidence of associations between *Community Victimisation* and any of the cognitive outcomes.

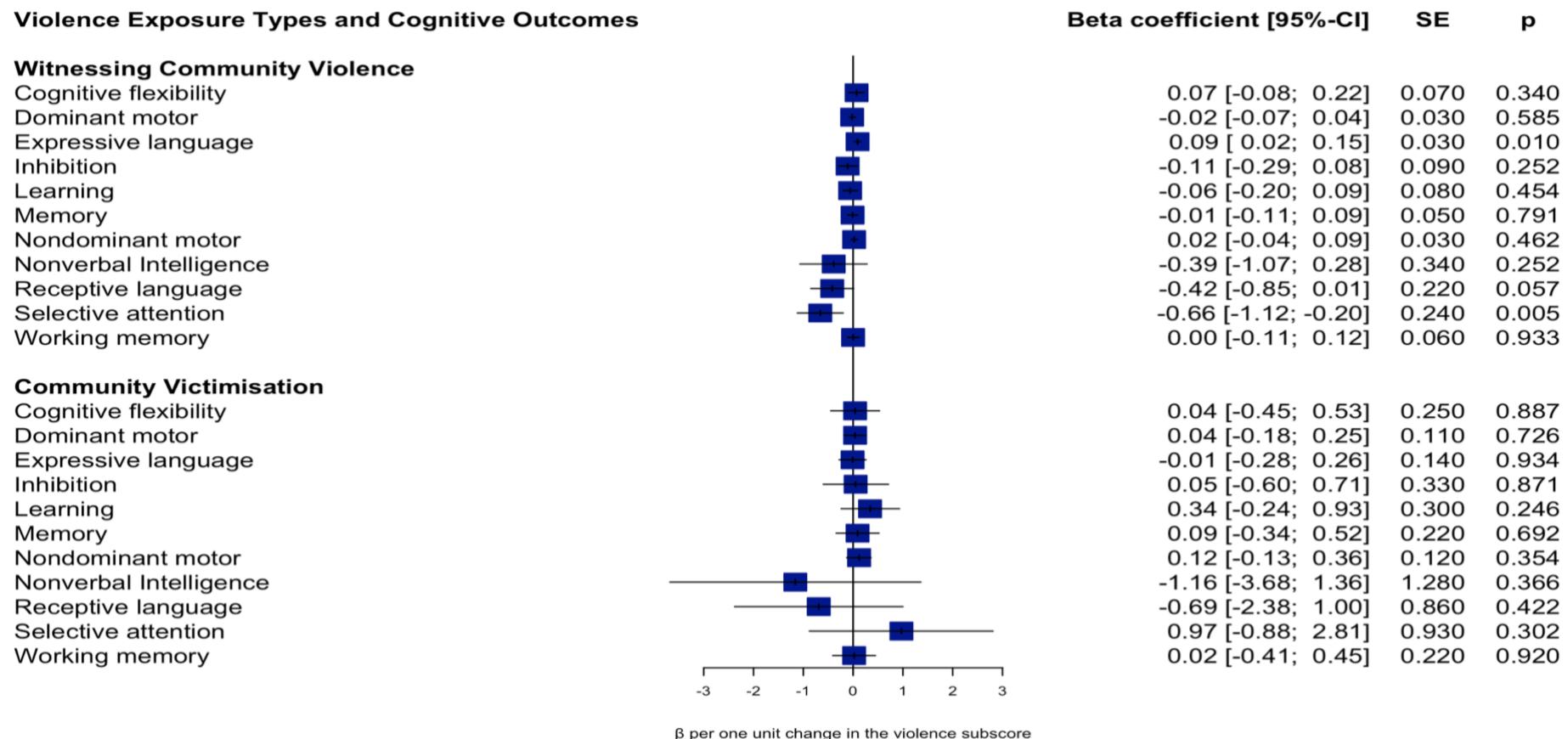


Figure 7.2 Forest plot estimates of associations between community violence and cognitive functions in imputed data ($N = 978$).

Notes: Models adjusted for child sex, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

7.3.3. Domestic violence

Figure 3 presents forest plot estimates of associations between domestic violence and measures of cognitive function: *Witnessing Domestic Violence* was associated with lower nonverbal intelligence, selective attention and receptive language ability. There was no evidence for associations with other cognitive outcomes.

Domestic Victimisation was associated with greater expressive language and cognitive flexibility although estimates were small. There was no evidence for associations with other cognitive functions.

Violence Exposure Types and Cognitive Outcomes

Beta coefficient [95%-CI] SE p

Witnessing Domestic Violence

Cognitive flexibility	0.02 [-0.33; 0.37]	0.180	0.917
Dominant motor	0.13 [-0.01; 0.28]	0.070	0.072
Expressive language	0.12 [-0.06; 0.29]	0.090	0.202
Inhibition	-0.46 [-0.94; 0.01]	0.240	0.054
Learning	0.01 [-0.36; 0.38]	0.190	0.958
Memory	-0.12 [-0.39; 0.14]	0.130	0.352
Nondominant motor	0.08 [-0.10; 0.26]	0.090	0.391
Nonverbal Intelligence	-2.34 [-3.99; -0.69]	0.840	0.006
Receptive language	-1.10 [-2.18; -0.02]	0.550	0.046
Selective attention	-1.53 [-2.71; -0.34]	0.600	0.012
Working memory	-0.10 [-0.39; 0.18]	0.140	0.465

Domestic Victimization

Cognitive flexibility	0.23 [0.00; 0.46]	0.110	0.045
Dominant motor	0.02 [-0.08; 0.11]	0.050	0.733
Expressive language	0.13 [0.02; 0.25]	0.060	0.022
Inhibition	-0.07 [-0.35; 0.22]	0.140	0.631
Learning	0.01 [-0.23; 0.25]	0.120	0.945
Memory	-0.03 [-0.20; 0.14]	0.090	0.729
Nondominant motor	0.05 [-0.06; 0.16]	0.060	0.341
Nonverbal Intelligence	-0.37 [-1.50; 0.76]	0.570	0.515
Receptive language	-0.33 [-1.03; 0.36]	0.350	0.345
Selective attention	-0.66 [-1.43; 0.11]	0.390	0.092
Working memory	0.03 [-0.16; 0.22]	0.100	0.733

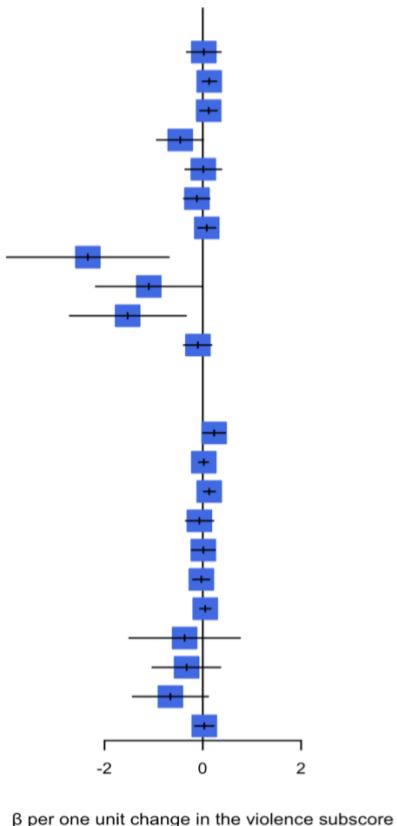


Figure 7.3 Forest plot estimates of associations between domestic violence and cognitive functions in imputed data ($N = 978$) .

Note: models adjusted for child sex, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. $p = p$ -value

7.3.4. Overall violence exposure and polyvictimisation

Figure 4 presents forest plot estimates of overall violence exposure, polyvictimisation and measures of cognitive function. Overall violence exposure was associated with lower selective attention and receptive language. There was also evidence for an association with greater expressive language. There was no evidence for associations with other cognitive functions.

Similarly, there was evidence for associations between polyvictimisation and lower nonverbal intelligence, selective attention and receptive language with weaker evidence of an association with poor inhibition. There was no evidence for associations with other measures of cognitive function.

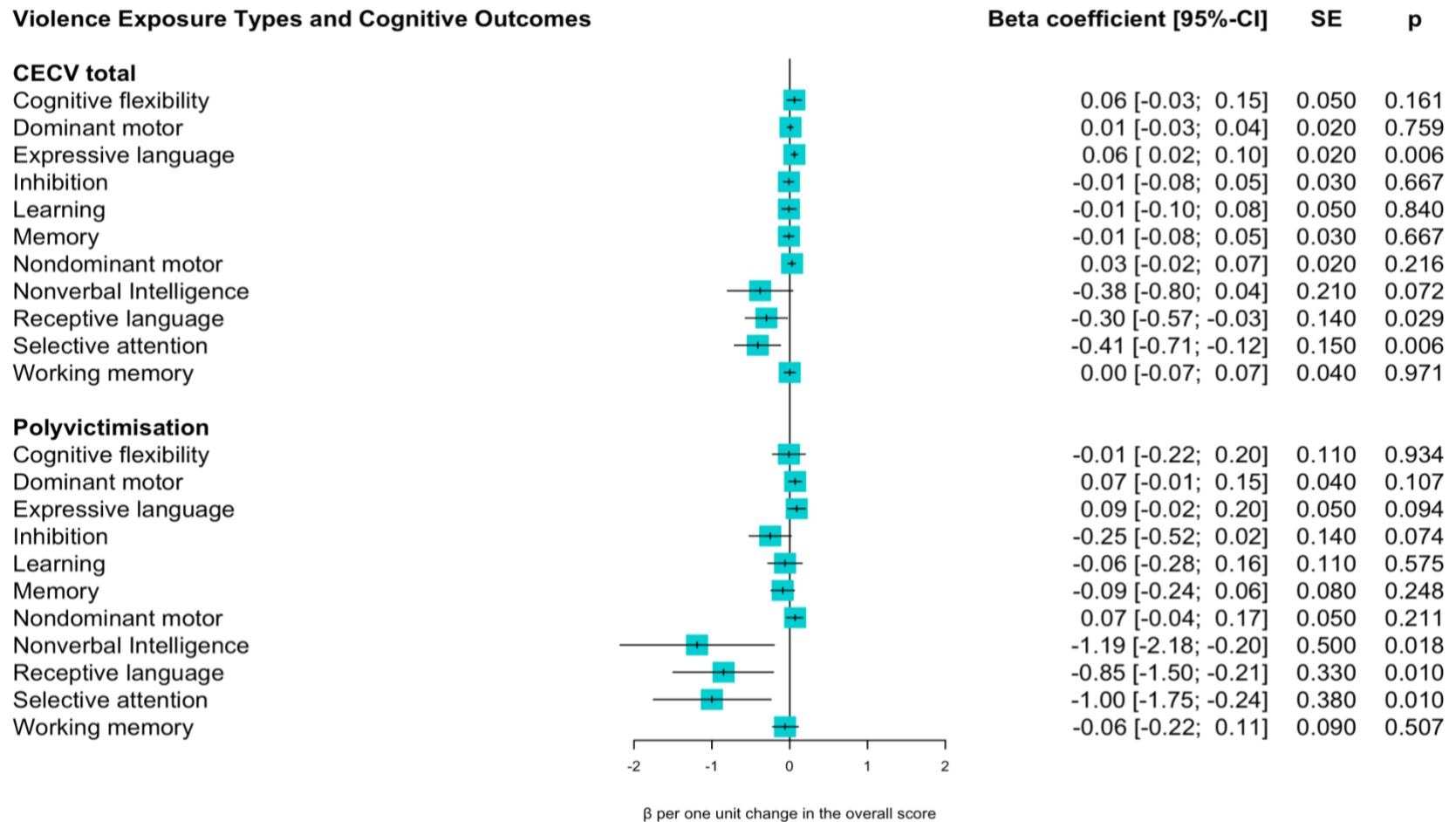


Figure 7.4 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in imputed data ($N = 978$).

Note: Models adjusted for child sex, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. CECV total = CECV Total Score; p = p-value

7.4. Discussion

7.4.1. Summary of findings

This study aimed to investigate relationships between lifetime violence exposure by 4.5 years and cognitive outcomes at 5 years in preschool children in a South African birth cohort. In the context of *Witnessing Community Violence*, the current study found associations with lower selective attention. The literature investigating associations between community violence and cognitive outcomes is limited, however, a previous study with a US sample (mean age = 9.89) similarly found that exposure to community violence was associated with poor selective attention (490). Interestingly, there was no association between *Witnessing Community Violence* and nonverbal intelligence, which is surprising given its implication in intellectual function impairment in US adolescents (216). This finding may be explained by methodological differences between the DCHS and the sample used in the previous study. However, given that research in this area is scarce, further research is needed to investigate patterns of associations preferably across different contexts. Findings in the current study did not reveal associations between *Community Victimisation* and any cognitive outcomes. Interestingly, the previous study with a sample of US adolescents, used a measure of community violence that comprised both witnessed and directed community violence (216). It is thus possible that in the current study, *Community Victimisation* reflected a less severe form of exposure, and thus there were no associations observed with cognitive outcomes.

Witnessing Domestic Violence was associated with lower nonverbal intelligence, selective attention and receptive language ability in the cohort. These findings are in line with research showing the impact of IPV on general intelligence and executive functions including inhibitory control in children as documented in a recent review (17). However, the current study extends this understanding to younger populations in LMICs, suggesting the profound impact of *Witnessing Domestic Violence* in early childhood. With regards to receptive language ability, the review found that associations with receptive language ability were inconsistent across studies, with some reporting negative associations and others reporting no associations. These conflicting findings support the need for further investigation of this question, including consideration contextual factors that influence these relationships present if different environments.

Surprisingly, *Domestic Victimisation* was not associated with poor selective attention, receptive language or nonverbal intelligence in the cohort at this age. Previous research has documented inverse associations between maltreatment and cognitive impairment in domains including general intelligence, language and executive functioning in populations of various ages, although predominantly in HICs (215,267). The lack of consistency in these findings may be attributable to differences between the current sample characteristics and other populations, both age and environment. For example, the children in the DCHS were preschoolers, when a majority of studies have investigated these patterns in older children. It is thus possible that the age at which children are assessed can influence the detection of cognitive impairments due to *Domestic Victimization*, with certain effects possibly emerging at different developmental stages. However future research is needed to investigate these patterns.

Overall violence exposure was associated with lower selective attention and receptive language. Polyvictimisation was associated and lower nonverbal intelligence, selective attention and receptive language. A recent metanalysis of cognitive outcomes in children with complex trauma which comprised both polyvictimisation and repeated exposure to violence, found that children with complex trauma had lower intelligence, language and executive functioning scores than unexposed children (18). Whilst these findings are similar to those of the current study, they differ in that, complex trauma does not solely capture polyvictimisation. Furthermore, all of the reviewed samples were from HICs. The current study findings therefore suggest the added impact that an increased burden of violence has on these cognitive domains in this LMIC sample.

Finding that expressive language ability increased with overall violence exposure, *Witnessing Community Violence* and *Domestic Victimization*, was surprising given that the inverse association between childhood violence exposure and expressive language has been well-documented (17,215,489). It has been argued that the expressive language subtest from the KABC-II relies heavily on crystallised knowledge that is dependent on culture-specific environmental experiences as such previous studies conducted in LMICs have opted to exclude this subtest due to problems with cultural suitability (494). While this is a limitation, further investigations reviewed that associations between expressive language and other variables in the sample (child age, sex, household income, maternal education, maternal employment status, maternal depression) were in accordance with expected patterns based on previous literature.

This therefore suggests that the association between violence exposure and expressive language is perhaps plausible in this sample. Given that most of the research in this area comes from HICs, disparities in their findings and the current study's maybe contextual. For example, it is possible that children in the current sample's expressive language functions matured faster than expected in reaction to the amount of violence they experienced in their surroundings, especially *Witnessing Community Violence* and *Domestic Victimization* as a means of coping. Of course, these findings are also noteworthy considering that an opposite pattern of associations was found with receptive language ability. While receptive language ability, being closely tied to cognitive processes, might be more directly impacted by the cognitive disruptions associated with violence exposure, expressive language development is influenced more by social and environmental interactions and could thus show a different pattern. A similar unexpected pattern of association was found between *Domestic Victimization* and cognitive flexibility. Previous studies found that childhood exposure to maltreatment was associated with poor cognitive flexibility (267). The discrepancy with the current study findings likewise possibly indicates some adaptive development in reaction to a harsh environment in the DCHS sample. Indeed, an emerging body of literature has proposed a viewpoint that links early adversity (such as violence exposure in early childhood) and accelerated development, highlighting that this acceleration is not necessarily progressive but is rather an adaptive process in response to stress (523). For example, early trauma has been associated with earlier age of menarche, accelerated epigenetic aging (524) and brain development (525). However, the magnitude of the effect sizes in these associations were small, similar to the current study findings. It is also not yet clear why this phenomenon has been observed in some children and not others and there is no consensus regarding the specific forms of adversity involved.

Previous studies have also found that this accelerated development is associated with poor health outcomes in adulthood, including increased morbidity and mortality (526,527). It has been suggested that the role of this accelerated development in childhood in relation to adversity is a trade-off, where compromised health and a shorter lifespan are necessary sacrifices for increased chances of reproduction (528). Regarding the results of the present study, there is a possibility that enhanced expressive language abilities at this age, in the context of violence exposure may present improved ability to express oneself, an important function for survival. While increased

cognitive flexibility affords the capacity to switch between tasks and rules as well as problem solve, a necessary skill for survival in the context of domestic victimisation. However, given the novelty of this area of research, more investigations are needed to understand these phenomena. It is also possible that there are other mechanisms and processes yet to be identified that influence the relationship between violence exposure and these abilities which emphasizes the need for context-specific research.

The evidence for lower dominant fine motor function in association with *Witnessing Domestic Violence* was not robust. In contrast, emerging research predominantly from HICs has found links between maternal IPV and children's poor motor functioning (17). Similar patterns were observed from LMICs in the systematic review in Chapter 2. Unexpectedly, there was no evidence for an association between violence exposure and learning, memory or visual working memory when negative associations between violence exposure and these cognitive outcomes have been previously well-documented (215,267). There are various possible explanations for this: The DCHS children may differ in characteristics, such as age range or cultural context compared to children in other populations. It is also possible that the tools used to assess learning, memory, or visual working memory were not adequately sensitive to the subtleties of impairment that can result from violence exposure, or that these cognitive domains are more resilient to the impacts of violence in this particular age group or population. Additionally, the cognitive tasks may not have reflected the real-world complexities and nuances of the DCHS children's experiences and abilities, or there could be developmental timing issues, with the effects of violence exposure on these cognitive domains manifesting at a different stage in child development. Indeed, previous research in this field was predominantly conducted in HICs with older children.

In reviewing the findings of the current study, it appears that the most clinically significant relationships are those between violence exposure and lower performance in selective attention, receptive language abilities, and nonverbal intelligence. On the other hand, the observed association of violence exposure with greater expressive language and cognitive flexibility have relatively small effect sizes in comparison. Additionally, the relationship with cognitive flexibility was only observed for one type of violence exposure, suggesting that these findings

may not have clinically relevance. The potential associations between violence exposure and decreased inhibition also appear to be less relevant in this cohort measured at this age.

7.4.2. Strengths and limitations

This study has a number of methodological strengths, including the use of a prospective birth cohort from a community-based sample in an LMIC. By using four subscales to capture violence exposure, it was able to investigate the relationships between different types of violence and cognitive outcomes. This was very valuable in filling in a gap in this area of research where studies investigating the relationship between different types of violence and cognition are scarce, especially those investigating community violence. These associations were investigated in early childhood, providing insight into these patterns during this sensitive period of development when exposure occurs, where previous studies have focussed on older children limiting generalisability to pre-schoolers. Furthermore, the inclusion of polyvictimisation, allowed the investigation of this widely neglected but prevalent phenomenon in relation to cognition, in children living in a context where they face a high burden of violence. A variety of cognitive outcomes were assessed, spanning multiple domains including, intelligence, language and executive functions allowing the investigation of the associations between violence exposure and various cognitive domains.

There are several limitations to consider. Due to the age group of children in the sample, violence exposure was based on caregiver report, which poses risks of under reporting due to social desirability bias (350). Despite this, study findings highlight high violence prevalence in the sample. There was attrition in the study and additionally cognitive data collection was impacted by the COVID-19 pandemic. Nevertheless, using robust multiple imputation methods for missing data, findings among observed and imputed data were similar. The loss of participants to follow-up resulted in a smaller sample size. This reduction in statistical power makes it harder to detect a true association between violence and cognition, even if one exists. Secondly, selection bias is a potential concern. Those lost to follow-up were more likely to come from families with higher socioeconomic status and lower smoking rates as discussed in Chapter 4. These characteristics might be associated with lower exposure to violence or better cognitive development. This could lead to an underestimation of the true association between violence

exposure and cognitive outcomes in the entire population. Missing data on violence exposure or cognitive outcomes for some participants can introduce bias, especially if the data is missing for reasons related to the variables being studied. For example, if children with the most severe outcomes (violence exposure and poor cognitive performance) are more likely to have missing data, the study might underestimate the true association between these variables. The exclusion of adolescent mothers from the study limits the generalizability of the findings. The experiences and challenges faced by adolescent mothers might differ from those in the study population, potentially leading to different associations between violence exposure and cognition for their children. Some cognitive measures have not been validated in South African samples and present cultural validity issues (e.g. KABC-II Expressive Vocabulary). Future psychometric research is needed to ensure reliable and valid cognitive measurement within the South African context. Despite confounding adjustment, residual confounding is still a possibility. For example, there was no confounder adjustment for genetic factors due to unavailability of data/ study constraints when previous research has highlighted the role of genetic factors in the relationship between violence exposure and cognition (529). It is important for future research to consider these factors in their study designs. The role of mediators in the associations between violence exposure and cognition were not explored as they were beyond the scope of the study. Future examination of moderators and/or mediators will enhance our understanding of the mechanisms of these relationships.

7.4.3. Implications and Conclusions

This study provides an important contribution to the evidence highlighting the associations between childhood violence exposure and preschoolers' cognitive functions, specifically, selective attention, nonverbal general intelligence and receptive vocabulary in LMICs. Attention is a gateway function important for learning, as such, impairment in this system has a negative impact on academic performance (88). Receptive language is important for children's adjustment in school and later life and poor receptive language ability in childhood has been associated with literacy problems and in turn poor socioeconomic prospects in adulthood (530). General intelligence is an aggregate of one's neuropsychological abilities and a noteworthy predictor of various psychosocial, socioeconomic and health outcomes in along the life span (213). As such, finding that violence exposure in early childhood may impact these aspects of cognition in this

sample is a cause for concern regarding their future wellbeing, and suggests the need for interventions to tackle this human rights and public health issue.

7.5. Supplementary

Supplementary Table 7.1 Sociodemographic and violence exposure in observed data

Variable		Proportion	N missing (%)
Child Sex	Female	49.1%	-
Household Monthly Income	< R1000 (52.56 USD)	35.2%	-
	R1000-5000	52.5%	
	>R5000 (258.66 USD)	12.4%	
Education	Primary	7.3%	-
	Some Secondary	55.4%	
	Completed Secondary	31.7%	
	Any Tertiary	5.6%	
Employment	Currently Unemployed	73.8%	-
Marital status	Married/Cohabiting	39.6%	-
Prenatal Tobacco Exposure	Exposed	29.6%	-
Prenatal Alcohol Exposure	Exposed	12.9%	41 (4.2%)
Child HIV Exposure	HIV Exposed Uninfected	22.0%	-
Maternal Antenatal Depression, median [IQR]	9.0 [6.0 - 12.0]		-
	Above Clinical Threshold	23.8%	
CECV Total, median [IQR]	2.0 [1.0 - 4.0]		-
Any Violence	Exposed	82.4%	
Witnessing Community Violence, median [IQR]	1.0 [0 - 2.0]		233 (23.8%)
Community Victimisation, median [IQR]	Exposed	74.5%	
	0 [0 - 0]		232 (23.7%)
Witnessing Domestic Violence, median [IQR]	Exposed	12.7%	
	0 [0 - 1.0]		232 (23.7%)
Domestic Victimisation, median [IQR]	Exposed	32.7%	
	0 [0 - 1.0]		232 (23.7%)
Polyvictimisation	Exposed	31.4%	
	None	17.0%	-
	1 type	37.8%	
	2 types	25.9%	
	3 types	15.4%	
	4 types	4.0%	

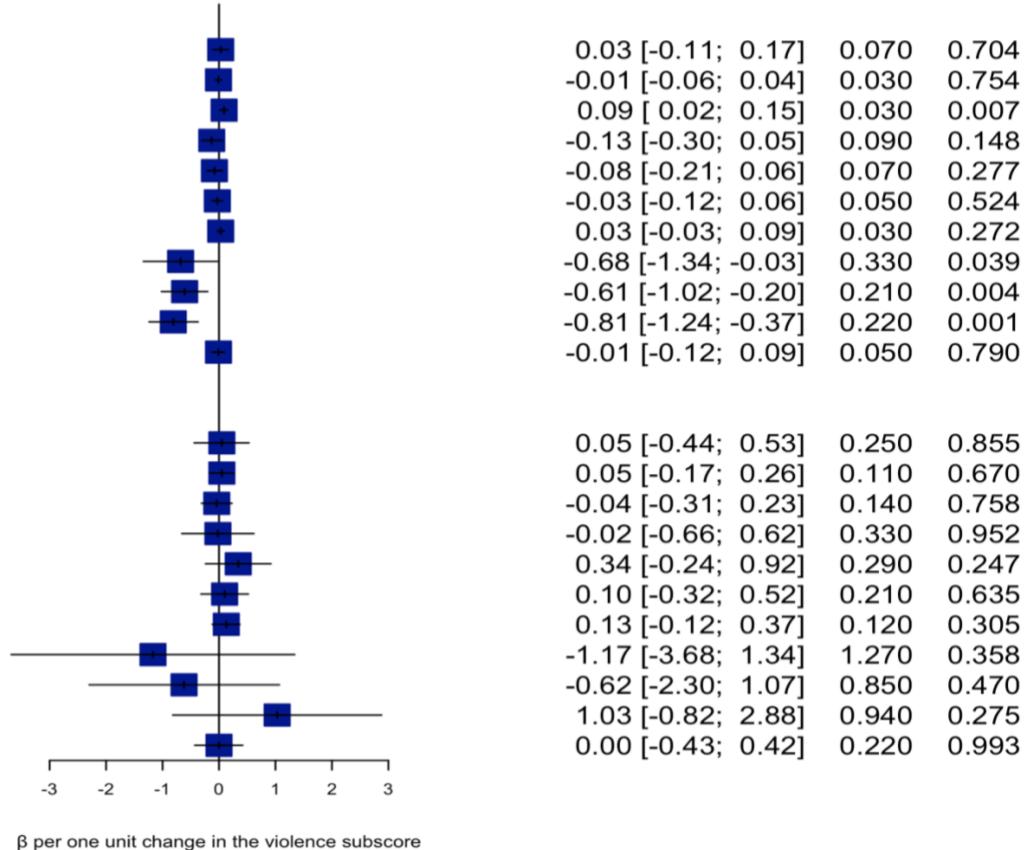
Supplementary Table 7.2 Cognitive scores in observed data

	Mean (SD)	Minimun	Maximum	N missing (%)
Nonverbal intelligence (standard scores)	76.2 (12.5)	48	115	396 (40.5%)
Expressive language (scaled scores)	6.0 (1.3)	1	11	350 (35.8%)
Learning (scaled scores)	7.3 (2.8)	2	15	341 (34.9%)
Memory (scaled scores)	9.7 (1.8)	3	16	368 (37.6%)
Working Memory (scaled scores)	7.6 (2.2)	1	16	340 (34.8%)
	Median [IQR]			
Receptive language (raw scores)	41.0 [36.0 - 45.0]	9	58	362 (37%)
Inhibition Stroop (no. of trials)	9.0 [6.0 - 10.0]	0	10	407 (41.6%)
Selective Attention (no. of targets)	30.0 [25.0 - 36.0]	9	68	403 (41.2%)
Dominant Motor (time in mins)	1.4 [1.1 - 2.2]	0.3	5	349 (35.7%)
Nondominant Motor (time in mins)	1.6 [1.2 - 2.7]	0.2	5	355 (36.3%)
Cognitive Flexibility (no. of trials)	0 [0 - 5]	0	6	346 (35.4%)

Violence Exposure Types and Cognitive Outcomes

Witnessing Community Violence

Cognitive flexibility
Dominant motor
Expressive language
Inhibition
Learning
Memory
Nondominant motor
Nonverbal Intelligence
Receptive language
Selective attention
Working memory



Supplementary Figure 7.1 Forest plot estimates of associations between community violence and cognitive functions in imputed data ($N = 978$).

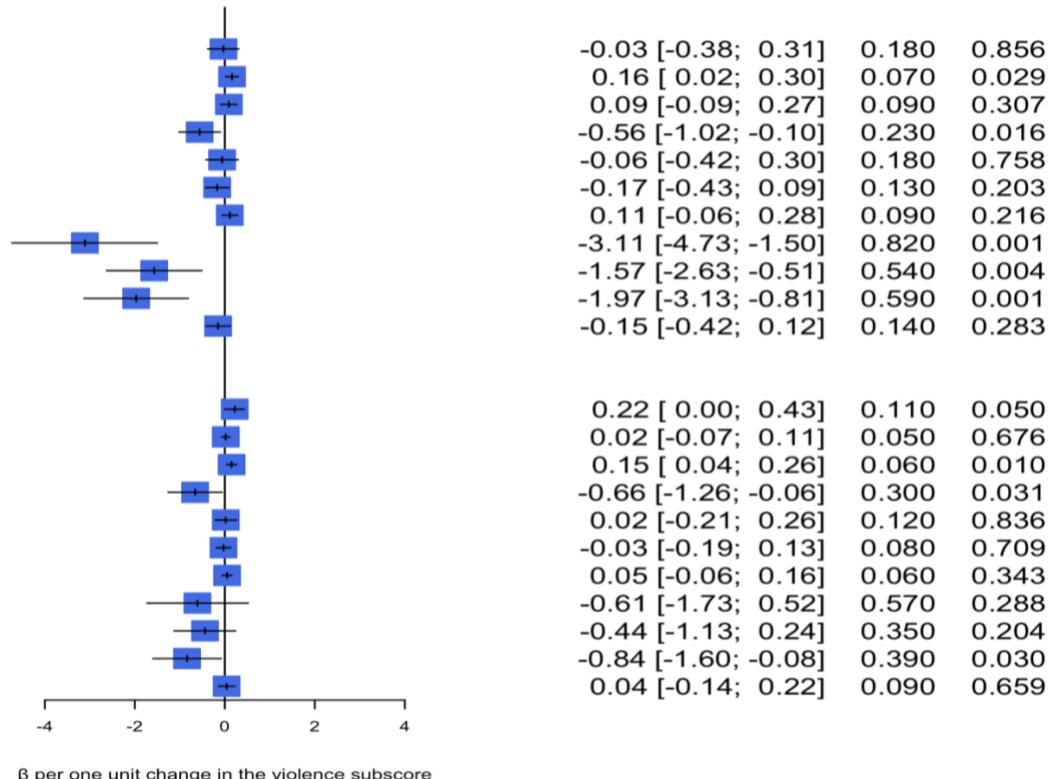
Note: Models are unadjusted. p = p-value

Violence Exposure Types and Cognitive Outcomes

Beta coefficient [95%-CI] SE p

Witnessing Domestic Violence

Cognitive flexibility
Dominant motor
Expressive language
Inhibition
Learning
Memory
Nondominant motor
Nonverbal Intelligence
Receptive language
Selective attention
Working memory



Domestic Victimization

Cognitive flexibility
Dominant motor
Expressive language
Inhibition
Learning
Memory
Nondominant motor
Nonverbal Intelligence
Receptive language
Selective attention
Working memory

Supplementary Figure 7.2 Forest plot estimates of associations between domestic violence and cognitive functions in imputed data (N = 978).

Note: Models are unadjusted. p = p-value

Violence Exposure Types and Cognitive Outcomes

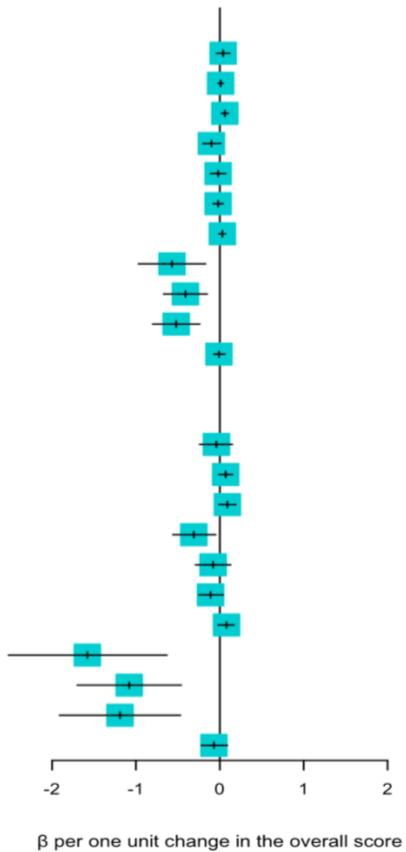
Beta coefficient [95%-CI] SE p

CECV total

Cognitive flexibility	0.04 [-0.04; 0.12]	0.040	0.354
Dominant motor	0.01 [-0.02; 0.04]	0.020	0.574
Expressive language	0.06 [0.02; 0.10]	0.020	0.004
Inhibition	-0.10 [-0.20; 0.01]	0.050	0.062
Learning	-0.02 [-0.11; 0.07]	0.040	0.642
Memory	-0.02 [-0.08; 0.04]	0.030	0.460
Nondominant motor	0.03 [-0.01; 0.07]	0.020	0.122
Nonverbal Intelligence	-0.57 [-0.97; -0.17]	0.200	0.006
Receptive language	-0.41 [-0.67; -0.15]	0.130	0.002
Selective attention	-0.52 [-0.80; -0.24]	0.140	0.001
Working memory	-0.01 [-0.07; 0.06]	0.030	0.800

Polyvictimisation

Cognitive flexibility	-0.04 [-0.24; 0.15]	0.100	0.667
Dominant motor	0.07 [-0.01; 0.15]	0.040	0.071
Expressive language	0.09 [-0.01; 0.19]	0.050	0.083
Inhibition	-0.31 [-0.56; -0.05]	0.130	0.020
Learning	-0.08 [-0.29; 0.13]	0.110	0.439
Memory	-0.11 [-0.25; 0.04]	0.070	0.151
Nondominant motor	0.08 [-0.02; 0.17]	0.050	0.129
Nonverbal Intelligence	-1.58 [-2.52; -0.63]	0.480	0.001
Receptive language	-1.08 [-1.70; -0.46]	0.310	0.001
Selective attention	-1.19 [-1.91; -0.47]	0.360	0.001
Working memory	-0.07 [-0.22; 0.09]	0.080	0.410



Supplementary Figure 7.3 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in imputed data ($N = 978$).

Note: Models are unadjusted. CECV total = CECV Total Score; p = p-value

Violence Exposure Types and Cognitive Outcomes

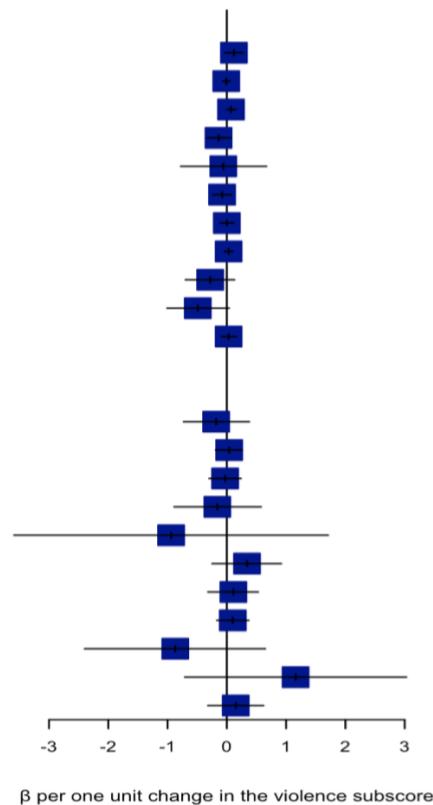
Beta coefficient [95%-CI] SE p

Witnessing Community Violence

Cognitive flexibility	0.12 [-0.03; 0.27]	0.080	0.120
Dominant motor	-0.01 [-0.07; 0.05]	0.030	0.740
Expressive language	0.07 [0.00; 0.15]	0.040	0.041
Inhibition	-0.14 [-0.34; 0.07]	0.110	0.193
Intelligence	-0.06 [-0.78; 0.67]	0.370	0.877
Learning	-0.08 [-0.24; 0.08]	0.080	0.311
Memory	0.00 [-0.11; 0.12]	0.060	0.945
Nondominant motor	0.03 [-0.04; 0.10]	0.040	0.440
Receptive language	-0.28 [-0.70; 0.13]	0.210	0.176
Selective attention	-0.49 [-1.01; 0.04]	0.270	0.068
Working memory	0.03 [-0.09; 0.16]	0.060	0.600

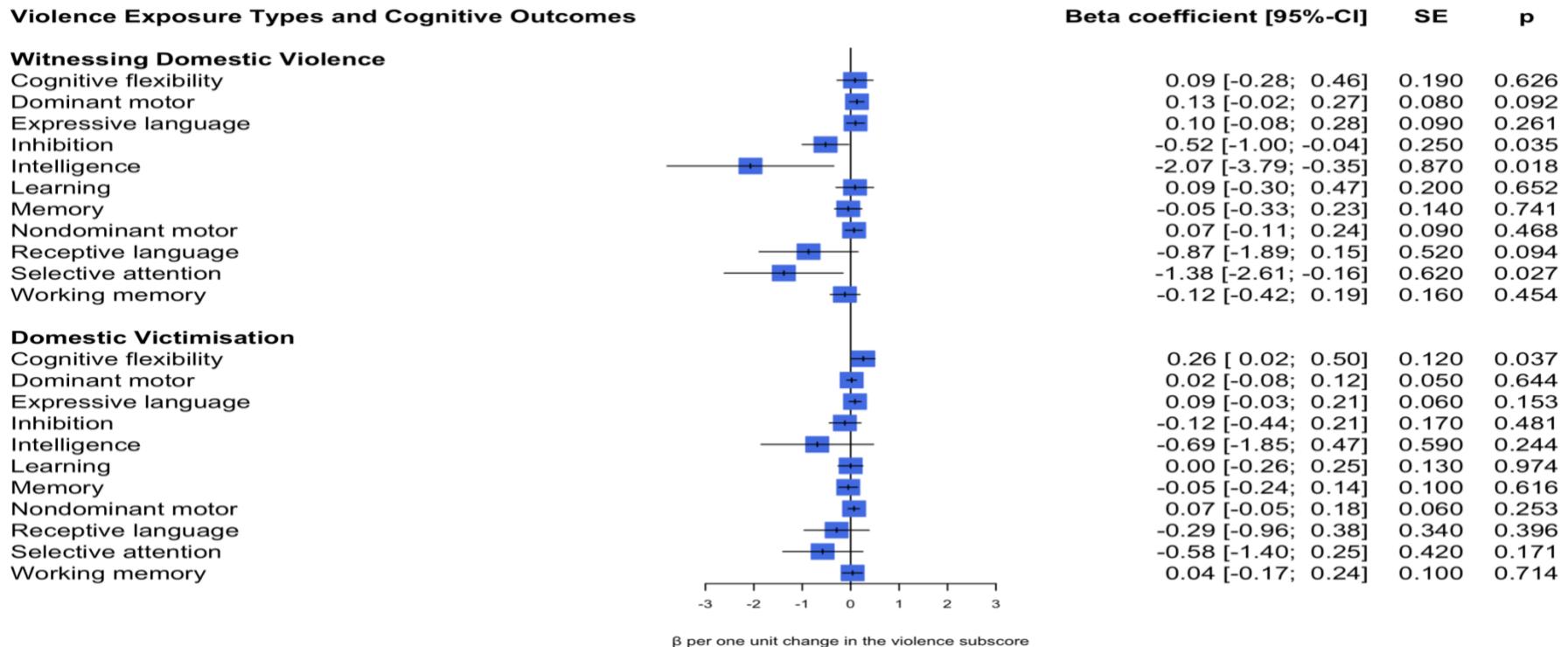
Community Victimisation

Cognitive flexibility	-0.18 [-0.73; 0.38]	0.280	0.537
Dominant motor	0.04 [-0.19; 0.26]	0.110	0.738
Expressive language	-0.03 [-0.30; 0.24]	0.140	0.805
Inhibition	-0.16 [-0.89; 0.58]	0.370	0.672
Intelligence	-0.94 [-3.59; 1.71]	1.350	0.485
Learning	0.34 [-0.25; 0.92]	0.300	0.261
Memory	0.11 [-0.32; 0.53]	0.220	0.627
Nondominant motor	0.10 [-0.17; 0.37]	0.140	0.454
Receptive language	-0.87 [-2.40; 0.65]	0.780	0.262
Selective attention	1.16 [-0.71; 3.03]	0.950	0.224
Working memory	0.15 [-0.32; 0.62]	0.240	0.529



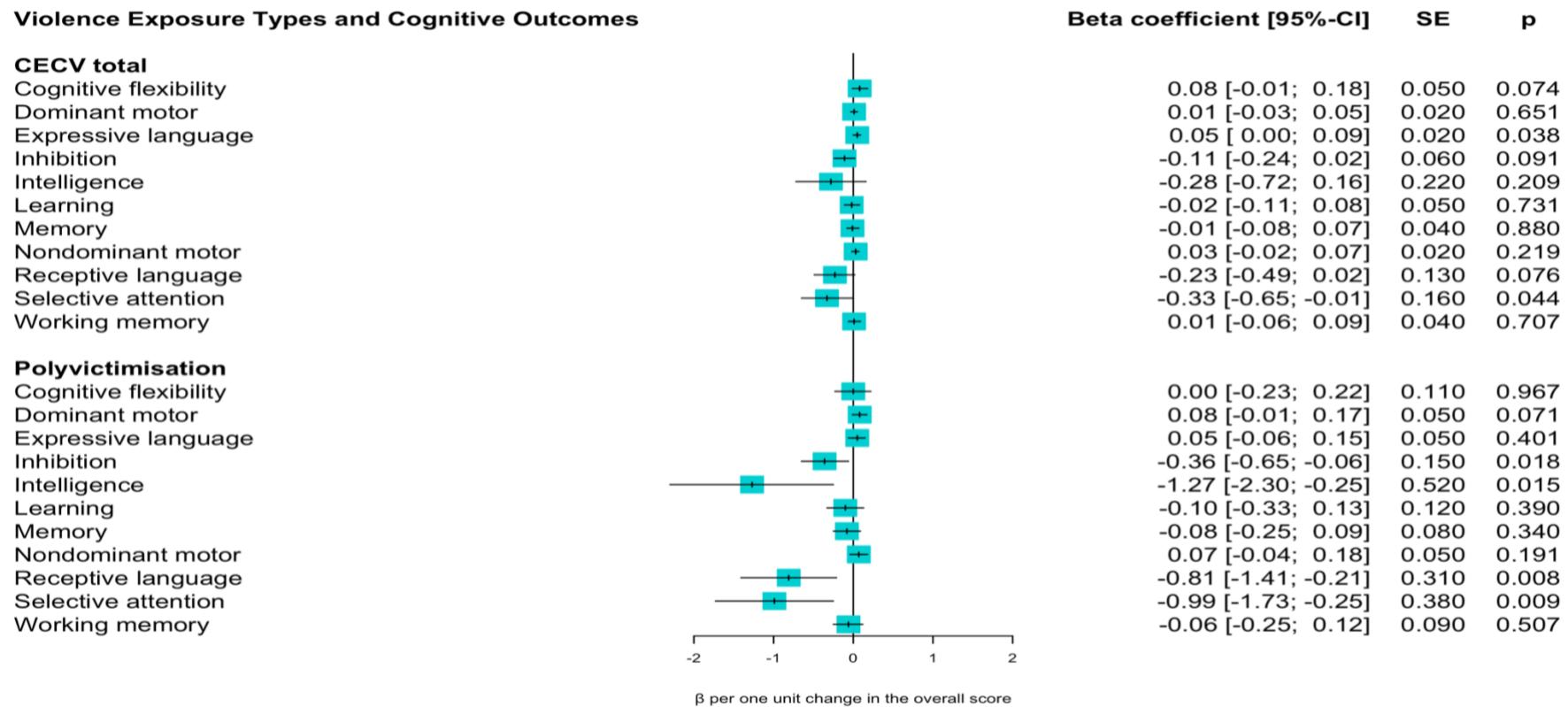
Supplementary Figure 7.4 Forest plot estimates of associations between community violence and cognitive functions in observed data

Note: Intelligence (N = 485), expressive language (N = 522), receptive language (N = 510), Learning (N = 528), memory (N = 506), dominant (N = 522) and nondominant motor (N = 518), inhibition (N = 476), selective attention (N = 480), working memory (N = 529) and cognitive flexibility (N = 525). Models adjusted for child sex, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value.



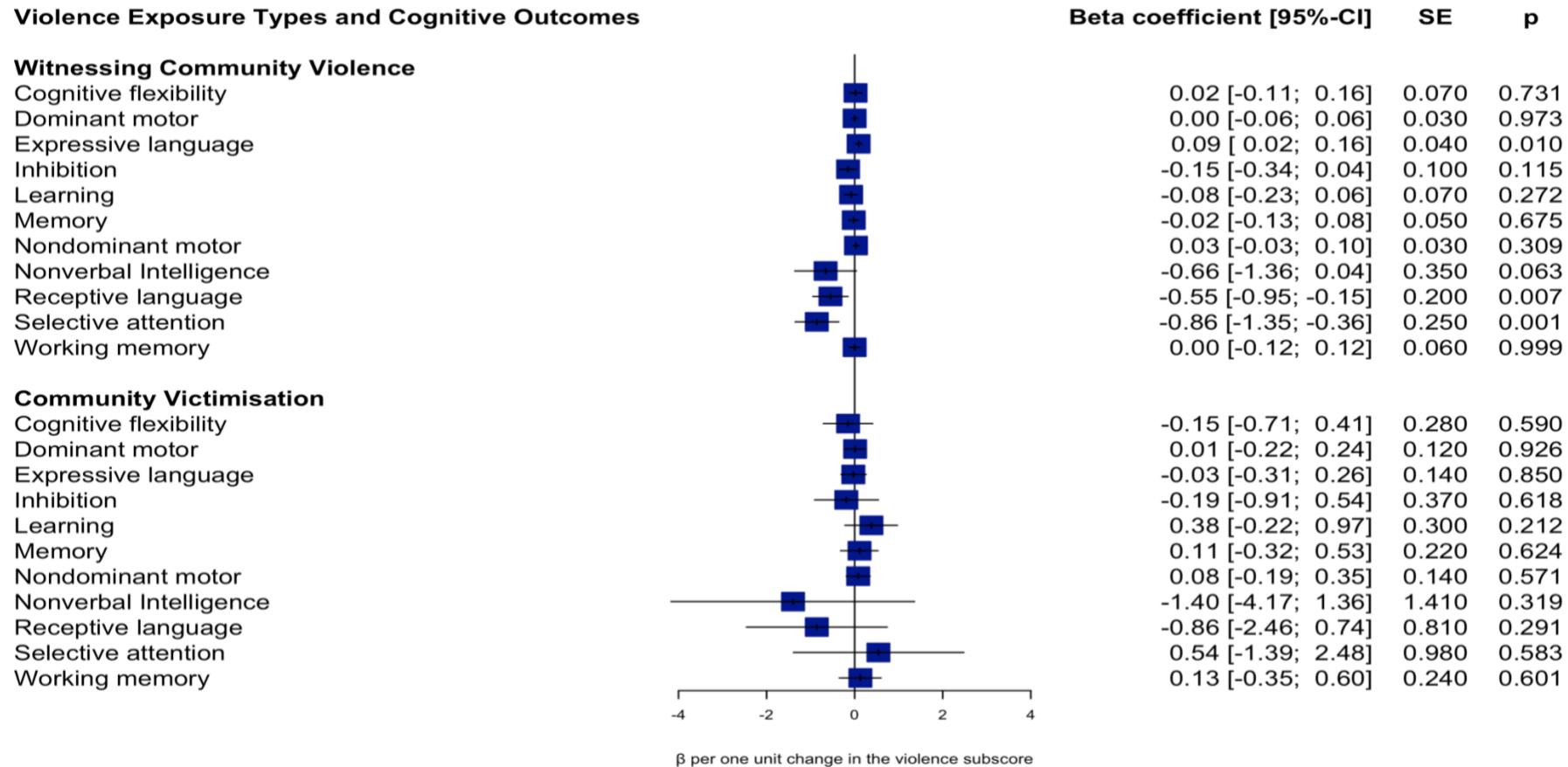
Supplementary Figure 7.5 Forest plot estimates of associations between domestic violence and cognitive functions in observed data

Note: Intelligence (N = 485), expressive language (N = 522), receptive language (N = 510), Learning (N = 528), memory (N = 506), dominant (N = 522) and nondominant motor (N = 518), inhibition (N = 476), selective attention (N = 480), working memory (N = 529) and cognitive flexibility (N = 525). Models adjusted for child sex, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value.



Supplementary Figure 7.6 Forest plot estimates of associations of overall violence exposure, polyvictimisation and cognitive functions in observed data

Note :Intelligence (N = 485), expressive language (N = 522), receptive language (N = 510), Learning (N = 528), memory (N = 506), dominant (N = 522) and nondominant motor (N = 518), inhibition (N = 476), selective attention (N = 480), working memory (N = 529) and cognitive flexibility (N = 525). Models adjusted for child sex, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. CECV total = CECV Total Score; p = p-value



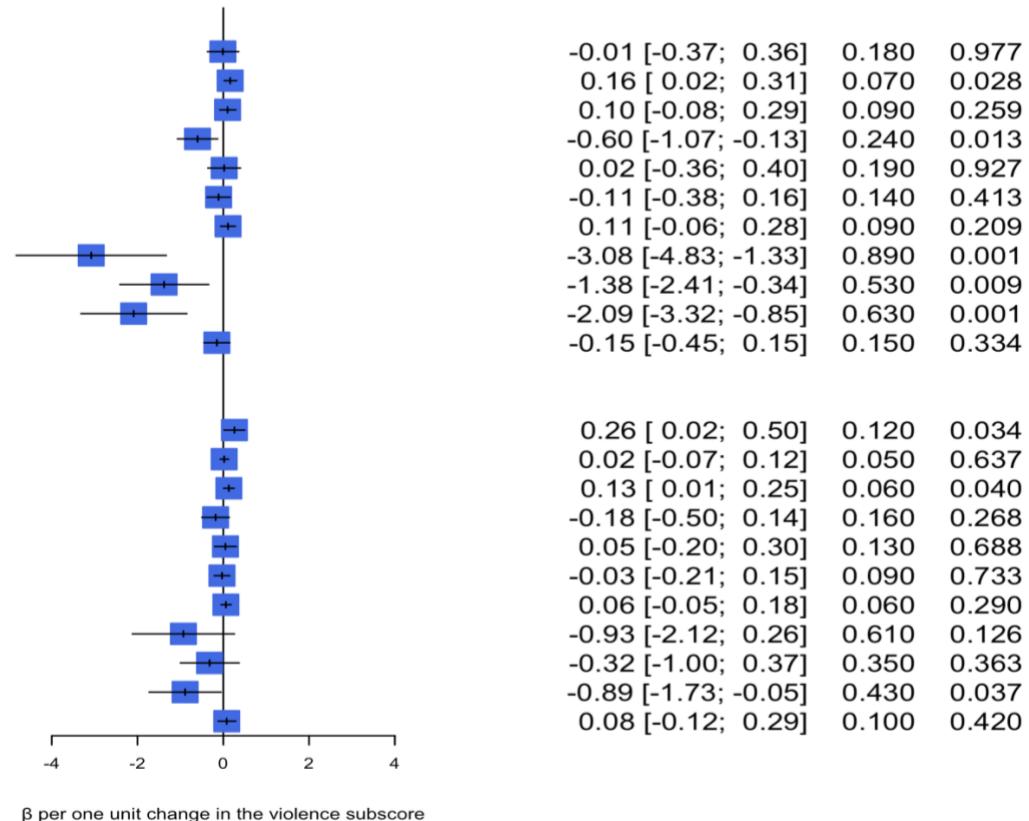
Supplementary Figure 7.7 Forest plot estimates of associations between community violence and cognitive functions in observed data

Note: Intelligence (N = 485), expressive language (N = 522), receptive language (N = 510), Learning (N = 528), memory (N = 506), dominant (N = 522) and nondominant motor (N = 518), inhibition (N = 476), selective attention (N = 480), working memory (N = 529) and cognitive flexibility (N = 525). Models are unadjusted. p = p-value

Violence Exposure Types and Cognitive Outcomes

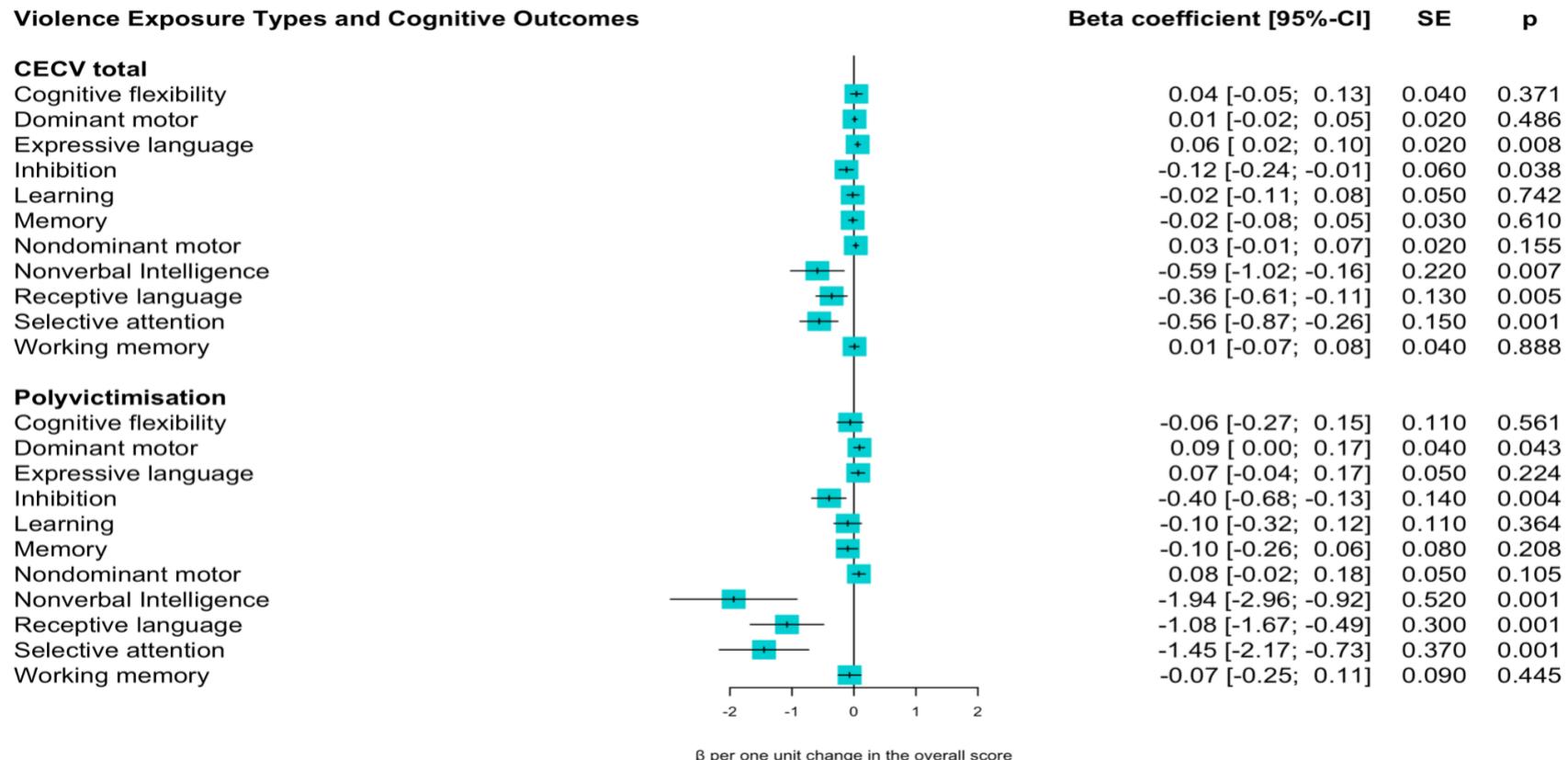
Witnessing Domestic Violence

Cognitive flexibility
Dominant motor
Expressive language
Inhibition
Learning
Memory
Nondominant motor
Nonverbal Intelligence
Receptive language
Selective attention
Working memory



Supplementary Figure 7.8 Forest plot estimates of associations between domestic violence and cognitive functions in observed data

Note: Intelligence (N = 485), expressive language (N = 522), receptive language (N = 510), Learning (N = 528), memory (N = 506), dominant (N = 522) and nondominant motor (N = 518), inhibition (N = 476), selective attention (N = 480), working memory (N = 529) and cognitive flexibility (N = 525). Models are unadjusted. p = p-value



Supplementary Figure 7.9 Forest plot estimates of associations of overall violence exposure, polyvictimisation and cognitive functions in observed data

Note: Intelligence (N = 485), expressive language (N = 522), receptive language (N = 510), Learning (N = 528), memory (N = 506), dominant (N = 522) and nondominant motor (N = 518), inhibition (N = 476), selective attention (N = 480), working memory (N = 529) and cognitive flexibility (N = 525). Models are unadjusted. CECV total = CECV Total Score

Chapter 8. Discussion

8.1. Overview of background and summary of key results

As detailed in Chapter 1, violence among children is major human rights and public health issue worldwide (1). Although the majority of children in the world live in LMICs and it has been shown that they experience higher levels of violence than those in HICs (2), there is limited data on the extent of violence and the types of violence they experience in early childhood. Furthermore, research investigating associations between violence exposure and developmental outcomes such as mental health and cognition in early childhood is limited, especially in these settings. Such evidence is needed to better understand the risk violence poses on the developing brain (88). While the prevention of violence should be the ultimate goal, a better understanding of its impact can better inform strategies for interventions to support young children exposed to violence, bolster their resilience, and provide them with coping mechanisms to improve their wellbeing and prepare them for the emotional and cognitive demands of school.

In this thesis, I aimed to address these research gaps by enhancing our knowledge of the violence exposure patterns of young children in LMICs and investigating how these patterns relate to their mental health and cognitive functions. I achieved this by undertaking a systematic review of the evidence on the association between violence exposure and cognitive outcome in children 11 years and under in LMICs (Chapter 2). I, together with another reviewer, screened 2937 records obtained from database searching. After full text screening, a total of 17 studies which encompassed 27 643 children from 20 LMICs were examined. The majority of these studies, focused on maltreatment, but IPV and war violence were also examined. The most frequently studied cognitive functions were early childhood cognitive, socioemotional and motor development, executive functioning, general intelligence/IQ and language ability. Overall, 71% of the reviewed studies found evidence to suggest an association between violence exposure and poor cognitive outcomes in children. I also found evidence to suggest cortisol moderated the relationship between maternal corporal punishment and children's executive functions in this review. Furthermore, I found that parental stimulation, scholastic involvement and maternal mental health, children's academic motivation, and child mental health mediate associations between violence exposure (IPV and maltreatment, respectively) and children's cognitive outcomes.

Chapter 3 presents results of a scoping review of the association between violence exposure and mental health outcomes in children up to age 11 living in LMICs. I explored the themes and gaps in the current evidence. Together with another reviewer, I screened 20543 records from database searches. Following full-text screening, we reviewed total of 58 studies encompassing 66020 children from 26 LMICs. Reviewed studies investigated exposure to bullying, community violence, IPV, maltreatment, political and war violence. Outcomes largely encompassed internalising and externalising problems. All reviewed studies found evidence suggesting that violence exposure is a risk factor for behavioural problems in children, similar to previous findings in reviews with predominantly older children and adults residing in HICs. Reviewed studies also identified moderating factors such as maternal mental health that could influence the strength or direction of the association between violence exposure and child mental health. Furthermore, factors such as parental mental health, child impulsivity, and concurrent exposure to other types of violence were also found as mediators in these associations. Some of the reviewed studies investigated sex differences in the relationship between violence exposure and mental health outcomes in children, with different patterns of associations, mediation, and moderation observed in boys and girls. Some studies reported differential associations with child mental health based on violence subtypes such as IPV and bullying subtypes. Important themes and gaps were identified by the review. The majority of the reviewed studies came from China (People's Republic of), and a substantial proportion from Brazil), and smaller numbers from Middle East and Africa. Most reviewed studies were cross-sectional studies; only 29% were longitudinal studies; study samples were predominantly school-going children; studies typically investigated maltreatment and IPV with comparatively fewer studies investigating community violence or collective violence; reviewed studies largely investigated exposure to one form of violence neglecting polyvictimisation; various measures were used to assess violence exposure and in most cases respondents were children; reviewed studies generally used established measures for assessing behavioural outcomes, mainly using the CBCL and SDQ.

In both above reviews I conducted a comprehensive risk of bias assessments and found that some reviewed studies' methodologies had a high risk of selection bias. Confounding control was not always adequate, especially with respect to adjusting for confounding effects due to caregivers' mental health and alcohol and substance use behaviours. In light of this observation, I paid particular attention to these points in my own original studies and analyses in Chapter 6-7 adjusted for multiple confounders.

Through the findings from the reviews, it was clear that the majority of previous research investigating childhood violence exposure in LMICs focused on school-going children. My research aimed to address this gap through a focus on data collected from preschoolers living in South Africa. Prior to examining associations between violence, mental health and cognitive outcomes, I set out to understand the patterns of violence exposure these children experience. Therefore, in Chapter 5, I describe the violence exposure patterns of preschoolers living in South Africa, using data from the DCHS. Lifetime direct and indirect exposure to domestic and community violence, was assessed through parental reports when children were aged 3.5 years ($N = 530$), 4.5 years ($N = 749$), and 6 years ($N = 417$), using the CECV. The analysis revealed three primary findings. First, a considerable portion of children (72%-75%) experienced some form of violence in their homes or communities from a young age. Second, substantial polyvictimisation was evident, with nearly half (49%) of the children experiencing more than one type of violence by the age of 6. Third, sex differences were observed by the age of 4.5, with boys more frequently exposed to domestic victimisation (28% vs. 17% for girls) and polyvictimisation (38% vs. 28% for girls). Moreover, witnessing community violence emerged as the most common type of violence (62% - 69%), corroborating previous research (531) and the high incidence of homicides and gang violence in the Western Cape Province in which the DCHS is based (429). Domestic victimisation (i.e., maltreatment) was also prevalent (24% - 31%), as well witnessing domestic violence (28% - 21%). Community victimisation was the least prevalent (9 - 14%) exposure. There were also no differences in children's exposure status based on their background (i.e. maternal marital status or SES). Of note, the DCHS population is generally characterised by low SES.

Chapter 6 presents associations between lifetime violence exposure at 4.5 years and internalising and externalising behaviour problems at 5 years in the DCHS ($N = 978$). These outcomes were chosen as they are the most universally accepted categorisations of mental health problems in children (284) as evidenced by in the scoping review in Chapter 3. Children's violence exposure was captured using the CECV as described above, and internalising and externalising behaviour problems were assessed using the CBCL. Findings revealed an overall lifetime violence exposure rate of 83% in the sample. Higher scores on internalising and externalising behaviours were associated with overall violence exposure, domestic victimisation and witnessing community violence in the current sample. There was

a positive association between polyvictimisation and externalising behaviours, but the evidence was less robust for internalising behaviour problems (the CIs spanned the null value). Evidence for an association of witnessing domestic violence with internalising or externalising behaviour problems was weak (CI spanned the null value and p-values were greater than 0.05). There was no association between community victimisation and internalising or externalising behaviours. Lastly, approximately 10% of the children had internalising behaviour problems in the clinical range and approximately 4% had externalising behaviour problems in the clinical range.

Chapter 7 investigated the relationship between violence exposure and cognitive outcomes in preschoolers in the DCHS. Specifically, multiple regression analyses investigated associations between lifetime violence exposure at age 4.5 (assessed using the CECV) and cognitive outcomes assessed at age 5. Following the systematic review in Chapter 2, which revealed a lack of consensus in the literature about the cognitive outcomes potentially affected by childhood violence exposure, Chapter 7 investigated various cognitive outcomes, specifically, executive functions (selective attention, visual working memory, inhibition, cognitive flexibility), language (receptive and expressive) ability, motor dexterity, learning and memory ability. I found inverse associations between lifetime exposure to violence and cognitive outcomes: overall violence exposure, witnessing community violence, witnessing domestic violence and polyvictimisation with selective attention; witnessing domestic violence and polyvictimisation with nonverbal general intelligence; overall violence exposure, witnessing domestic violence and polyvictimisation with receptive language ability. Witnessing domestic violence and polyvictimisation with inhibition (weak evidence). Unexpectedly, overall violence exposure, witnessing community violence, domestic victimisation, were associated with greater expressive language ability; and domestic victimisation was associated with greater cognitive flexibility. There were no associations between lifetime exposure to violence and visual working memory, fine-motor functions, learning and memory ability.

8.2. Discussion of key findings

8.2.1. High prevalence of lifetime violence in the lives of South African children

Perhaps the most striking finding in the thesis is the high level of violence children in the DCHS experienced. Chapter 6 and 7 highlighted that by 4.5 years of age, about 83% of the sample had experienced some form of violence. Furthermore, in Chapter 5, findings revealed that even at an earlier age of 3.5 years, the majority of children (72%) had experienced violence in their lives, with witnessing community violence being the most prevalent exposure, experienced by 62% - 69% of the children by the ages of 3.5 – 6 years. The findings in Chapter 5 not only align with those of other studies with older South African children in terms of prevalence of community violence (387,388,532,533), but also uniquely emphasise the prevalence of this exposure in the lives of South African preschoolers. Thus, stressing the pervasive nature of community exposure across the life span in certain South African communities. Indeed, research in South African adult populations from similar contexts has found the experience of witnessing violence to be a common phenomenon (531). Similarly, mothers in the DCHS, reported high levels of lifetime exposure to community violence themselves (400). It is understood that community violence in South Africa stems from its political history, encompassing the pre-colonial to colonial period, through slavery and apartheid (368,391). During a subsequent period of resistance and liberation numerous South African people from marginalised groups were subject to state violence as a method of public order policing (534). Through these systems, (1) violence in South Africa was normalised and socially accepted (2) marginalised groups of people were severely economically disadvantaged through low educational resources, employment prospects, income, and being forced into communities where gang activity, crime and violence is rife, driven by deprivation (487,535).

Interestingly, in the DCHS lifetime exposure to domestic victimisation (i.e. maltreatment) and witnessing domestic violence (including IPV) were similarly prevalent, at rates of approximately 31% - 33% at 4.5 years of age. Family violence, which encompasses both of these phenomena is prevalent in South Africa, with other studies reporting estimates of 9% - 34% for maltreatment (536,537) and 23% - 38% for IPV in women (298,538–540). There are several possible explanations for these findings. It is understood that apartheid impacted family social dynamics through the migrant labour system that resulted in many fathers being

absent from their children's lives (541). As such single-parent homes are common in South Africa, such that a large proportion of children are raised by their mother (39%) or neither parent (23%) (356). Indeed, at enrolment, 60% of the mothers in the DCHS cohort were single. It is argued that single caregivers experience higher levels of stress as a result of parenting by themselves which is exacerbated under financial hardship (542). A such, this strain may result in inconsistent discipline and harsh disciplinary practices (543).

Furthermore, the racial oppression, unequal power dynamics and economic inequalities experienced through the migrant labour system increased gender inequalities (544). This together with certain cultural and social norms that endorse the use of violence by certain members of society with high status (i.e. men) against those of a lower status (i.e. women and children) may lead to IPV and maltreatment of children (545). Unfortunately, children are often viewed as having a low status, and prevailing social norms sometimes treat them as if they were their parents' "property". This perception increases children's susceptibility to violence from caregivers, leaving them disempowered and unable to report maltreatment (410,487). It is also possible that the political history discussed above in the context of community violence may have influenced the general cultural and social norms in South Africa such that the use of violence in domestic settings is also normalised (371). Notably, the constitutional ruling against caregivers' use of corporal punishment in South Africa was only made in 2019 (546). While the legality of the use corporal punishment prior to this ruling by no means indicates caregivers' endorsement of it, it is plausible that the legal defence for it in the backdrop of the country's socio-political history likely fuelled its use. Indeed, in the DCHS, the most commonly reported form of domestic victimisation was *child being hit by a stick, belt or another hard item at home*, experienced by 6% - 13% of the children aged 3.5 to 6 years.

Children in the DCHS also experienced polyvictimisation, at rates of up to 49% by age 6. Although it was mainly characterised by exposure to two or three types of violence in the DCHS, results from the Birth to Twenty Plus Cohort Study in Johannesburg, South Africa found that around 40 % of the children experienced five or six types of violence across their lifetime (0-22 years) in settings that included home, community, school, peers and intimate relationships (547). In the DCHS, children could only experience up to four types of violence, as determined by the number of subscales measured. However, findings from the Birth to Twenty Plus Cohort Study emphasize the risk of exposure to additional forms of

violence that children in the DCHS might encounter throughout their lifetimes in the absence of interventions.

I also found that boys experienced a greater burden of domestic victimisation and polyvictimisation than girls. This pattern may stem from differences in socialization, with boys often less supervised and more susceptible to witnessing or experiencing violent experiences due to more time spent outside the home as well as potential disparities in parental attitudes towards the acceptability of harsh discipline based on the child's gender (548). Indeed, other studies conducted in South Africa (549,550) and other countries have found that boys experience more corporal punishment than girls (548). Additionally, the rate for homicide is higher among boys than girls globally (2).

Lastly, community victimisation was the least prevalent type of violence experienced by children in the DCHS, experienced by about 13% of the sample by age 4.5. This is likely due to their young age, which meant that the children likely spent the majority of their time at home as opposed to outside in the community or school. Previous studies of older South Africa children (10 – 17 years) found community victimisation prevalence rates of 39% - 40% (387,476), so that the relatively low prevalence in the DCHS is likely due to the young age of participants.

8.2.2. Violence exposure - a risk factor for mental health problems for children in LMICs

A second key finding in the thesis was the risk of poor mental health outcomes in children exposed to violence in LMICs. This phenomenon has been well-documented in the literature in adolescents and adults predominantly based in HICs (14,16,118,119,275) with some emerging research finding similar patterns in similar population groups in South Africa (298,430,532,533). Chapter 6 contributes to the growing body of research on preschoolers in LMICs, documenting that preschoolers exposed to maltreatment, community violence and polyvictimisation in the DCHS were at risk of experiencing internalising and externalising behaviour problems similar to their older counterparts. This is important given that there is widespread belief that it is difficult to observe such behaviours in preschoolers (especially internalising behaviours), and the belief that children at that age will not remember, are not affected by or quickly recover from violence (551–553). This is also important in establishing violence exposure as a risk factor for mental health problems in early childhood. This

together with the previous thesis findings linking violence exposure and poor cognitive outcomes in this preschool sample, suggests the potential disruption of brain development from violence exposure, a phenomenon that has been well-documented in neuroimaging studies investigating early life stress (108,554,555). Researchers have described how early childhood experiences “get under the skin”, a concept used to illustrate how events occurring in early life can shape biological systems creating developmental gradients (105,556,557). Furthermore, polyvictimisation was associated with poor outcomes in both mental health and cognition in this sample, highlighting the added impact of an increased burden of violence on children’s development in this cohort. Finding low prevalence of clinically significant psychopathology in the sample alludes to the possibility of resilience in the sample. Resilience reportedly features in some children who have had traumatic experiences and is tied to the presence of protective factors such as self-regulation, family, school and peer support (203). Alternatively, it has been suggested that violence exposure puts a child at risk of experiencing mental health problems later, at any point in their lives (558). As such children in the DCHS and other similar contexts exposed to violence who may not meet the criteria for a diagnosis of a mental health problem currently, may still experience clinical levels of psychopathology later.

Of note there was no evidence of an association between community victimisation and either mental health or cognitive outcomes in the DCHS sample (Chapters 6 and 7). This type of exposure has been associated with poor mental health in South African adolescents (388). Furthermore, a previous study in USA found that community violence (including community victimisation) was negatively correlated with IQ in adolescents (216). In the DCHS, it is likely that community victimisation is a less severe form of exposure, possibly explaining the absence of observed effects.

8.2.3. Violence exposure – a risk factor for poor cognitive outcomes for children in LMICs

Another important finding that emerged from the thesis is that children (11 years and under) exposed to violence in LMICs are at risk of poor cognitive outcomes. It was also clear from the systematic review in Chapter 2 that research investigating violence exposure and cognitive outcomes in LMICs is limited in comparison to that conducted in HICs or investigating mental health/behavioural outcomes (see Chapter 3). While the findings from

the systematic review in Chapter 2 were largely similar to those conducted in HICs especially in adolescent and adult populations (20) there were some differences. For example, in my review of studies conducted in LMIC settings in young children, maltreatment was associated with poor cognitive functioning in most domains except memory, when previous studies in HICs have found associations between childhood violence exposure and poor memory (20,215). Similarly, in the DCHS, there were no associations found between any form of violence and learning or memory (Chapter 7). It is possible that these are true findings, suggesting differential patterns of associations across populations. However, given that only one study in the Chapter 2 review assessed memory and, previous reviews reported mixed findings with regards to the association between childhood violence and memory (19,267) it is plausible that methodological variations among different studies could explain the inconsistencies observed in the literature. Further research is necessary to thoroughly examine these associations and clarify these divergent findings. There were also inconsistencies in the associations between IPV and cognitive outcomes in the thesis, although generally, IPV was associated with poor cognitive outcomes in both the systematic review (Chapter 2) and in the DCHS (Chapter 7). The pattern was more consistent in Chapter 7 compared to the review, as witnessing domestic violence was associated with poor selective attention, nonverbal intelligence, receptive language ability and inhibition in the DCHS, similar to previous research with older samples in HICs, (17). Interestingly, in the systematic review, there were no studies investigating community violence, indicating a critical gap in the literature pertaining to LMICs. However, similarly, there are relatively few studies that have investigated associations between childhood exposure to community violence and cognition in HICs as well, I only identified a small number during the course of the PhD (26,124,216,217,489,490,559–565). Using data from the DCHS, Chapter 7 highlighted witnessing community violence as a risk factor for poor selective attention ability in preschoolers in LMIC communities, contributing to this critical evidence gap. Although polyvictimisation has been identified as a risk factor for mental health problems in other populations, even posing a greater risk than single exposures (118), research on its relationship with cognition is very limited. As such finding that polyvictimisation was associated with poor selective attention, receptive language ability, nonverbal intelligence and inhibition ability in this LMIC sample is a step towards addressing this research gap. Another unique contribution of the thesis was finding that violence exposure was associated with greater expressive language ability and cognitive flexibility. This is in contrast to previous research findings (267) and suggests possible adaptive cognitive responses under

stress (215,489). However, such responses have been associated with poor health outcomes later (526,527) as accelerated development likely comes at a cost (528). Given the preliminary nature of the research in this area especially pertaining to cognitive outcomes and the small effect sizes observed in these associations, further research is needed. The lack of associations between violence exposure and learning, memory, motor dexterity, or visual working memory, may be a true finding. Alternatively, they could be as a result of the measures used to assess these functions which were designed in Western contexts not being culturally applicable or sensitive to capture the abilities of the children in the DCHS. This points to the need for more contextual and nuanced investigations into appropriate cognitive measures to use in South Africa.

8.3. Strengths and limitations

Each of the results chapters presented strengths and limitations pertaining to their specific analyses. Nonetheless it is important to consider the following strengths and limitations in relation to the thesis results Chapters.

8.3.1. Methodology

Even though the use of data from a community based prospective birth cohort is a key strength of the thesis overall, it also had its limitations. The study recruited pregnant mothers who were receiving antenatal care in their first or second trimester. This means that pregnant women who only went to the antenatal clinics in their third trimester were excluded. This may reduce sample representativeness. While most South African women (96% -97%) attend public antenatal clinics during the course of their pregnancy (566,567), their characteristics may vary in relation to antenatal care initiation time. For example, previous studies have found that being employed and having a wanted pregnancy were associated with early antenatal care initiation in urban settings in South African (566–568). Excluding adolescent mothers from the study population may limit the generalizability of the findings to this specific subgroup. If adolescent mothers experience violence exposure or its consequences differently from other caregivers, excluding them could lead to incomplete understanding of the associations under investigation. For example, adolescent mothers may face unique stressors and vulnerabilities that put them at increased risk of experiencing violence, such as lower SES, lack of support networks, and dependence on potentially abusive partners.

Additionally, they may lack the resources and coping mechanisms that older caregivers have, making them more susceptible to various forms of violence. Therefore, excluding adolescent mothers from the study could lead to an underestimation of the true prevalence and impact of violence exposure on child outcomes. Regardless of this, recruitment into the DCHS was comprehensive and exclusion criteria were limited to increase representativeness.

Furthermore, the two DCHS communities may differ in terms of patterns of violence exposure and demographic characteristics, which may affect associations with child mental health and cognitive outcomes. South Africa's political history racialised groups of people which inevitably risks the danger of interpreting racial categories as causal agents (372). As such, I decided to not assess community-level differences in the thesis to avoid the use of racialised categories as explanations for violence exposure patterns. In so doing, I hope that the reader can objectively enquire about the multifactorial origins of the violence that children in the DCHS experience. Regardless, inclusion of community samples consisting of two racialised South African groups is a key strength of the thesis highlighting the socioeconomic challenges that previously marginalised groups continue to face in South Africa.

Another limitation of the thesis methodology overall is that there were no mediation or moderation analyses conducted. Inclusion of mediation analyses would have contributed to our understanding of mechanisms involved in the pathway from violence exposure to mental health and/or cognitive functioning problems in preschoolers. This would have possibly provided information on which intermediary variables to target in preventing the development of mental health problems or maladaptive cognitive processes in preschoolers exposed to violence. Furthermore, moderation analyses would have provided additional insight into which groups to focus on in interventions. However, these analyses were beyond the scope of the thesis. As such, in Chapter 1, I provided a comprehensive summary of the mechanisms that have been implicated in previous studies. Furthermore, findings from the review chapters highlighted moderators that have been implicated in these associations.

8.3.2. Attrition

There was attrition in the study, as is common in longitudinal studies. There were 163 participants who were completely lost to follow up (i.e. inactive), resulting in an active sample of 980 participants. While these are low attrition rates given the long follow up period

(at least 6 years) and the psychosocial challenges faced by individuals in the DCHS, this could potentially introduce selection bias. Indeed, despite the characteristics of the active and inactive samples being largely similar, there were some differences. Specifically, the inactive sample tended to have a higher household income, education level and were more likely to consist of non-smokers compared to the active sample. Selection bias could lead to overestimation or underestimation of associations between violence exposure and the outcomes investigated. Specifically, for example if individuals who experienced more severe forms of violence were less likely to be retained in the study, this could lead to an underestimation of the true association between violence exposure and outcomes. Furthermore, it is possible that finding a lack of association between household income and children's violence exposure in Chapter 5 was due to selection bias, specifically, it is likely that the sample in the analyses were mostly had a low household income. As a result, there might have been reduced variability in household income, making it difficult to detect any differences in violence exposure patterns related to income levels. Given that I was focusing on the years past infant years in the thesis, it was inevitable that I would be faced with missing data. A smaller sample size can lead to less statistical power, making it harder to detect true associations even if they exist. This reduction in statistical power can weaken the observed associations, making them appear less significant or robust than they actually are. I conducted multiple imputation methods to address missing data at wave level in the active sample in Chapter 6 and 7, to address some of these challenges and results were similar across observed and imputed datasets.

8.3.3. Sample size

Considering the relatively modest sample size of the DCHS, it is possible that the absence of interactions with child sex in the associations between violence exposure and the assessed outcomes may have been influenced by the limited sample size. Specifically, the sample size becomes smaller when conducting interaction analyses as such a smaller sample size was used in these analyses potentially compromising the statistical power of the study. This diminished statistical power could have made it more challenging to detect interaction effects. Furthermore, this may account for the disparities between the patterns of sex

differences observed in the thesis results chapters and those reported in the review chapters. A larger sample size could have potentially yielded more robust results.

8.3.4. Confounding influences

A strength of the study was the adjustment of multiple confounding variables available in the DCHS in Chapter 6 and 7. However, there is still a risk of residual confounding in the associations of violence exposure with mental health and cognitive outcomes in the DCHS preschoolers. As such, the results in the Chapter 6 and 7 might be attributed to the partial adjustment for measured and unmeasured confounding variables. For example, a previous review found that although individuals (children, adolescents and adults) from two longitudinal cohorts who experienced polyvictimisation had various cognitive impairments including general intelligence, memory and language in adolescence and adulthood, these cognitive impairments could be mostly attributed to genetic risk (569). Similarly, genetic risk has been found in individuals exposed to maltreatment in children who later develop mental health problems (570,571). Unfortunately, the use of data from a longitudinal birth cohort meant that I was only able to include variables that were measured in the study. As such I adjusted for multiple prenatal socioeconomic and maternal factors such as household income, and maternal depression which have been implicated in previous literature (318,521). In the thesis, associations of violence exposure with child mental health and cognitive functioning, were largely sustained with confounder adjustment.

8.3.5. Use of translated measures

DCHS participants were largely isiXhosa or Afrikaans speakers, and all the measures used to assess violence exposure, mental health and cognitive functions in the thesis were translated from English into these languages. Even though care was taken into ensuring that translations were appropriate through the use of backtranslations, measures previously used in other South African contexts and having consultations with a multiprofessional team of native speakers, it is possible that there may be limitations to this process. It would be preferable that measures designed in the native languages were used in the study, however there is a gap in measurement development in non-Western societies such as South Africa, such that measures used to assess psychological phenomena are typically developed in Western countries (572). Furthermore, interpreters were used at times especially with the isiXhosa-speaking participants which has its added limitations such as reduced rapport and the

possibility of misinterpretations (573). In my capacity as a research assistant for the DCHS, I actively participated in the careful measures taken by the study to prevent disparities. This included assisting in the thorough training of fellow research assistants and interpreters, along with attending regular consensus meetings to ensure consistency in procedures across different teams.

8.3.6. Violence exposure assessment

Some of the strengths of the thesis lie in the use of the CECV to assess childhood violence exposure. Specifically, through the various types of violence captured by the CECV, I was able to create violence exposure subscales, enabling comprehensive assessment. Furthermore, I could investigate polyvictimisation, which allowed me to investigate the burden of violence experienced by the young children in the DCHS. However, there are also limitations that came with the CECV, the main one being that caregivers were the primary respondents. As discussed in Chapters 5 – 7, this may have resulted in social desirability bias such that caregivers might have underreported their children’s exposure to violence. However, from my personal experience spanning 6 years administering this measure in the DCHS, parents were largely forthcoming in their reporting of violent experiences, especially pertaining to community violence. When asked about maltreatment, they would often voice their awareness of the controversies surrounding the use of harsh disciplinary practices before reporting on said use. There are number of possible explanations for this: Firstly, as previously discussed, the ban on the use of corporal punishment in the home was only made by the South African Constitutional court in 2019. This together with the widespread normalisation of violence in South Africa meant that caregivers may have not had any reservations about divulging information about their harsh disciplinary practices, believing that their actions were legally permissible. Indeed, I found that on a separate questionnaire, the Paediatric Emotional Distress Scale, when I asked caregivers whether their child had had any traumatic experience, their responses would be typically no, despite having described such experiences on the CECV. It is quite likely that violence is such a common phenomenon in the DCHS communities like others in South Africa, such that individuals living in these settings no longer view them as traumatic or significant. Indeed, researchers have documented desensitization in individuals living in high violence settings (16,574). It is possible that this is a necessary adaptation in order to cope.

Secondly, it is possible that the DCHS study environment created an atmosphere that made it possible for the participants to trust study staff with such sensitive information (575) . The majority of the participants used the public health services which are overburdened (401) as such people are not always afforded the opportunity to discuss sensitive issues at health care visits. The interview format of the DCHS questionnaires accommodated the low literacy levels among participants providing them with an unusual level of attention and the opportunity to talk freely about domestic and community violence. Lastly, a combination of these possible explanations is also possible. Of course, despite the points above, there still exists the possibility that caregivers were not always as forthcoming in their reports and the children in the DCHS might have had more violent experiences. This is further plausible given that some of the caregivers' knowledge on the violence their children experienced was at times dependent on their children or others informing them. This might not have occurred as the children may have struggled to convey these experiences or to recognise their significance (576). This is further understandable given the ubiquity of certain exposures like community violence in their life together with the widespread normalisation of violence in South Africa as described above. Indeed, one of the reasons self-report measures of violence for children as young as those sampled are discouraged as children may be too young to accurately describe their experiences and doing so may risk retraumatising them (577,578).

The CECV response options (item level) were binarised into “exposed” and “unexposed” in Chapter 5-7. This was done as it may not be always possible to accurately recall exact frequencies when questioned. Furthermore, response options such as “a few times” and “many times” on the CECV are not specific and require subjective interpretation to an extent (579,580). Finally, it meant that subscore totals were a reflection of the variety of exposures experienced, distinct from the frequency with which they occurred. However, it means that exposure frequency was not captured in the current analyses. Despite this limitation, the thesis was able to highlight the high levels of violence children in the DCHS experience, laying the foundation for future research to assess frequency of exposures.

The CECV measures lifetime exposure to violence, as such data could not be collected on exact timing of exposure. This limitation meant that I could not investigate longitudinal patterns of violence exposure or its longitudinal associations with mental health and cognitive outcomes. However, a strength of the thesis is the use of prospective analyses in Chapter 5-7. This is important given that a majority of research in the field has used cross-sectional

analyses and assessed violence exposure retrospectively (14,16,17,118,267). As such the potential for reverse causation and recall bias is reduced in the Thesis analyses.

The CECV was not created with subscales in mind as such, the theoretical subscales I created varied in terms of the number of items they encompassed. Consequently, results from the linear regression analyses in Chapters 6-7 are not directly comparable across subscales. This is because a one-unit change in violence exposure within one subscale does not equate to a one-unit change in violence exposure within another subscale. However valuable contributions were made from examining each subscale's association with mental health and cognitive outcomes in the DCHS.

Another limitation of the CECV and the thesis overall is that other forms of violence such as racial violence or bullying were not assessed, as such we are limited in our understanding of the extend of these exposures in the lives of the DCHS and how they relate with the children's mental health and cognition. These forms of violence have been reported in the lives of older South African children living in similar settings (537,581). Furthermore, the Scoping review in Chapter 3 provides insights into the association between bullying and mental health outcomes in children from LMICs.

8.3.7. Caregiver report of mental health outcomes

Reliability and validity of the CBCL 1.5-5 has been established in most HICs and some LMICs (582), however only a few South African studies have assessed the measure's internal consistency (583,584), despite its popular use. Although assessments of internal consistency of the internalising and externalising behavioural problems scales in the DCHS were acceptable, there is no telling whether it is applicable to the south African context. Furthermore, given the children's age, this version of the CBCL is relies on caregiver report. It is therefore possible that caregivers might have underreported their child's behavioural problems due to social desirability bias or overreported problems based on their emotional state and/or in hope for benefits associated with diagnosis (585). However, researchers have argued that young children have underdeveloped language skills, tend to respond to mental health questions based on their current state of mind as opposed to their general levels of wellbeing, may be less reliable in assessing their own mental health and can under-report symptoms (72,586–589). Perhaps more clinician administered objective measures, multiple

informants or a combination should be used in the future. However, there are costs involved with these methods that have to be considered.

8.3.8. Cultural appropriateness of cognitive measures

The inclusion of cognitive measures meant that I was able to investigate associations between violence exposure and cognitive outcomes in the DCHS children. This was a key strength of the thesis as it addressed a critical evidence gap. However, there are limitations to the types of cognitive measures used. Specifically, all the measures were created in Western contexts, although the majority have been used in South Africa and other LMICs, there were not all evaluated for suitability in the South African context. For example, while the Peabody Picture Vocabulary Test, fourth edition (PPVT-IV) has been widely used to assess children's receptive vocabulary and was previously validated in other South African studies (497,498), the full version was not administered in the DCHS as there were no available translations for items 61 to 228, given the difficulty in matching those items to the South African context. The DCHS also had to adapt the Day/Night Stroop to fit the study context as the children were unfamiliar with the picture of the *moon* used to depict *night* in the test. Furthermore, the Kaufman Assessment Battery for Children, second edition (KABC-II) Expressive Vocabulary subtest is not widely used in non-Western contexts due to concerns about cultural fairness (494). For example it requires children to identify and name picture items that include a *mailbox* and a *unicorn*, which are not common in the majority of South African children's lives especially those from a low SES background who live in informal housing and do not have access to Western learning material. The KABC-II was included in the DCHS given the limited availability of alternative measures of expressive vocabulary. Other KABC-II subtests, Atlantis 1 and 2 which assess learning and memory, respectively, have also been questioned in terms their cultural appropriateness in the South African context. The subtests present children with a series of pictures paired with nonsense words. A previous South African study opted to use isiZulu pronunciations instead of those recommended in the manual following challenges encountered with the nonsense words in a pilot study (590). While it is possible that the lack of associations between either of these outcomes with violence may be attributed to these challenges, the distribution of scores showed variability suggestive of a true finding. Furthermore, the KABC-II is considered one of the most widely validated and culture fair tools available despite these limitations (494,500,591).

In contrast, there were floor effects in the assessment of cognitive flexibility using the Dimensional Change Card Sort (DCSS), evidenced by predominantly low scores within the DCHS sample. For instance, the median score and the interquartile range for this test were 0 [0 - 5], indicating that most participants scored at the bottom of the scale. It is possible that this was due to generally underdeveloped cognitive skills across the sample in this domain, however, it is also possible that the test might not be sensitive enough to capture variations in cognitive flexibility for the DCHS children warranting the use an alternative measure.

8.3.9. Generalisability of findings

Given that the roots and nature of interpersonal violence in South Africa are unique and specific to its history, the findings of the thesis may not be directly applicable to other LMIC contexts. Therefore, caution should be exercised in generalising the thesis findings to other contexts, this may pertain to forms of violence such as community violence, that are characterised by gang violence, use of guns and homicide that are more prevalent in South Africa and other LMICs specifically in the Americas (2). As such other contexts may experience other forms of community violence, such as witnessing muggings or people fighting. However, other forms of violence such as maltreatment and IPV although prevalent globally, are more prevalent in LMICs and the nature may vary. For example, some LMICs do not have laws that ban the use of corporal punishment, whilst in others, corporal punishment is still lawful (592). As such, the findings from the thesis may be generalisable to similar contexts where corporal punishment is prevalent and not others where the nature of child maltreatment may constitute primarily emotional and/or physical abuse.

8.4. Implications and future directions

The findings of the thesis strongly suggest the need for interventions tackling the human rights violation that is violence, in line with the Sustainable Development Goals (SDGs)(593). Children in LMICs are particularly vulnerable to this epidemic and need targeted interventions that protect them in their homes and communities (2). Given the complexities that exist in the South African context, structural issues related to oppression

and socioeconomic marginalisation would need to be addressed. This may involve the provision of redress of the socioeconomic and health disparities that exist as part of the apartheid legacy (594). It may also mean enforcement of laws that protect South African children against maltreatment, this may be a crucial step in advocating for the needs of this vulnerable and often overlooked group of people. Importantly, parenting interventions that provide support to parents (especially single or non-parent caregivers) to promote socioeconomic development and good parenting may be warranted in South Africa as they have been shown to be effective in other contexts (595). Furthermore, interventions targeting boys living in contexts similar to the DCHS who experience disproportionately higher levels of maltreatment and polyvictimisation may be needed to reduce their burden of violence.

Given the issues surrounding the measurement of violence exposure in young children, more research is needed investigating the developmental capacity of young children to provide self-reports of exposure. This may be investigated in conjunction with a multi-informant approach. The thesis also identified crucial gaps in the literature investigating relationships between violence exposure and cognition in children. As such further research is needed to in this area which can add to our understanding of the patterns of association. The thesis findings also suggest the ongoing need for culturally appropriate measures of children's cognitive functions in South Africa. Such measures would need to take into account the multi-cultural and linguistic context.

The thesis highlighted the detrimental effects of violence exposure on mental health and cognitive functioning of preschoolers in LMICS. Having difficulties in either of these domains not only affects children's general wellbeing but additionally reduces their chances to effectively cope with the demands of school (596). Indeed, therapeutic interventions would be important to help children with psychological adjustment (596) while cognitive remediation may improve cognitive functioning (597). Of note, research on resilience has documented the protective effects of various factors including the supportive family, peer and community networks in children exposed to violence (203). As such interventions that promote these factors may be further important in protecting children against the harmful effects of violence. This is particularly crucial alongside interventions to eradicate violence. Furthermore, supportive family interventions providing resources for cognitive stimulation would assist the cognitive development in low resource settings (598). Future studies should also investigate mechanisms and moderators involved in the associations between violence

exposure and mental health and cognitive outcomes of preschoolers. This would ensure that interventions are tailored to high-risk subgroups and target factors that increase impairment.

Notably, these findings highlight the challenges that children in South Africa and similar LMIC contexts face that may impact their development. Prioritising their wellbeing is extremely relevant for their successful development and should be a public health priority.

8.5. Conclusion

In this thesis I aimed to investigate the mental health and cognitive outcomes of young children from LMICs exposed to violence. Through comprehensive reviews, I found that exposure to violence such as IPV and maltreatment increases the risk of experiencing mental health problems and poor cognitive functioning in children from LMICs. Furthermore, findings involving South African preschoolers in the DCHS, highlighted not only the alarming prevalence of violence, especially community violence, from an early age in this sample but also its association with internalising and externalising behaviour problems as well poor selective attention, inhibition, nonverbal intelligence, and receptive language, during the preschool years. The implications of this research are significant, emphasising the urgent need for efforts to eradicate violence and support affected children, especially in LMICs where these young victims are often overlooked in research despite the high burden of violence they experience. These findings lay the groundwork for future investigations into the mediators and moderators of these relationships and calls for research on protective factors that could foster resilience among children in violent environments. Research I hope to pursue in the near future.

References

1. Butchart A, Mikton C, Dahlberg LL, Krug EG. Global status report on violence prevention 2014. Injury Prevention [Internet]. 2015 Jun;21(3):213. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25995201>
2. World Health Organization. Global status report on preventing violence against children 2020 [Internet]. 2020. 2020 [cited 2022 Oct 31]. Available from: <https://apps.who.int/iris/bitstream/handle/10665/332394/9789240004191-eng.pdf>
3. Gilbert R, Widom CS, Browne K, Fergusson D, Webb E, Janson S. Burden and consequences of child maltreatment in high-income countries. *The Lancet* [Internet]. 2009 Jan 3 [cited 2020 Nov 11];373(9657):68–81. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0140673608617067>
4. Unicef. The state of the world's children 2019: statistical tables. United Nations Children's Fund, New York. 2019;
5. World Health Organization. Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016 [Internet]. Geneva; 2018. Available from: <https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates>
6. Black MM, Walker SP, Fernald LCH, Andersen CT, DiGirolamo AM, Lu C, et al. Early childhood development coming of age: science through the life course. *The Lancet* [Internet]. 2017 Jan 1 [cited 2022 Oct 23];389(10064):77–90. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5884058/>
7. Pestieau P, Lefebvre M. The welfare state in Europe: Economic and social perspectives. Oxford University Press; 2018.
8. Irwin L, Siddiqi A, Herztman C. Early child development : A powerful equalizer. Final Report for the World Health Organization's Commission on the Social Determinants of Health. http://www.who.int/social_determinants/resources/ecd_kn_report_07_2007.pdf [Internet]. 2007; Available from: <https://ci.nii.ac.jp/naid/10026507958/en/>
9. Britto PR, Lye SJ, Proulx K, Yousafzai AK, Matthews SG, Vaivada T, et al. Nurturing care: promoting early childhood development. *The Lancet* [Internet]. 2017 Jan [cited 2023 Dec 12];389(10064):91–102. Available from: <http://dx.doi.org/10.1016>
10. Shonkoff JP, Phillips DA, National Research Council (U.S.). Committee on Integrating the Science of Early Childhood Development. From neurons to neighborhoods : the science of early child development. National Academy Press; 2000. 588 p.
11. Devakumar D, Palfreyman A, Uthayakumar-Cumarasamy A, Ullah N, Ranasinghe C, Minckas N, et al. Mental health of women and children experiencing family violence in conflict settings: a mixed methods systematic review. *Confl Health* [Internet]. 2021

- Dec 1 [cited 2022 Oct 31];15(1):1–19. Available from:
<https://conflictandhealth.biomedcentral.com/articles/10.1186/s13031-021-00410-4>
12. Leeb RT, Lewis T, Zolotor AJ. A Review of Physical and Mental Health Consequences of Child Abuse and Neglect and Implications for Practice. *Am J Lifestyle Med* [Internet]. 2011 Sep 3 [cited 2022 Sep 7];5(5):454–68. Available from: <https://journals.sagepub.com/doi/full/10.1177/1559827611410266>
 13. Ribeiro WS, Andreoli SB, Ferri CP, Prince M, Mari JDJ. Exposure to violence and mental health problems in low and middle-income countries: a literature review [Internet]. Vol. 31, *Revista Brasileira de Psiquiatria. Associação Brasileira de Psiquiatria*; 2009 [cited 2022 Oct 31]. p. S49–57. Available from: <http://www.scielo.br/j/rbp/a/NXwXSNY6XrmvJ57gzHwst5c/?format=html&lang=en>
 14. Baldwin JR, Wang B, Karwatowska L, Schoeler T, Tsaligopoulou A, Munafò MR, et al. Childhood Maltreatment and Mental Health Problems: A Systematic Review and Meta-Analysis of Quasi-Experimental Studies. *Am J Psychiatry* [Internet]. 2023 Feb 1 [cited 2023 Apr 26];180(2):117–26. Available from: <https://ajp.psychiatryonline.org/doi/10.1176/appi.ajp.20220174>
 15. Thabet A, Vostanis P. Impact of political violence and trauma in Gaza on children's mental health and types of interventions: A review of research evidence in a historical context. *International Journal of Peace and Development Studies* [Internet]. 2011 [cited 2023 Apr 24];2(8):214–8. Available from: <https://academicjournals.org/journal/IJPDS/article-full-text-pdf/7F6380841087>
 16. Fowler PJ, Tompsett CJ, Braciszewski JM, Jacques-Tiura AJ, Baltes BB. Community violence: A meta-analysis on the effect of exposure and mental health outcomes of children and adolescents. *Dev Psychopathol* [Internet]. 2009 Jan 15 [cited 2020 Nov 10];21(1):227–59. Available from: https://www.cambridge.org/core/product/identifier/S0954579409000145/type/journal_article
 17. Savopoulos P, Bryant C, Fogarty A, Conway LJ, Fitzpatrick KM, Condron P, et al. Intimate Partner Violence and Child and Adolescent Cognitive Development: A Systematic Review [Internet]. *Trauma, Violence, and Abuse*. SAGE Publications Ltd; 2022 [cited 2023 Apr 22]. Available from: https://journals.sagepub.com/doi/full/10.1177/15248380221082081?casa_token=7UR1BTgDOWwAAAAA%3A5zVuIpAEGqINPF1Mt7zmKn7jkmEITHjsa0nMCD7KYDEQmxkAOGoSELvbBe4iaCcZWtkXenxZoxXesw
 18. Matte-Landry A, Grisé Bolduc MÈ, Tanguay-Garneau L, Collin-Vézina D, Ouellet-Morin I. Cognitive Outcomes of Children With Complex Trauma: A Systematic Review and Meta-Analyses of Longitudinal Studies. *Trauma Violence Abuse* [Internet]. 2022 Jul 4 [cited 2022 Nov 1];0(0):1–15. Available from: <https://journals.sagepub.com/doi/full/10.1177/15248380221111484>
 19. Maguire SA, Williams B, Naughton AM, Cowley LE, Tempest V, Mann MK, et al. A systematic review of the emotional, behavioural and cognitive features exhibited by school-aged children experiencing neglect or emotional abuse. *Child Care Health Dev*

- [Internet]. 2015 Sep 1;41(5):641–53. Available from: <https://onlinelibrary.wiley.com/doi/10.1111/cch.12227>
20. Su Y, D'Arcy C, Yuan S, Meng X. How does childhood maltreatment influence ensuing cognitive functioning among people with the exposure of childhood maltreatment? A systematic review of prospective cohort studies. *J Affect Disord* [Internet]. 2019 Jun 1 [cited 2020 Sep 21];252(August):278–93. Available from: <http://www.sciencedirect.com/science/article/pii/S0165032719300862>
21. Irigaray TQ, Pacheco JB, Grassi-Oliveira R, Fonseca RP, Leite JC de C, Kristensen CH. Child maltreatment and later cognitive functioning: a systematic review. *Psicologia: Reflexão e Crítica* [Internet]. 2013 [cited 2020 Sep 21];26(2):376–87. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-79722013000200018&lng=en&nrm=iso&tlang=en
22. Romano E, Babchishin L, Marquis R, Fréchette S. Childhood Maltreatment and Educational Outcomes. *Trauma Violence Abuse* [Internet]. 2015 Oct 4 [cited 2020 Dec 16];16(4):418–37. Available from: <http://journals.sagepub.com/doi/10.1177/1524838014537908>
23. Lloyd M. Domestic Violence and Education: Examining the Impact of Domestic Violence on Young Children, Children, and Young People and the Potential Role of Schools. *Front Psychol* [Internet]. 2018 Nov 13 [cited 2022 Nov 15];9(NOV). Available from: [/pmc/articles/PMC6243007/](https://pmc/articles/PMC6243007/)
24. Sherr L, Hensels IS, Skeen S, Tomlinson M, Roberts KJ, Macedo A. Exposure to violence predicts poor educational outcomes in young children in South Africa and Malawi. *Int Health* [Internet]. 2015 Dec 17;8(1):ihv070. Available from: <https://academic.oup.com/inthealth/article-lookup/doi/10.1093/inthealth/ihv070>
25. Fry D, Fang X, Elliott S, Casey T, Zheng X, Li J, et al. The relationships between violence in childhood and educational outcomes: A global systematic review and meta-analysis. *Child Abuse Negl* [Internet]. 2018 Jan 1 [cited 2020 Sep 21];75:6–28. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0145213417302491>
26. Schwartz D, Gorman AH. Community violence exposure and children's academic functioning. *J Educ Psychol* [Internet]. 2003 Mar;95(1):163–73. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/0022-0663.95.1.163>
27. Jaffee SR, Ambler A, Merrick M, Goldman-Mellor S, Odgers CL, Fisher HL, et al. Childhood Maltreatment Predicts Poor Economic and Educational Outcomes in the Transition to Adulthood. *Am J Public Health* [Internet]. 2018 Sep 1;108(9):1142–7. Available from: <https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2018.304587>
28. Danese A, McEwen BS. Adverse childhood experiences, allostatic load, and age-related disease. *Physiol Behav*. 2012;106(1):29–39.
29. Shonkoff JP, Boyce WT, McEwen BS. Neuroscience, Molecular Biology, and the Childhood Roots of Health Disparities: Building a New Framework for Health Promotion and Disease Prevention. *JAMA* [Internet]. 2009 Jun 3 [cited 2023 May]

- 10];301(21):2252–9. Available from:
<https://jamanetwork.com/journals/jama/fullarticle/184019>
30. Danese A, Baldwin JR. Hidden Wounds? Inflammatory Links Between Childhood Trauma and Psychopathology. *Annu Rev Psychol* [Internet]. 2017 Jan 3;68(1):517–44. Available from: <https://www.annualreviews.org/doi/full/10.1146/annurev-psych-010416-044208>
 31. Lupien SJ, McEwen BS, Gunnar MR, Heim C. Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nat Rev Neurosci* [Internet]. 2009 Jun 29;10(6):434–45. Available from: <http://www.nature.com/articles/nrn2639>
 32. Sapolsky RM. Why stress is bad for your brain. *Science* (1979). 1996;273(5276):749–50.
 33. Pereznieta P, Montes A, Routier S, Langston L. The Costs and Economic Impact of Violence against Children. *ChildFund* [Internet]. 2014 [cited 2021 Feb 1];(September):1–65. Available from:
https://www.childfund.org/uploadedFiles/public_site/media/ODI Report The cost and economic impact of violence against children.pdf
 34. Mercy JA, Hillis SD, Butchart A, Bellis MA, Ward CL, Fang X, et al. Interpersonal Violence: Global Impact and Paths to Prevention. In: Disease Control Priorities, Third Edition (Volume 7): Injury Prevention and Environmental Health [Internet]. The World Bank; 2017 [cited 2023 May 29]. p. 71–96. Available from:
<https://www.ncbi.nlm.nih.gov/books/NBK525208/>
 35. UNESCO. School Violence and Bullying Global Status Report Sustainable Development Goals United Nations Educational, Scientific and Cultural Organization [Internet]. 2017. Available from: <http://www.unesco.org/open-access/terms-use-ccbysa-en>
 36. Centre UIR, Chávez C, Aguilar M. The Impact of Community Violence on Educational Outcomes: A Review of the Literature [Internet]. United Nations; 2021 May [cited 2023 Nov 23]. Available from: <https://www.un-ilibrary.org/content/papers/10.18356/25206796-2021-03>
 37. Bunting L, Davidson G, McCartan C, Hanratty J, Bywaters P, Mason W, et al. The association between child maltreatment and adult poverty – A systematic review of longitudinal research. *Child Abuse Negl* [Internet]. 2018 Mar 1 [cited 2023 Aug 15];77:121–33. Available from:
<https://linkinghub.elsevier.com/retrieve/pii/S0145213417304817>
 38. Suglia SF, Sapra KJ, Koenen KC. Violence and cardiovascular health: A systematic review. *Am J Prev Med* [Internet]. 2015 Feb 1;48(2):205–12. Available from:
<http://dx.doi.org/10.1016/j.amepre.2014.09.013>
 39. Nikulina V, Widom CS. Does executive functioning mediate the association between childhood maltreatment and adult psychopathy? *Compr Psychiatry* [Internet].

- 2014;55(8):e55. Available from:
<http://www.sciencedirect.com/science/article/pii/S0010440X14002235>
40. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The Long-Term Health Consequences of Child Physical Abuse, Emotional Abuse, and Neglect: A Systematic Review and Meta-Analysis. *PLoS Med* [Internet]. 2012 Nov 27;9(11):e1001349. Available from: <https://doi.org/10.1371/journal.pmed.1001349>
41. Wright AW, Austin M, Booth C, Kliewer W. Systematic Review: Exposure to Community Violence and Physical Health Outcomes in Youth. *J Pediatr Psychol* [Internet]. 2016 Oct 27;42(4):364–78. Available from:
<https://doi.org/10.1093/jpepsy/jsw088>
42. Domond P, Orri M, Vergunst F, Bouchard S, Findlay L, Kohen D, et al. Childhood Abuse, Intimate Partner Violence in Young Adulthood, and Welfare Receipt by Midlife. *Pediatrics* [Internet]. 2023 Mar 1 [cited 2023 Aug 15];151(3). Available from: [/pediatrics/article/151/3/e2022057379/190634/Childhood-Abuse-Intimate-Partner-Violence-in-Young](https://pediatrics.org/doi/10.1542/peds.2022-057379)
43. de Ribera OS, Trajtenberg N, Shenderovich Y, Murray J. Correlates of youth violence in low- and middle-income countries: A meta-analysis. *Aggress Violent Behav*. 2019 Nov 1;49:101306.
44. Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. *The Lancet* [Internet]. 2002;360(9339):1083–8. Available from:
[https://www.sciencedirect.com/science/article/pii/S0140673602111330](http://www.sciencedirect.com/science/article/pii/S0140673602111330)
45. Mathers CD, Inoue M, Guigoz Y, Lozano R, Tomaskovic L. Statistical annex. R LozanoWorld report on violence and health. 2002;255–325.
46. Jewkes RK, Dunkle K, Nduna M, Jama PN, Puren A. Associations between childhood adversity and depression, substance abuse and HIV and HSV2 incident infections in rural South African youth. *Child Abuse Negl*. 2010;34(11):833–41.
47. Skeen S, Macedo A, Tomlinson M, Hensels IS, Sherr L. Exposure to violence and psychological well-being over time in children affected by HIV/AIDS in South Africa and Malawi. *AIDS Care* [Internet]. 2016 Mar 24;28(sup1):16–25. Available from: <http://www.tandfonline.com/doi/full/10.1080/09540121.2016.1146219>
48. Reza A, Breiding MJ, Gulaid J, Mercy JA, Blanton C, Mthethwa Z, et al. Sexual violence and its health consequences for female children in Swaziland: a cluster survey study. *The Lancet* [Internet]. 2009;373(9679):1966–72. Available from:
www.thelancet.com
49. Norman R, Matzopoulos R, Groenewald P, Bradshaw D, Bradshaw D. The high burden of injuries in South Africa. *Bull World Health Organ* [Internet]. 2007 Sep;85(9):695–702. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/18026626>
50. Collins PY, Patel V, Joestl SS, March D, Insel TR, Daar AS, et al. Grand challenges in global mental health. *Nature*. 2011;475(7354):27–30.

51. Becker AE, Kleinman A. Mental health and the global agenda. *New England Journal of Medicine*. 2013;369(1):66–73.
52. Finkelhor D, Turner H, Hamby S, Ormrod R. Polyvictimization: Children's Exposure to Multiple Types of Violence, Crime, and Abuse. *National Survey of Children's Exposure to Violence [Internet]*. 2011 Oct 1 [cited 2023 Apr 27]; Available from: <https://scholars.unh.edu/ccrc/25>
53. Fry DA, Elliott SP. Understanding the linkages between violence against women and violence against children. *Lancet Glob Health [Internet]*. 2017 May 1 [cited 2024 Apr 9];5(5):e472–3. Available from: <http://www.thelancet.com/article/S2214109X17301535/fulltext>
54. Guedes A, Bott S, Garcia-Moreno C, Colombini M. Bridging the gaps: a global review of intersections of violence against women and violence against children. *Glob Health Action [Internet]*. 2016 Dec 1 [cited 2024 Apr 9];9(1). Available from: <https://www.tandfonline.com/doi/abs/10.3402/gha.v9.31516>
55. Pearson I, Page S, Zimmerman C, Meinck F, Gennari F, Guedes A, et al. The Co-Occurrence of Intimate Partner Violence and Violence Against Children: A Systematic Review on Associated Factors in Low- and Middle-Income Countries. *Trauma Violence Abuse [Internet]*. 2023 Oct 28 [cited 2024 Apr 9];24(4):2097–114. Available from: <https://doi.org/10.1177/15248380221082943>
56. Achenbach TM. The classification of children's psychiatric symptoms: a factor-analytic study. *Psychological Monographs: general and applied*. 1966;80(7):1.
57. Cicchetti D, Valentino K. An Ecological-Transactional Perspective on Child Maltreatment: Failure of the Average Expectable Environment and Its Influence on Child Development. In: *Developmental Psychopathology [Internet]*. Wiley; 2015. p. 129–201. Available from: <https://onlinelibrary.wiley.com/doi/10.1002/9780470939406.ch4>
58. Coulton CJ, Crampton DS, Irwin M, Spilsbury JC, Korbin JE. How neighborhoods influence child maltreatment: A review of the literature and alternative pathways. *Child Abuse Negl*. 2007 Nov 1;31(11–12):1117–42.
59. Solomon A, Maguire-Jack K, Marçal K. Neighborhoods and child abuse: Multiple informant perspectives. *Child Abuse Negl [Internet]*. 2023 Oct 1 [cited 2024 Apr 9];144:106331. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0145213423003198>
60. Wright EM, Pinchevsky GM, Xie M. Neighborhoods and Intimate Partner Violence: A Decade in Review. [https://doi.org/10.1177/1557085120987632 \[Internet\]](https://doi.org/10.1177/1557085120987632). 2021 Jan 15 [cited 2024 Apr 9];16(3):337–50. Available from: <https://journals.sagepub.com/doi/10.1177/1557085120987632?cid=int.sj-full-text.similar-articles.1>
61. Matzopoulos R, Bowman B, Butchart A, Mercy JA. The impact of violence on health in low- to middle-income countries. *Int J Inj Contr Saf Promot [Internet]*. 2008 Dec 1

- [cited 2022 Nov 1];15(4):177–87. Available from:
<https://doi.org/10.1080/17457300802396487>
62. Kimber M, Adham S, Gill S, McTavish J, MacMillan HL. The association between child exposure to intimate partner violence (IPV) and perpetration of IPV in adulthood—A systematic review. *Child Abuse Negl.* 2018 Feb 1;76:273–86.
 63. Adams TR, Handley ED, Manly JT, Cicchetti D, Toth SL. Intimate partner violence as a mechanism underlying the intergenerational transmission of maltreatment among economically disadvantaged mothers and their adolescent daughters. *Dev Psychopathol.* 2019;31(1):83–93.
 64. Widom CS, Czaja S, Dutton MA. Child abuse and neglect and intimate partner violence victimization and perpetration: A prospective investigation. *Child Abuse Negl.* 2014 Apr 1;38(4):650–63.
 65. Langevin R, Marshall C, Kingsland E. Intergenerational Cycles of Maltreatment: A Scoping Review of Psychosocial Risk and Protective Factors [Internet]. Vol. 22, Trauma, Violence, and Abuse. 2021 [cited 2023 Mar 14]. p. 672–88. Available from: <http://journals.sagepub.com/doi/10.1177/1524838019870917>
 66. Berlin LJ, Appleyard K, Dodge KA. Intergenerational Continuity in Child Maltreatment: Mediating Mechanisms and Implications for Prevention. *Child Dev* [Internet]. 2011 Jan 1 [cited 2024 Apr 10];82(1):162–76. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1467-8624.2010.01547.x>
 67. Achenbach T, Rescorla L. Achenbach System of Empirically Based Assessment. In: Encyclopedia of Autism Spectrum Disorders [Internet]. New York, NY: Springer New York; 2013 [cited 2023 May 2]. p. 31–9. Available from: https://link.springer.com/referenceworkentry/10.1007/978-1-4419-1698-3_219
 68. Achenbach TM. The Achenbach system of empirically based assessment (ASEBA): Development, findings, theory, and applications. University of Vermont, Research Center for Children, Youth, & Families; 2009.
 69. Polanczyk G V., Salum GA, Sugaya LS, Caye A, Rohde LA. Annual Research Review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *Journal of Child Psychology and Psychiatry* [Internet]. 2015 Mar 1 [cited 2023 Aug 31];56(3):345–65. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/jcpp.12381>
 70. Vasileva M, Graf RK, Reinelt T, Petermann U, Petermann F. Research review: A meta-analysis of the international prevalence and comorbidity of mental disorders in children between 1 and 7 years. *Journal of Child Psychology and Psychiatry* [Internet]. 2021 Apr 20 [cited 2023 Aug 31];62(4):372–81. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/jcpp.13261>
 71. Grills AE, Ollendick TH. Issues in Parent-Child Agreement: The Case of Structured Diagnostic Interviews. *Clin Child Fam Psychol Rev.* 2002;5(1).

72. Marsh H, Debus R, Bornholt L. Validating young children's self-concept responses: Methodological ways and means to understand their responses. *Handbook of research methods in developmental science*. 2005;23–160.
73. Edelbrock C, Costello AJ, Dulcan MK, Kalas R, Conover NC. Age Differences in the Reliability of the Psychiatric Interview of the Child. *Child Dev*. 1985 Feb;56(1):265.
74. Maldonado BN, Chandna J, Gladstone M. A systematic review of tools used to screen and assess for externalising behaviour symptoms in low and middle income settings. *Global Mental Health [Internet]*. 2019 [cited 2023 Nov 6];6(e13):e13. Available from: <https://www.cambridge.org/core/journals/global-mental-health/article/systematic-review-of-tools-used-to-screen-and-assess-for-externalising-behaviour-symptoms-in-low-and-middle-income-settings/88DBACE72F026205CAA7388828736628>
75. Williams ST. Mental Health Screening and Assessment Tools for Children Literature Review Northern California Training Academy Review of Mental HealthScreening and Assessment Tools • Oct. 2008 • Page 2 PREPARED BY. 2008 [cited 2023 Nov 6]; Available from: www.humanservices.ucdavis.edu/academy
76. Pihlakoski L, Sourander A, Aromaa M, Rautava P, Helenius H, Sillanpää M. The continuity of psychopathology from early childhood to preadolescence: a prospective cohort study of 3–12-year-old children. *Eur Child Adolesc Psychiatry*. 2006;15:409–17.
77. Morgan PL, Farkas G, Wu Q. Kindergarten predictors of recurring externalizing and internalizing psychopathology in the third and fifth grades. *J Emot Behav Disord*. 2009;17(2):67–79.
78. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005;62(6):593–602.
79. Prior M, Smart D, Sanson A, Oberklaid F. Longitudinal predictors of behavioural adjustment in pre-adolescent children. *Australian & New Zealand Journal of Psychiatry*. 2001;35(3):297–307.
80. Bosquet M, Egeland B. The development and maintenance of anxiety symptoms from infancy through adolescence in a longitudinal sample. *Dev Psychopathol*. 2006;18(2):517–50.
81. Gilbert R, Widom CS, Browne K, Fergusson D, Webb E, Janson S. Burden and consequences of child maltreatment in high-income countries. *The Lancet [Internet]*. 2009 Jan [cited 2023 Aug 31];373(9657):68–81. Available from: www.thelancet.com
82. Collishaw S. Annual Research Review: Secular trends in child and adolescent mental health. *Journal of Child Psychology and Psychiatry [Internet]*. 2015 Mar 1 [cited 2023 Aug 31];56(3):370–93. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/jcpp.12372>

83. Roder V, Medalia A. Neurocognition and social cognition in schizophrenia patients: basic concepts and treatment. Vol. 177. Karger Medical and Scientific Publishers; 2010.
84. Josman N, Abdallah TM, Engel-Yeger B. Using the LOTCA to measure cultural and sociodemographic effects on cognitive skills in two groups of children. *The American Journal of Occupational Therapy*. 2011;65(3):e29–37.
85. Harvey PD. Domains of cognition and their assessment. *Dialogues Clin Neurosci [Internet]*. 2019 Sep 30 [cited 2023 Nov 7];21(3):227–37. Available from: <https://www.tandfonline.com/doi/abs/10.31887/DCNS.2019.21.3/pharvey>
86. Cristofori I, Cohen-Zimerman S, Grafman J. Executive functions. *Handb Clin Neurol*. 2019 Jan 1;163:197–219.
87. Wechsler D. The measurement of adult intelligence. 1944;
88. Perkins S, Graham-Bermann S. Violence exposure and the development of school-related functioning: Mental health, neurocognition, and learning. *Aggress Violent Behav [Internet]*. 2012 Jan 1 [cited 2022 Sep 9];17(1):89–98. Available from: <https://www.sciencedirect.com/science/article/pii/S135917891100108X>
89. Baddeley AD, Logie RH. Working Memory: The Multiple-Component Model. In: *Models of Working Memory [Internet]*. Cambridge University Press; 1999. p. 28–61. Available from: https://www.cambridge.org/core/product/identifier/CBO9781139174909A012/type/book_part
90. Lezak MD. Neuropsychological assessment. Oxford University Press, USA; 2004.
91. Buening J, Brown RD. Visuospatial cognition. In: *Neuroscience of Mathematical Cognitive Development: From Infancy Through Emerging Adulthood [Internet]*. Springer International Publishing; 2018 [cited 2023 Nov 7]. p. 79–96. Available from: https://link.springer.com/chapter/10.1007/978-3-319-76409-2_5
92. Lamy D, Leber AB, Egeth HE. Selective Attention. *Handbook of Psychology, Second Edition [Internet]*. 2012 Sep 26 [cited 2023 Nov 7]; Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/9781118133880.hop204010>
93. Posner MI, Petersen SE. The Attention System of the Human Brain. *Annu Rev Neurosci [Internet]*. 1990 Mar;13(1):25–42. Available from: <https://www.annualreviews.org/doi/10.1146/annurev.ne.13.030190.000325>
94. Salthouse TA. The processing-speed theory of adult age differences in cognition. *Psychol Rev*. 1996;103(3):403.
95. Offit PA, Snow A, Fernandez T, Cardona L, Grigorenko EL, Doyle CA, et al. Visual-Motor Function. *Encyclopedia of Autism Spectrum Disorders [Internet]*. 2013 [cited 2023 Nov 7];3318–9. Available from: https://link.springer.com/referenceworkentry/10.1007/978-1-4419-1698-3_758

96. Blair C. Stress and the Development of Self-Regulation in Context. *Child Dev Perspect* [Internet]. 2010 Dec 15;4(3):181–8. Available from: <https://srcd.onlinelibrary.wiley.com/doi/10.1111/j.1750-8606.2010.00145.x>
97. Zelazo PD, Müller U. Executive function in typical and atypical development. In: *The Wiley-Blackwell handbook of childhood cognitive development*, 2nd ed. Zelazo, Philip David: Institute of Child Development, University of Minnesota, 51 East River Parkway, Minneapolis, MN, US, 55455, zelazo@umn.edu: Wiley Blackwell; 2011. p. 574–603.
98. Diamond A. Executive Functions. <https://doi.org/10.1146/annurev-psych-113011-143750> [Internet]. 2013 Jan 2 [cited 2023 Nov 7];64:135–68. Available from: <https://www.annualreviews.org/doi/abs/10.1146/annurev-psych-113011-143750>
99. Blair C. Developmental Science and Executive Function. <https://doi.org/10.1177/0963721415622634> [Internet]. 2016 Feb 10 [cited 2023 Nov 7];25(1):3–7. Available from: <https://journals.sagepub.com/doi/10.1177/0963721415622634>
100. Willoughby MT, Pek J, Blair CB. Measuring Executive Function in Early Childhood: A Focus on Maximal Reliability and the Derivation of Short Forms. *Psychol Assess* [Internet]. 2013 [cited 2023 Nov 7];25(2):664. Available from: [/pmc/articles/PMC4203363/](https://pmc/articles/PMC4203363/)
101. Hüsser A, Fourdain S, Gallagher A. Neuropsychologic assessment. *Handb Clin Neurol*. 2020 Jan 1;174:239–49.
102. Vakil E. Neuropsychological assessment: Principles, rationale, and challenges. *J Clin Exp Neuropsychol* [Internet]. 2012 Feb 1 [cited 2023 Nov 8];34(2):135–50. Available from: <https://www.tandfonline.com/doi/abs/10.1080/13803395.2011.623121>
103. Baron IS. Neuropsychological evaluation of the child: Domains, methods, & case studies. Oxford University Press; 2018.
104. Casey BJ, Tottenham N, Liston C, Durston S. Imaging the developing brain: what have we learned about cognitive development? *Trends Cogn Sci*. 2005;9(3):104–10.
105. Hertzman C, Boyce T. How experience gets under the skin to create gradients in developmental health. *Annu Rev Public Health*. 2010 Apr 21;31:329–47.
106. Deoni SCL, Dean III DC, O’Muircheartaigh J, Dirks H, Jerskey BA. Investigating white matter development in infancy and early childhood using myelin water fraction and relaxation time mapping. *Neuroimage*. 2012;63(3):1038–53.
107. Knickmeyer RC, Gouttard S, Kang C, Evans D, Wilber K, Smith JK, et al. A structural MRI study of human brain development from birth to 2 years. *Journal of neuroscience*. 2008;28(47):12176–82.
108. Shonkoff JP, Garner AS, Siegel BS, Dobbins MI, Earls MF, McGuinn L, et al. The Lifelong Effects of Early Childhood Adversity and Toxic Stress. *Pediatrics* [Internet].

- 2012 Jan 1 [cited 2023 Aug 31];129(1):e232–46. Available from: /pediatrics/article/129/1/e232/31628/The-Lifelong-Effects-of-Early-Childhood-Adversity
109. Schoon I. Childhood cognitive ability and adult academic attainment: evidence from three British cohort studies. Longit Life Course Stud [Internet]. 2010 May 31 [cited 2023 Sep 27];1(3). Available from: <http://www.llcsjournal.org/index.php/llcs/article/view/93>
 110. Osler M, Avlund K, Mortensen EL. Socio-economic position early in life, cognitive development and cognitive change from young adulthood to middle age. Eur J Public Health [Internet]. 2013 Dec 1 [cited 2023 Sep 27];23(6):974–80. Available from: <https://dx.doi.org/10.1093/eurpub/cks140>
 111. Ritchie SJ, Bates TC. Enduring Links From Childhood Mathematics and Reading Achievement to Adult Socioeconomic Status. Psychol Sci [Internet]. 2013 May 2 [cited 2023 Sep 27];24(7):1301–8. Available from: https://journals.sagepub.com/doi/full/10.1177/0956797612466268?casa_token=x4-UFHPSX0MAAAAAA%3ASBZ6OEcRUK5yAJt-HdXe3u0XPqfTb93UMVeu92tDZNyY5vkyOpqGzFSEKFt8xK9FM7mDpf6HA
 112. Carr A, Duff H, Craddock F. A Systematic Review of Reviews of the Outcome of Noninstitutional Child Maltreatment [Internet]. Vol. 21, Trauma, Violence, and Abuse. SAGE PublicationsSage CA: Los Angeles, CA; 2020 [cited 2022 Sep 7]. p. 828–43. Available from: <https://journals.sagepub.com/doi/full/10.1177/1524838018801334>
 113. Li M, D'Arcy C, Meng X. Maltreatment in childhood substantially increases the risk of adult depression and anxiety in prospective cohort studies: Systematic review, meta-analysis, and proportional attributable fractions [Internet]. Vol. 46, Psychological Medicine. Cambridge University Press; 2016 [cited 2023 May 3]. p. 717–30. Available from: <https://www.cambridge.org/core/journals/psychological-medicine/article/maltreatment-in-childhood-substantially-increases-the-risk-of-adult-depression-and-anxiety-in-prospective-cohort-studies-systematic-review-metaanalysis-and-proportional-attributable-fr>
 114. Jaffee SR. Child Maltreatment and Risk for Psychopathology in Childhood and Adulthood. Annu Rev Clin Psychol [Internet]. 2017 May 8 [cited 2023 May 12];13:525–51. Available from: <https://www.annualreviews.org/doi/abs/10.1146/annurev-clinpsy-032816-045005>
 115. Pingley T. The impact of Witnessing Domestic Violence on Children: A Systematic Review. Master of Social Work Clinical Research Papers [Internet]. 2017 [cited 2020 Oct 28];1:1–35. Available from: https://ir.stthomas.edu/ssw_mstrp/773/
 116. Lourenco LM, Baptista MN, Senra LX, Adriana A. A, Basilio C, Bhona FM de C. Consequences of Exposure to Domestic Violence for Children: A Systematic Review of the Literature. Archer Bandura, Costa, Costa, Cui, Deslandes, Edleson, Garcia-Moreno, Ghazarian, Graham-Bermann, Graham-Bermann, Grundy, Holt, Kelleher, Krug, Lourenco, Maldonado, McDonald, Minayo, O'Donnell, Reichenheim, Reveles, Salisbury, Saltzman, Sani, Sani, Senra, B, editor. Paidéia (Ribeirão Preto) [Internet].

- 2013 May;23(55):263–71. Available from:
http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-863X2013000200263&lng=en&tlang=en
117. Fong VC, Hawes D, Allen JL. A Systematic Review of Risk and Protective Factors for Externalizing Problems in Children Exposed to Intimate Partner Violence. *Trauma Violence Abuse* [Internet]. 2019 Apr 1 [cited 2022 Sep 7];20(2):149–67. Available from:
https://journals.sagepub.com/doi/full/10.1177/1524838017692383?casa_token=eDhucx1FZ6wAAAAA%3ANe_T0G_rfMjxGFC2pmI1dxH8Jh3v4lK6JSxMipmZPT-hwQEG1d47Yd4v37zs21rUAOB_P6QaQOM
118. Haahr-Pedersen I, Ershadi AAE, Hyland P, Hansen M, Perera C, Sheaf G, et al. Polyvictimization and psychopathology among children and adolescents: A systematic review of studies using the Juvenile Victimization Questionnaire. *Achenbach Achenbach, Adams, Aho, Alvarez-Lister, Alvarez-Lister, Anda, Andrews, Babchishin, Bashir, Beck, Briere, Briere, Briggs-Gowan, Chan, Chase, Chen, Cloitre, Cloitre, Contractor, Cuevas, Cyr, Cyr, Cyr, Davies, Debowska, DeHart, Dierkhising, Finkelhol A, editor. Child Abuse Negl [Internet]. 2016/10/04.* 2020 Sep 1 [cited 2020 Apr 27];107(1):104589. Available from:
<http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc17&NEWS=N&AN=2020-69735-001>
119. Le MTH, Holton S, Romero L, Fisher J. Polyvictimization Among Children and Adolescents in Low- and Lower-Middle-Income Countries: A Systematic Review and Meta-Analysis. Afifi Al-Fayez, Alyahri, Amone-P'Olak, Bayer, Betancourt, Catani, Catani, Chan, Choo, Coker, Das, Deb, Deeks, Edwards, Elbert, Escueta, Ez-Elarab, Finkelhor, Finkelhor, Finkelhor, Fry, Hamby, Harder, Karsberg, Kinyanda, Klasen, Kmet, Kohrt, Le A, editor. *Trauma Violence Abuse* [Internet]. 2018 Jul 26 [cited 2020 Oct 29];19(3):323–42. Available from:
<http://journals.sagepub.com/doi/10.1177/1524838016659489>
120. De Bellis MD, Woolley DP, Hooper SR. Neuropsychological Findings in Pediatric Maltreatment: Relationship of PTSD, Dissociative Symptoms, and Abuse/Neglect Indices to Neurocognitive Outcomes. *Child Maltreat* [Internet]. 2013 Jul 25;18(3):171–83. Available from: <https://doi.org/10.1177/1077559513497420>
121. Gould F, Clarke J, Heim C, Harvey PD, Majer M, Nemeroff CB. The effects of child abuse and neglect on cognitive functioning in adulthood. *J Psychiatr Res* [Internet]. 2012;46(4):500–6. Available from:
<http://www.sciencedirect.com/science/article/pii/S0022395612000064>
122. Lynch KS, Widom CS. Childhood maltreatment and cognitive functioning in middle adulthood. *Child Abuse Negl*. 2022 Oct 1;132:105791.
123. Nikulina V, Widom CS. Child Maltreatment and Executive Functioning in Middle Adulthood: A Prospective Examination. *Neuropsychology* [Internet]. 2013 Jul [cited 2023 Nov 9];27(4):417–27. Available from: [/pmc/articles/PMC3855039/](https://PMC3855039/)

124. Schwab-Stone ME, Ayers TS, Kasprow W, Voyce C, Barone C, Shriver T, et al. No safe haven: A study of violence exposure in an urban community. *J Am Acad Child Adolesc Psychiatry*. 1995;34(10):1343–52.
125. Margolin G, Vickerman KA, Oliver PH, Gordis EB. Violence Exposure in Multiple Interpersonal Domains: Cumulative and Differential Effects. *Journal of Adolescent Health*. 2010;47(2):198–205.
126. Carrión VG, Weems CF, Eliez S, Patwardhan A, Brown W, Ray RD, et al. Attenuation of frontal asymmetry in pediatric posttraumatic stress disorder. *Biol Psychiatry*. 2001;50(12):943–51.
127. De Bellis MD, Keshavan MS, Shifflett H, Iyengar S, Beers SR, Hall J, et al. Brain structures in pediatric maltreatment-related posttraumatic stress disorder: a sociodemographically matched study. *Biol Psychiatry*. 2002;52(11):1066–78.
128. De Brito SA, Viding E, Sebastian CL, Kelly PA, Mechelli A, Maris H, et al. Reduced orbitofrontal and temporal grey matter in a community sample of maltreated children. *Journal of child psychology and psychiatry*. 2013;54(1):105–12.
129. Hanson JL, Chung MK, Avants BB, Shirtcliff EA, Gee JC, Davidson RJ, et al. Early stress is associated with alterations in the orbitofrontal cortex: a tensor-based morphometry investigation of brain structure and behavioral risk. *Journal of neuroscience*. 2010;30(22):7466–72.
130. Carrión VG, Weems CF, Watson C, Eliez S, Menon V, Reiss AL. Converging evidence for abnormalities of the prefrontal cortex and evaluation of midsagittal structures in pediatric posttraumatic stress disorder: An MRI study. *Psychiatry Res Neuroimaging [Internet]*. 2009 Jun;172(3):226–34. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0925492708000991>
131. Richert KA, Carrión VG, Karchemskiy A, Reiss AL. Regional differences of the prefrontal cortex in pediatric PTSD: an MRI study. *Depress Anxiety*. 2006;23(1):17–25.
132. Kelly PA, Viding E, Wallace GL, Schaer M, De Brito SA, Robustelli B, et al. Cortical thickness, surface area, and gyration abnormalities in children exposed to maltreatment: neural markers of vulnerability? *Biol Psychiatry*. 2013;74(11):845–52.
133. Edmiston EE. Corticostriatal-Limbic Gray Matter Morphology in Adolescents With Self-reported Exposure to Childhood Maltreatment. *Arch Pediatr Adolesc Med [Internet]*. 2011 Dec 1;165(12):1069. Available from: <http://archpedi.jamanetwork.com/article.aspx?doi=10.1001/archpediatrics.2011.565>
134. Hanson JL, Nacewicz BM, Sutterer MJ, Cayo AA, Schaefer SM, Rudolph KD, et al. Behavioral problems after early life stress: contributions of the hippocampus and amygdala. *Biol Psychiatry*. 2015;77(4):314–23.
135. Hart H, Rubia K. Neuroimaging of child abuse: a critical review. *Front Hum Neurosci*. 2012;6:52.

136. McCrory E, De Brito SA, Viding E. The impact of childhood maltreatment: a review of neurobiological and genetic factors. *Front Psychiatry*. 2011;2:48.
137. Liao M, Yang F, Zhang Y, He Z, Song M, Jiang T, et al. Childhood Maltreatment Is Associated with Larger Left Thalamic Gray Matter Volume in Adolescents with Generalized Anxiety Disorder. Draganski B, editor. *PLoS One* [Internet]. 2013 Aug 12;8(8):e71898. Available from: <https://dx.plos.org/10.1371/journal.pone.0071898>
138. Anderson CM, Teicher MH, Polcari A, Renshaw PF. Abnormal T2 relaxation time in the cerebellar vermis of adults sexually abused in childhood:: potential role of the vermis in stress-enhanced risk for drug abuse. *Psychoneuroendocrinology*. 2002;27(1–2):231–44.
139. De Bellis MD, Hooper SR. Neural substrates for processing task-irrelevant emotional distracters in maltreated adolescents with depressive disorders: a pilot study. *J Trauma Stress*. 2012;25(2):198–202.
140. Bruce J, Fisher PA, Graham AM, Moore WE, Peake SJ, Manning AM. Patterns of brain activation in foster children and nonmaltreated children during an inhibitory control task. *Dev Psychopathol*. 2013;25(4pt1):931–41.
141. Lim L, Hart H, Mehta MA, Simmons A, Mirza K, Rubia K. Neural correlates of error processing in young people with a history of severe childhood abuse: an fMRI study. *American Journal of Psychiatry*. 2015;172(9):892–900.
142. Carrión VG, Haas BW, Garrett A, Song S, Reiss AL. Reduced hippocampal activity in youth with posttraumatic stress symptoms: an fMRI study. *J Pediatr Psychol*. 2010;35(5):559–69.
143. Graham AM, Fisher PA, Pfeifer JH. What sleeping babies hear: A functional MRI study of interparental conflict and infants' emotion processing. *Psychol Sci*. 2013;24(5):782–9.
144. Cicchetti D, Curtis WJ. An event-related potential study of the processing of affective facial expressions in young children who experienced maltreatment during the first year of life. *Dev Psychopathol*. 2005;17(3):641–77.
145. Meyer A, Proudfoot GH, Bufferd SJ, Kujawa AJ, Laptook RS, Torpey DC, et al. Self-reported and observed punitive parenting prospectively predicts increased error-related brain activity in six-year-old children. *J Abnorm Child Psychol*. 2015;43:821–9.
146. Miskovic V, Schmidt LA, Georgiades K, Boyle M, MacMillan HL. Stability of resting frontal electroencephalogram (EEG) asymmetry and cardiac vagal tone in adolescent females exposed to child maltreatment. *Dev Psychobiol*. 2009;51(6):474–87.
147. Levine S, Alpert M, Lewis GW. Infantile experience and the maturation of the pituitary adrenal axis. *Science* (1979). 1957;126(3287):1347.

148. De Bellis MD, Keshavan MS, Clark DB, Casey BJ, Giedd JN, Boring AM, et al. Developmental traumatology part II: Brain development. *Biol Psychiatry*. 1999 May 15;45(10):1271–84.
149. Carrión VG, Weems CF, Ray RD, Glaser B, Hessl D, Reiss AL. Diurnal salivary cortisol in pediatric posttraumatic stress disorder. *Biol Psychiatry*. 2002;51(7):575–82.
150. Cicchetti D, Rogosch FA. The impact of child maltreatment and psychopathology on neuroendocrine functioning. *Dev Psychopathol*. 2001;13(4):783–804.
151. Cicchetti D, Rogosch FA, Gunnar MR, Toth SL. The differential impacts of early physical and sexual abuse and internalizing problems on daytime cortisol rhythm in school-aged children. *Child Dev*. 2010;81(1):252–69.
152. Murali R, Chen E. Exposure to violence and cardiovascular and neuroendocrine measures in adolescents. *Annals of Behavioral Medicine*. 2005;30(2):155–63.
153. Carpenter LL, Tyrka AR, McDougle CJ, Malison RT, Owens MJ, Nemeroff CB, et al. Cerebrospinal fluid corticotropin-releasing factor and perceived early-life stress in depressed patients and healthy control subjects. *Neuropsychopharmacology*. 2004;29(4):777–84.
154. Heim C, Newport DJ, Heit S, Graham YP, Wilcox M, Bonsall R, et al. Pituitary-adrenal and autonomic responses to stress in women after sexual and physical abuse in childhood. *JAMA*. 2000;284(5):592–7.
155. Heim C, Mletzko T, Purselle D, Musselman DL, Nemeroff CB. The dexamethasone/corticotropin-releasing factor test in men with major depression: role of childhood trauma. *Biol Psychiatry*. 2008;63(4):398–405.
156. Trickett PK, Noll JG, Susman EJ, Shenk CE, Putnam FW. Attenuation of cortisol across development for victims of sexual abuse. *Dev Psychopathol* [Internet]. 2010 Feb [cited 2023 Sep 16];22(1):165–75. Available from: <https://www.cambridge.org/core/journals/development-and-psychopathology/article/abs/attenuation-of-cortisol-across-development-for-victims-of-sexual-abuse/1786EC6230C922137A8A533020BC2766>
157. Danese A, McEwen BS. Adverse childhood experiences, allostatic load, and age-related disease. *Physiol Behav* [Internet]. 2012 Apr 12 [cited 2023 Aug 17];106(1):29–39. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0031938411004045>
158. Gunnar M, Quevedo K. The neurobiology of stress and development. *Annu Rev Psychol*. 2007;58:145–73.
159. Lupien SJ, McEwen BS, Gunnar MR, Heim C. Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nat Rev Neurosci* [Internet]. 2009 Jun 29;10(6):434–45. Available from: <http://www.nature.com/articles/nrn2639>

160. Kim-Cohen J, Caspi A, Taylor A, Williams B, Newcombe R, Craig IW, et al. MAOA, maltreatment, and gene–environment interaction predicting children’s mental health: new evidence and a meta-analysis. *Mol Psychiatry*. 2006;11(10):903–13.
161. De Bellis MD, Baum AS, Birmaher B, Keshavan MS, Eccard CH, Boring AM, et al. Developmental traumatology part I: biological stress systems. *Biol Psychiatry*. 1999 May 15;45(10):1259–70.
162. Bremner JD. Long-term effects of childhood abuse on brain and neurobiology. *Child and Adolescent Psychiatric Clinics*. 2003;12(2):271–92.
163. Oades RD, Lasky-Su J, Christiansen H, Faraone S V, Sonuga-Barke EJS, Banaschewski T, et al. The influence of serotonin-and other genes on impulsive behavioral aggression and cognitive impulsivity in children with attention-deficit/hyperactivity disorder (ADHD): Findings from a family-based association test (FBAT) analysis. *Behavioral and Brain Functions*. 2008;4:1–14.
164. Greenough WT, Black JE, Wallace CS. Experience and brain development. *Child Dev*. 1987;539–59.
165. Ahmed AU. An overview of inflammation: Mechanism and consequences. *Frontiers of Biology in China* [Internet]. 2011 Aug 29 [cited 2023 Sep 18];6(4):274–81. Available from: <https://link.springer.com/article/10.1007/s11515-011-1123-9>
166. Bilbo SD, Schwarz JM. Early-life programming of later-life brain and behavior: a critical role for the immune system. *Front Behav Neurosci*. 2009;3:670.
167. Khandaker GM, Pearson RM, Zammit S, Lewis G, Jones PB. Association of serum interleukin 6 and C-reactive protein in childhood with depression and psychosis in young adult life: a population-based longitudinal study. *JAMA Psychiatry*. 2014;71(10):1121–8.
168. Atladóttir HÓ, Thorsen P, Østergaard L, Schendel DE, Lemcke S, Abdallah M, et al. Maternal infection requiring hospitalization during pregnancy and autism spectrum disorders. *J Autism Dev Disord*. 2010;40:1423–30.
169. Deykin EY, Macmahon B. Viral Exposure and Autism. *Am J Epidemiol* [Internet]. 1979 Jun;109(6):628–38. Available from: <https://academic.oup.com/aje/article-lookup/doi/10.1093/oxfordjournals.aje.a112726>
170. Khandaker GM, Zimbron J, Lewis G, Jones P. Prenatal maternal infection, neurodevelopment and adult schizophrenia: a systematic review of population-based studies. *Psychol Med*. 2013;43(2):239–57.
171. Mednick SA, Machon RA, Huttunen MO, Bonett D. Adult schizophrenia following prenatal exposure to an influenza epidemic. *Arch Gen Psychiatry*. 1988;45(2):189–92.
172. Boulanger LM. Immune proteins in brain development and synaptic plasticity. *Neuron*. 2009;64(1):93–109.

173. Deverman BE, Patterson PH. Cytokines and CNS development. *Neuron*. 2009;64(1):61–78.
174. Beattie EC, Stellwagen D, Morishita W, Bresnahan JC, Ha BK, Von Zastrow M, et al. Control of synaptic strength by glial TNF α . *Science* (1979). 2002;295(5563):2282–5.
175. Huh GS, Boulanger LM, Du H, Riquelme PA, Brotz TM, Shatz CJ. Functional requirement for class I MHC in CNS development and plasticity. *Science* (1979). 2000;290(5499):2155–9.
176. Paolicelli RC, Bolasco G, Pagani F, Maggi L, Scianni M, Panzanelli P, et al. Synaptic pruning by microglia is necessary for normal brain development. *Science* (1979). 2011;333(6048):1456–8.
177. Peferoen L, Kipp M, van der Valk P, van Noort JM, Amor S. Oligodendrocyte-microglia cross-talk in the central nervous system. *Immunology*. 2014;141(3):302–13.
178. Perry VH, Holmes C. Microglial priming in neurodegenerative disease. *Nat Rev Neurol*. 2014;10(4):217–24.
179. Danese A, Pariante CM, Caspi A, Taylor A, Poulton R. Childhood maltreatment predicts adult inflammation in a life-course study. *Proceedings of the National Academy of Sciences*. 2007;104(4):1319–24.
180. Baumeister D, Akhtar R, Ciufolini S, Pariante CM, Mondelli V. Childhood trauma and adulthood inflammation: a meta-analysis of peripheral C-reactive protein, interleukin-6 and tumour necrosis factor- α . *Mol Psychiatry*. 2016;21(5):642–9.
181. Coelho R, Viola TW, Walss-Bass C, Brietzke E, Grassi-Oliveira R. Childhood maltreatment and inflammatory markers: a systematic review. *Acta Psychiatr Scand*. 2014;129(3):180–92.
182. Takizawa R, Danese A, Maughan B, Arseneault L. Bullying victimization in childhood predicts inflammation and obesity at mid-life: a five-decade birth cohort study. *Psychol Med*. 2015;45(13):2705–15.
183. Shirtcliff EA, Coe CL, Pollak SD. Early childhood stress is associated with elevated antibody levels to herpes simplex virus type 1. *Proceedings of the National Academy of Sciences*. 2009;106(8):2963–7.
184. Danese A, Caspi A, Williams B, Ambler A, Sugden K, Mika J, et al. Biological embedding of stress through inflammation processes in childhood. *Mol Psychiatry*. 2011;16(3):244–6.
185. Slopen N, Kubzansky LD, McLaughlin KA, Koenen KC. Childhood adversity and inflammatory processes in youth: A prospective study. *Psychoneuroendocrinology*. 2013 Feb 1;38(2):188–200.
186. Cicchetti D, Handley ED, Rogosch FA. Child maltreatment, inflammation, and internalizing symptoms: Investigating the roles of C-reactive protein, gene variation,

- and neuroendocrine regulation. *Dev Psychopathol* [Internet]. 2015 May 6;27(2):553–66. Available from: https://www.cambridge.org/core/product/identifier/S0954579415000152/type/journal_article
187. Carpenter LL, Gawuga CE, Tyrka AR, Lee JK, Anderson GM, Price LH. Association between plasma IL-6 response to acute stress and early-life adversity in healthy adults. *Neuropsychopharmacology*. 2010;35(13):2617–23.
188. Pace TWW, Mletzko TC, Alagbe O, Musselman DL, Nemeroff CB, Miller AH, et al. Increased stress-induced inflammatory responses in male patients with major depression and increased early life stress. *American Journal of Psychiatry*. 2006;163(9):1630–3.
189. Danese A, Moffitt TE, Pariante CM, Ambler A, Poulton R, Caspi A. Elevated inflammation levels in depressed adults with a history of childhood maltreatment. *Arch Gen Psychiatry*. 2008;65(4):409–15.
190. Gouin JP, Glaser R, Malarkey WB, Beversdorf D, Kiecolt-Glaser JK. Childhood abuse and inflammatory responses to daily stressors. *Annals of Behavioral Medicine*. 2012;44(2):287–92.
191. Kiecolt-Glaser JK, Gouin JP, Weng N ping, Malarkey WB, Beversdorf DQ, Glaser R. Childhood adversity heightens the impact of later-life caregiving stress on telomere length and inflammation. *Psychosom Med*. 2011;73(1):16.
192. Tippett N, Wolke D. Socioeconomic Status and Bullying: A Meta-Analysis. *Am J Public Health* [Internet]. 2014 [cited 2023 Dec 21];104(6):e48. Available from: [/pmc/articles/PMC4061998/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4061998/)
193. Meinck F, Cluver LD, Boyes ME, Mhlongo EL. Risk and protective factors for physical and sexual abuse of children and adolescents in Africa: A review and implications for practice. *Trauma Violence Abuse*. 2015 Jan 6;16(1):81–107.
194. Walsh D, Mccartney G, Smith M, Armour G. Relationship between childhood socioeconomic position and adverse childhood experiences (ACEs): a systematic review. *J Epidemiol Community Health* [Internet]. 2019 [cited 2023 Dec 21];73:1087–93. Available from: <http://dx.doi.org/10.1136/jech-2019-212738>
195. Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield CH, Perry BD, et al. The enduring effects of abuse and related adverse experiences in childhood: A convergence of evidence from neurobiology and epidemiology. *Eur Arch Psychiatry Clin Neurosci*. 2006;256:174–86.
196. Ayoub C, O'Connor E, Rappolt-Schlichtmann G, Vallotton C, Raikes H, Chazan-Cohen R. Cognitive skill performance among young children living in poverty: Risk, change, and the promotive effects of Early Head Start. *Early Child Res Q*. 2009;24(3):289–305.

197. Burchinal M, Vernon-Feagans L, Cox M, Investigators KFLP. Cumulative social risk, parenting, and infant development in rural low-income communities. *Parent Sci Pract.* 2008;8(1):41–69.
198. Krishnakumar A, Black MM. Longitudinal predictors of competence among African American children: The role of distal and proximal risk factors. *J Appl Dev Psychol.* 2002;23(3):237–66.
199. Berens AE, Jensen SKGG, Nelson CA. Biological embedding of childhood adversity: from physiological mechanisms to clinical implications. *BMC Med.* 2017 Jul 20;15(1):135.
200. Fritz J, de Graaff AM, Caisley H, van Harmelen AL, Wilkinson PO. A Systematic Review of Amenable Resilience Factors That Moderate and/or Mediate the Relationship Between Childhood Adversity and Mental Health in Young People. *Front Psychiatry.* 2018 Jun 19;9:341825.
201. Guinasso SA, Johnson SB, Riley AW. Multiple adverse experiences and child cognitive development. *Pediatr Res [Internet].* 2016 Jan 13 [cited 2023 Jul 30];79(1–2):220–6. Available from: <https://www.nature.com/articles/pr2015195>
202. Noonan CB, Pilkington PD. Intimate partner violence and child attachment: A systematic review and meta-analysis. *Child Abuse Negl.* 2020 Nov 1;109:104765.
203. Yule K, Houston J, Grych J. Resilience in Children Exposed to Violence: A Meta-analysis of Protective Factors Across Ecological Contexts. *Clin Child Fam Psychol Rev [Internet].* 2019 Sep 15 [cited 2023 May 3];22(3):406–31. Available from: <https://link.springer.com/article/10.1007/s10567-019-00293-1>
204. Boxer P, Sloan-Power E. Coping With Violence: A Comprehensive Framework and Implications for Understanding Resilience. *Trauma Violence Abuse [Internet].* 2013 Jul [cited 2024 Apr 11];14(3):209. Available from: [/pmc/articles/PMC7238431/](https://pmc/articles/PMC7238431/)
205. Evans KE, Schmidt-Sane MM, Bender AE, Berg KA, Holmes MR. Children's Exposure to Intimate Partner Violence and Acceptance or Appraisals of IPV: A Systematic Review. *J Fam Violence [Internet].* 2022 Nov 1 [cited 2024 Apr 11];37(8):1301–19. Available from: <https://link.springer.com/article/10.1007/s10896-021-00318-w>
206. McLaughlin KA, Colich NL, Rodman AM, Weissman DG. Mechanisms linking childhood trauma exposure and psychopathology: a transdiagnostic model of risk and resilience. *BMC Medicine* 2020 18:1 [Internet]. 2020 Apr 1 [cited 2024 Apr 10];18(1):1–11. Available from: <https://link.springer.com/article/10.1186/s12916-020-01561-6>
207. Mathews T, Dempsey M, Overstreet S. Effects of exposure to community violence on school functioning: The mediating role of posttraumatic stress symptoms. *Behaviour Research and Therapy.* 2009 Jul 1;47(7):586–91.

208. Martín V, Granero R, Ezpeleta L. Comorbidity of oppositional defiant disorder and anxiety disorders in preschoolers. *Psicothema* [Internet]. 2014 Jan 28 [cited 2024 Apr 12];26(1):27–32. Available from: <https://portalrecerca.uab.cat/en/publications/comorbidity-of-oppositional-defiant-disorder-and-anxiety-disorder>
209. Calder MC, Regan L. Working with mothers in situations of sexual and domestic abuse: reframing resistance as restricted choices. *The carrot or the stick*. 2008;249–76.
210. Gubbels J, van der Put CE, Assink M. Risk Factors for School Absenteeism and Dropout: A Meta-Analytic Review. *Journal of Youth and Adolescence* 2019 48:9 [Internet]. 2019 Jul 15 [cited 2024 Apr 12];48(9):1637–67. Available from: <https://link.springer.com/article/10.1007/s10964-019-01072-5>
211. Lloyd M. Domestic violence and education: Examining the impact of domestic violence on young children, children, and young people and the potential role of schools. *Front Psychol* [Internet]. 2018 Nov 13 [cited 2024 Apr 12];9(NOV):396402. Available from: www.frontiersin.org
212. Suglia SF, Sapra KJ, Koenen KC. Violence and Cardiovascular Health. *Am J Prev Med* [Internet]. 2015;48(2):205–12. Available from: <http://dx.doi.org/10.1016/j.amepre.2014.09.013>
213. Fergusson DM, Horwood LJ, Ridder EM. Show me the child at seven II: Childhood intelligence and later outcomes in adolescence and young adulthood. *J Child Psychol Psychiatry*. 2005 Aug;46(8):850–8.
214. Rhoades BL, Greenberg MT, Domitrovich CE. The contribution of inhibitory control to preschoolers' social-emotional competence. *J Appl Dev Psychol*. 2009 May 1;30(3):310–20.
215. Young-Southward G, Eaton C, O'Connor R, Minnis H, O'Connor R, Minnis H. Investigating the causal relationship between maltreatment and cognition in children: A systematic review. *Child Abuse Negl* [Internet]. 2020 Sep 1 [cited 2020 Sep 21];107(December 2019):104603. Available from: <https://doi.org/10.1016/j.chab.2020.104603>
216. Butler O, Yang XF, Laube C, Kühn S, Immordino-Yang MH. Community violence exposure correlates with smaller gray matter volume and lower IQ in urban adolescents. *Hum Brain Mapp* [Internet]. 2018 May 1 [cited 2022 Sep 9];39(5):2088–97. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/hbm.23988>
217. Sharkey PT, Tirado-Strayer N, Papachristos A V., Raver CC. The effect of local violence on children's attention and impulse control. *Am J Public Health* [Internet]. 2012 Dec [cited 2023 May 31];102(12):2287–93. Available from: <http://www>.
218. McCoy DC, Raver CC, Sharkey P. Children's Cognitive Performance and Selective Attention Following Recent Community Violence. *J Health Soc Behav* [Internet]. 2015 Mar 16 [cited 2023 May 30];56(1):19–36. Available from: <https://journals.sagepub.com/doi/10.1177/0022146514567576>

219. Bowman B, Matzopoulos R, Butchart A, Mercy JA. The impact of violence on development in low- to middle-income countries. *Int J Inj Contr Saf Promot* [Internet]. 2008 Dec;15(4):209–19. Available from: <http://www.tandfonline.com/doi/abs/10.1080/17457300802417911>
220. Perkins S, Graham-Bermann S. Violence exposure and the development of school-related functioning: Mental health, neurocognition, and learning. *Aggress Violent Behav.* 2012 Jan 1;17(1):89–98.
221. Walker SP, Wachs TD, Grantham-McGregor S, Black MM, Nelson CA, Huffman SL, et al. Inequality in early childhood: risk and protective factors for early child development. *The Lancet* [Internet]. 2011 Oct;378(9799):1325–38. Available from: www.thelancet.com
222. Maxfield MG, Widom CS. The Cycle of Violence: Revisited 6 Years Later. *Arch Pediatr Adolesc Med* [Internet]. 1996 Apr 1 [cited 2022 Nov 2];150(4):390–5. Available from: <https://jamanetwork.com/journals/jamapediatrics/fullarticle/517903>
223. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* [Internet]. 2021 Mar 29;372:n71. Available from: <http://www.bmj.com/content/372/bmj.n71.abstract>
224. World Health Organization. Report of the consultation on child abuse prevention, 29–31 March 1999, WHO, Geneva. World Health Organization; 1999.
225. Edleson JL. Children's witnessing of adult domestic violence. *J Interpers Violence*. 1999;14(8):839–70.
226. Jouriles EN, McDonald R, Norwood WD, Ezell E. Issues and controversies in documenting the prevalence of children's exposure to domestic violence. 2001;
227. Wolak J, Finkelhor D. Children exposed to partner violence. na; 1998.
228. Gredler GR. Olweus, D. (1993).Bullying at school: What we know and what we can do. Malden, MA: Blackwell Publishing, 140 pp., \$25.00. *Psychol Sch* [Internet]. 2003 Nov 1 [cited 2020 Nov 9];40(6):699–700. Available from: <http://doi.wiley.com/10.1002/pits.10114>
229. Krug EG, World Health Organization. World report on violence and health. World Health Organization; 2002. 346 p.
230. Kiely KM. Cognitive Function. *Encyclopedia of Quality of Life and Well-Being Research* [Internet]. 2014 [cited 2023 Apr 17];974–8. Available from: https://link.springer.com/referenceworkentry/10.1007/978-94-007-0753-5_426
231. Palmese CA. Cognitive Functioning. In: *Encyclopedia of Clinical Neuropsychology* [Internet]. Cham: Springer International Publishing; 2017 [cited 2023 May 30]. p. 1–4. Available from: https://link.springer.com/referenceworkentry/10.1007/978-3-319-56782-2_1084-2

232. Gandon A, Kotyuk E, Bizonics R, Khan I, Petánszki M, Kiss L, et al. An exploratory study of the relationship between motor skills and indicators of cognitive and socio-emotional development in preschoolers. *European Journal of Developmental Psychology* [Internet]. 2023 Jan 2 [cited 2023 Oct 3];20(1):50–65. Available from: <https://www.tandfonline.com/doi/abs/10.1080/17405629.2022.2028617>
233. 1999 WHO Consultation on Child Abuse Prevention (62).
234. Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. *The Lancet* [Internet]. 2002 Oct 5;360(9339):1083–8. Available from: [https://doi.org/10.1016/S0140-6736\(02\)11133-0](https://doi.org/10.1016/S0140-6736(02)11133-0)
235. Kitzmann KM, Gaylord NK, Holt AR, Kenny ED. Child witnesses to domestic violence: a meta-analytic review. *J Consult Clin Psychol*. 2003;71(2):339.
236. Fantuzzo J, Boruch R, Beriama A, Atkins M, Marcus S. Domestic violence and children: Prevalence and risk in five major US cities. *J Am Acad Child Adolesc Psychiatry*. 1997;36(1):116–22.
237. Park J, Lee Y, Seo H, Jang B, Son H, Kim S, et al. Risk of bias assessment tool for non-randomized studies (RoBANS): development and validation of a new instrument. In: 19th Cochrane Colloquium. 2011. p. 19–22.
238. Petersen JM, Barrett M, Ahrens KA, Murray EJ, Bryant AS, Hogue CJ, et al. The confounder matrix: A tool to assess confounding bias in systematic reviews of observational studies of etiology. *Res Synth Methods*. 2022 Mar 1;13(2):242–54.
239. Carvalho JCN, Donat JC, Moura TC de, Dertelmann C de FV, Kristensen CH. Cognitive screening and clinical symptoms in victims of child maltreatment: Evidence of intellectual deficit in a Brazilian sample. *Psychol Neurosci* [Internet]. 2017 Dec 1 [cited 2023 Apr 20];10(4):372–82. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/pne0000109>
240. Barnett W, Halligan SL, Wedderburn C, MacGinty R, Hoffman N, Zar HJ, et al. Maternal emotional and physical intimate partner violence and early child development: Investigating mediators in a cross-sectional study in a South African birth cohort. *BMJ Open* [Internet]. 2021 Oct 1 [cited 2023 Aug 22];11(10):e046829. Available from: <https://bmjopen.bmj.com/content/11/10/e046829>
241. Barrera M, Calderón L, Bell V. The Cognitive Impact of Sexual Abuse and PTSD in Children: A Neuropsychological Study. <http://dx.doi.org/101080/105387122013811141> [Internet]. 2013 Aug 1 [cited 2023 Feb 21];22(6):625–38. Available from: <https://www.tandfonline.com/doi/abs/10.1080/10538712.2013.811141>
242. Bengwasan P, Bancual MEJF. The developmental status of abused and neglected children in the Philippines. *Child Youth Serv Rev*. 2020 Mar 1;110:104756.
243. Bernardes ET, Manitto AM, Miguel EC, Pan PM, Batistuzzo MC, Rohde LA, et al. Relationships between childhood maltreatment, impairment in executive functions and

disruptive behavior disorders in a community sample of children. *Eur Child Adolesc Psychiatry* [Internet]. 2020 Jul 26 [cited 2022 Oct 5];29(7):969–78. Available from: <https://doi.org/10.1007/s00787-019-01408-3>

244. Diab SYM, Guillaume M, Punamäki RL. Ecological approach to academic achievement in the face of war and military violence: Mediating and moderating role of school, family, and child characteristics. *Elementary School Journal*. 2018 Sep 1;119(1):1–28.
245. Hecker T, Hermenau K, Salmen C, Teicher M, Elbert T. Harsh discipline relates to internalizing problems and cognitive functioning: findings from a cross-sectional study with school children in Tanzania. *BMC Psychiatry* [Internet]. 2016 Dec 29 [cited 2023 Feb 21];16(1):118. Available from: <https://bmcpsychiatry.biomedcentral.com/articles/10.1186/s12888-016-0828-3>
246. Jeong J, Adhia A, Bhatia A, Charles D, Yousafzai AK. Intimate partner violence, maternal and paternal parenting, and early child development. *Pediatrics* [Internet]. 2020 Jun 1 [cited 2023 Jun 4];145(6). Available from: [/pediatrics/article/145/6/e20192955/76925/Intimate-Partner-Violence-Maternal-and-Paternal](https://pediatrics.aappublications.org/article/145/6/e20192955/76925/Intimate-Partner-Violence-Maternal-and-Paternal)
247. Julio A, Reopta KG, Jandoc KR. Nuances in the effect of types of intimate partner violence on aspects of child development: Evidence from the Philippines. *Child Abuse Negl*. 2023 Apr 1;138:106074.
248. Kohrt BK, Barrueco S, Pérez CP. Domestic violence as a threat to maternal and child well-being in an urban migrant community in Peru. 2015;
249. Leyton A. A latent class analysis to identify how patterns of Intimate Partner Violence influence Early Childhood Development outcomes in Honduras. *Child Abuse Negl*. 2020 Sep 1;107:104609.
250. Malik F, Gul A, Humphreys G. Behavioral and emotional problems in abused and nonabused children in a Pakistan cohort. *Pakistan Journal of Psychological Research* [Internet]. 2010;25(2):179–202. Available from: <https://link.gale.com/apps/doc/A259959331/HRCA?u=anon~39451211&sid=googleScholar&xid=ec3431bf>
251. Rocha HAL, Sudfeld CR, Leite ÁJM, Rocha SGMO, Machado MMT, Campos JS, et al. Adverse Childhood Experiences and Child Development Outcomes in Ceará, Brazil: A Population-based Study. *Am J Prev Med* [Internet]. 2021 Apr 1 [cited 2023 Feb 21];60(4):579–86. Available from: <http://www.ajpmonline.org/article/S0749379720303913/fulltext>
252. Sartori RF, Ribeiro Bandeira PF, Nobre GC, da Silva Ramalho MH, Valentini NC. Associations between motor proficiency in children with history of maltreatment and living in social economically vulnerability. *Child Abuse Negl* [Internet]. 2017 Aug 1 [cited 2023 Feb 28];70:75–81. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0145213417302107>

253. Vameghi R, Amir Ali Akbari S, Sajedi F, Sajjadi H, Alavi Majd H. Path Analysis Association between Domestic Violence, Anxiety, Depression and Perceived Stress in Mothers and Children's Development. *Iran J Child Neurol* [Internet]. 2016 Sep 1 [cited 2023 Aug 23];10(4):36. Available from: [/pmc/articles/PMC5100036/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5100036/)
254. Xing X, Wang M. The moderating role of HPA activity in the relations between parental corporal punishment and executive function in Chinese school-aged children. *Psychol Violence* [Internet]. 2018 Jul 1 [cited 2023 Feb 21];8(4):418–26. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/vio0000143>
255. Xing X, Yin T, Wang M. Cortisol stress reactivity moderates the effects of parental corporal punishment on Chinese preschoolers' executive function. *Child Abuse Negl* [Internet]. 2019 Feb 1 [cited 2023 Feb 21];88:288–97. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0145213418304484>
256. Xing X, Wang M. The moderating role of HPA activity in the relations between parental corporal punishment and executive function in Chinese school-aged children. *Psychol Violence* [Internet]. 2018 Jul 1 [cited 2023 Feb 21];8(4):418–26. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/vio0000143>
257. Hecker T, Hermenau K, Salmen C, Teicher M, Elbert T. Harsh discipline relates to internalizing problems and cognitive functioning: Findings from a cross-sectional study with school children in Tanzania. *BMC Psychiatry* [Internet]. 2016 Apr 29 [cited 2023 Feb 21];16(1):2. Available from: <https://bmcpsychiatry.biomedcentral.com/articles/10.1186/s12888-016-0828-3>
258. Bernardes ET, Manitto AM, Miguel EC, Pan PM, Batistuzzo MC, Rohde LA, et al. Relationships between childhood maltreatment, impairment in executive functions and disruptive behavior disorders in a community sample of children. *Eur Child Adolesc Psychiatry* [Internet]. 2020 Jul 1 [cited 2023 Feb 21];29(7):969–78. Available from: <https://link.springer.com/article/10.1007/s00787-019-01408-3>
259. Kohrt BK, Barrueco S, ra, Perez CP. Domestic violence as a threat to maternal and child well-being in an urban migrant community in Peru. *Rev Panam Salud Publica* [Internet]. 2015 [cited 2023 Feb 21];37(4):265–72. Available from: <https://iris.paho.org/handle/10665.2/8265>
260. Carvalho JCN, Donat JC, De Moura TC, De Fátima Vieira Dertelmann C, Kristensen CH. Cognitive Screening and Clinical Symptoms in Victims of Child Maltreatment: Evidence of Intellectual Deficit in a Brazilian Sample. *Psychol Neurosci* [Internet]. 2017 Dec 1 [cited 2023 Feb 21];10(4):372–82. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/pne0000109>
261. Kohrt BK, Barrueco S, Pérez CP. Domestic violence as a threat to maternal and child well-being in an urban migrant community in Peru [Internet]. Vol. 46, Revista Panamericana de Salud Pública/Pan American Journal of Public Health. Pan American Health Organization; 2022 [cited 2023 Feb 21]. p. 2015. Available from: <https://iris.paho.org/handle/10665.2/8265>

262. Carvalho JCN, Donat JC, De Moura TC, De Fátima Vieira Dertelmann C, Kristensen CH. Cognitive Screening and Clinical Symptoms in Victims of Child Maltreatment: Evidence of Intellectual Deficit in a Brazilian Sample. *Psychol Neurosci* [Internet]. 2017 [cited 2022 Oct 5];10(4):372–82. Available from: <https://psycnet.apa.org/record/2017-48290-001>
263. Hecker T, Hermenau K, Salmen C, Teicher M, Elbert T. Harsh discipline relates to internalizing problems and cognitive functioning: Findings from a cross-sectional study with school children in Tanzania. *BMC Psychiatry* [Internet]. 2016;16. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc13&NEWS=N&AN=2016-21831-001>
264. Hecker T, Hermenau K, Salmen C, Teicher M, Elbert T. Harsh discipline relates to internalizing problems and cognitive functioning: Findings from a cross-sectional study with school children in Tanzania. *BMC Psychiatry* [Internet]. 2016 Apr 29 [cited 2023 Feb 21];16(1):2. Available from: <https://bmcpsychiatry.biomedcentral.com/articles/10.1186/s12888-016-0828-3>
265. Bernardes ET, Manitto AM, Miguel ECEC, Pan PM, Batistuzzo MC, Rohde LA, et al. Relationships between childhood maltreatment, impairment in executive functions and disruptive behavior disorders in a community sample of children. *Eur Child Adolesc Psychiatry* [Internet]. 2020 Jul 1 [cited 2022 Oct 5];29(7):969–78. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc16&NEWS=N&AN=2019-58663-001>
266. Bernardes ET, Manitto AM, Miguel EC, Pan PM, Batistuzzo MC, Rohde LA, et al. Relationships between childhood maltreatment, impairment in executive functions and disruptive behavior disorders in a community sample of children. *Eur Child Adolesc Psychiatry* [Internet]. 2020;29(7):969–78. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc16&NEWS=N&AN=2019-58663-001>
267. Kavangaugh BC, Dupont-Frechette JA, Jerskey BA, Holler KA. Neurocognitive deficits in children and adolescents following maltreatment: Neurodevelopmental consequences and neuropsychological implications of traumatic stress. *Appl Neuropsychol Child* [Internet]. 2017 Jan 2 [cited 2023 Jun 6];6(1):64–78. Available from: <https://www.tandfonline.com/doi/full/10.1080/21622965.2015.1079712>
268. Gerhardt S. Why love matters: How affection shapes a baby's brain. <https://doi.org/101080/13698030601074476> [Internet]. 2006 Dec [cited 2023 Mar 7];9(3):305–9. Available from: <https://www.tandfonline.com/doi/abs/10.1080/13698030601074476>
269. Boyce WT, Levitt P, Martinez FD, McEwen BS, Shonkoff JP. Genes, environments, and time: The biology of adversity and resilience. *Pediatrics* [Internet]. 2021 Feb 1 [cited 2023 Oct 2];147(2). Available from: [/pediatrics/article/147/2/e20201651/36339/Genes-Environments-and-Time-The-Biology-of](https://pediatrics.aappublications.org/content/147/2/e20201651/36339/Genes-Environments-and-Time-The-Biology-of)

270. De Bellis MD, Hooper SR, Woolley DP, Shenk CE. Demographic, maltreatment, and neurobiological correlates of PTSD symptoms in children and adolescents. *J Pediatr Psychol* [Internet]. 2010 Jun 1 [cited 2022 Oct 31];35(5):570–7. Available from: <https://academic.oup.com/jpepsy/article/35/5/570/891483>
271. Basch CE. Aggression and Violence and the Achievement Gap Among Urban Minority Youth. *Journal of School Health* [Internet]. 2011 Oct 1 [cited 2023 Mar 7];81(10):619–25. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1746-1561.2011.00636.x>
272. Lövdén M, Fratiglioni L, Glymour MM, Lindenberger U, Tucker-Drob EM. Education and Cognitive Functioning Across the Life Span. *Psychological Science in the Public Interest* [Internet]. 2020 Aug 1 [cited 2023 Oct 2];21(1):6–41. Available from: <https://journals.sagepub.com/doi/full/10.1177/1529100620920576>
273. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. *The Lancet* [Internet]. 2007 Jan 6;369(9555):60–70. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0140673607600324>
274. Fisher BW, Gardella JH, Teurbe-Tolon AR. Peer Cybervictimization Among Adolescents and the Associated Internalizing and Externalizing Problems: A Meta-Analysis. *J Youth Adolesc*. 2016 Sep 1;45(9):1727–43.
275. Vu NL, Jouriles EN, McDonald R, Rosenfield D. Children's exposure to intimate partner violence: A meta-analysis of longitudinal associations with child adjustment problems. *Clin Psychol Rev* [Internet]. 2016 Jun 1 [cited 2020 Nov 10];46:25–33. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0272735815300982>
276. Irigaray TQ, Pachecob JB, Grassi-Oliveiraa R, Fonsecaa RP, de Carvalho Leite JC, Kristensen CH. Child maltreatment and later cognitive functioning: A systematic review. *Psicologia: Reflexao e Critica*. 2013;26(2):376–87.
277. Liming KW, Grube WA. Wellbeing Outcomes for Children Exposed to Multiple Adverse Experiences in Early Childhood: A Systematic Review. Vol. 35, *Child and Adolescent Social Work Journal*. Springer New York LLC; 2018. p. 317–35.
278. Wood SL, Sommers MS. Consequences of Intimate Partner Violence on Child Witnesses: A Systematic Review of the Literature. *Journal of Child and Adolescent Psychiatric Nursing*. 2011 Nov;24(4):223–36.
279. Evans SE, Davies C, DiLillo D. Exposure to domestic violence: A meta-analysis of child and adolescent outcomes. Vol. 13, *Aggression and Violent Behavior*. Pergamon; 2008. p. 131–40.
280. Evans SE, Davies C, DiLillo D. Exposure to domestic violence: A meta-analysis of child and adolescent outcomes. *Aggress Violent Behav*. 2008;13(2):131–40.
281. Haahr-Pedersen I, Ershadi A, Hyland P, Hansen M, Perera C, Sheaf G, et al. Polyvictimization and psychopathology among children and adolescents: A systematic

review of studies using the Juvenile Victimization Questionnaire. Vol. 107, Child Abuse and Neglect. Elsevier Ltd; 2020. p. 104589.

282. Li M, Gao T, Su Y, Zhang Y, Yang G, D'Arcy C, et al. The Timing Effect of Childhood Maltreatment in Depression: A Systematic Review and meta-Analysis [Internet]. Trauma, Violence, and Abuse. SAGE PublicationsSage CA: Los Angeles, CA; 2022 [cited 2023 May 12]. Available from:
https://journals.sagepub.com/doi/abs/10.1177/15248380221102558?casa_token=CZGDvzHfqryMAAAAAA%3AwQVd0LzcZ4Rt-lFwfgd-dAPtNO-V5cXFYRsHyYrYbgGeY1mOqMCe8Z-tB_sIgloZQXjCPOH1I8LoNQ&journalCode=tvaa
283. Consultation on Child Abuse Prevention (1999: Geneva S, Team WHOrganizationV and IP, Research GF for H, World Health Organization. Report of the consultation on child abuse prevention, 29-31 March 1999, WHO, Geneva [Internet]. Geneva: World Health Organization; 1999. Available from:
<https://apps.who.int/iris/handle/10665/65900>
284. Achenbach TM, Ivanova MY, Rescorla LA, Turner L V., Althoff RR. Internalizing/Externalizing Problems: Review and Recommendations for Clinical and Research Applications. *J Am Acad Child Adolesc Psychiatry*. 2016 Aug 1;55(8):647–56.
285. Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol* [Internet]. 2018 Nov 19 [cited 2023 Dec 16];18(1):1–7. Available from:
<https://link.springer.com/articles/10.1186/s12874-018-0611-x>
286. Meeks Gardner JM, Powell CA, Grantham-McGregor SM. Determinants of aggressive and prosocial behavior among Jamaican schoolboys. *West Indian Medical Journal* [Internet]. 2007;56(1):34–41. Available from:
<http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed10&NEWS=N&AN=47007845>
287. Mousa Thabet AA, Karim K, Vostanis P. Trauma exposure in pre-school children in a war zone. *British Journal of Psychiatry* [Internet]. 2006 Feb 2;188(2):154–8. Available from:
https://www.cambridge.org/core/product/identifier/S0007125000169624/type/journal_article
288. Lansford JE, Sharma C, Malone PS, Woodlief D, Dodge KA, Oburu P, et al. Corporal Punishment, Maternal Warmth, and Child Adjustment: A Longitudinal Study in Eight Countries. *Journal of Clinical Child & Adolescent Psychology* [Internet]. 2014;43(4):670–85. Available from: <https://doi.org/10.1080/15374416.2014.893518>
289. Basu B, Dutta N. Psychological Changes of Children Surviving Terrorist Shock in Indian Kashmir. *J Child Neurol* [Internet]. 2010 Nov 10;25(11):1331–4. Available from: <http://journals.sagepub.com/doi/10.1177/0883073810362925>

290. Alenko A, Girma S, Abera M, Workicho A. Children emotional and behavioural problems and its association with maternal depression in Jimma town, southwest Ethiopia. *Gen Psychiatr* [Internet]. 2020 Jul 2;33(4):e100211. Available from: <http://gpsych.bmj.com/lookup/doi/10.1136/gpsych-2020-100211>
291. ALLWOOD MA, BELL-DOLAN D, HUSAIN SA. Children's Trauma and Adjustment Reactions to Violent and Nonviolent War Experiences. *J Am Acad Child Adolesc Psychiatry* [Internet]. 2002 Apr;41(4):450–7. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S089085670960873X>
292. Alyahri A, Goodman R. Harsh corporal punishment of Yemeni children: Occurrence, type and associations. *Child Abuse Negl* [Internet]. 2008/07/29. 2008 Aug;32(8):766–73. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0145213408001208>
293. Baker-Henningham H, Francis T. Parents' use of harsh punishment and young children's behaviour and achievement: a longitudinal study of Jamaican children with conduct problems. *Global Mental Health* [Internet]. 2018 Oct 12;5:e32. Available from: https://www.cambridge.org/core/product/identifier/S2054425118000213/type/journal_article
294. Barbarin OA, Richter L, DeWet T. Exposure to violence, coping resources, and psychological adjustment of South African children. *American Journal of Orthopsychiatry* [Internet]. 2001;71(1):16–25. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/0002-9432.71.1.16>
295. Bauer A, Fairchild G, Halligan SL, Hammerton G, Murray J, Santos IS, et al. Harsh parenting and child conduct and emotional problems: parent- and child-effects in the 2004 Pelotas Birth Cohort. *Eur Child Adolesc Psychiatry* [Internet]. 2022 Aug 18 [cited 2023 Jul 28];31(8):1–11. Available from: <https://link.springer.com/10.1007/s00787-021-01759-w>
296. Bordin I. Severe physical punishment: risk of mental health problems for poor urban children in Brazil. *Bull World Health Organ* [Internet]. 2009 May 1;87(5):336–44. Available from: <https://doi.org/10.2471/blt.07.043125>
297. Boxer P, Rowell Huesmann L, Dubow EF, Landau SF, Gvirsman SD, Shikaki K, et al. Exposure to Violence Across the Social Ecosystem and the Development of Aggression: A Test of Ecological Theory in the Israeli–Palestinian Conflict. *Child Dev* [Internet]. 2013 Jan 20;84(1):163–77. Available from: <https://srcd.onlinelibrary.wiley.com/doi/10.1111/j.1467-8624.2012.01848.x>
298. Chander P, Kvalsvig J, Mellins CA, Kauchali S, Arpadi SM, Taylor M, et al. Intimate Partner Violence and Child Behavioral Problems in South Africa. *Pediatrics* [Internet]. 2017 Mar 1 [cited 2023 Nov 20];139(3). Available from: <https://pubmed.ncbi.nlm.nih.gov/28242862/>
299. Chimienti G, Nasr JA, Khalifeh I. Children's reactions to war-related stress. *Soc Psychiatry Psychiatr Epidemiol* [Internet]. 1989 Nov;24(6):282–7. Available from: <http://link.springer.com/10.1007/BF01788030>

300. Durand JG, Schraiber LB, França-Junior I, Barros C. Repercussão da exposição à violência por parceiro íntimo no comportamento dos filhos. *Rev Saude Publica* [Internet]. 2011 Apr;45(2):355–64. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034-89102011000200014&lng=pt&tlang=pt
301. Eisenberg N, Chang L, Ma Y, Huang X. Relations of parenting style to Chinese children's effortful control, ego resilience, and maladjustment. *Dev Psychopathol* [Internet]. 2009/04/01. 2009 May 1;21(2):455–77. Available from: https://www.cambridge.org/core/product/identifier/S095457940900025X/type/journal_article
302. Evare BS. The effects of exposure to intimate partner violence: A study of rural Cambodian children. *Dissertation Abstracts International: Section B: The Sciences and Engineering*. 2018;78(12):No-Specified.
303. Flores JE. Psychological effects of the civil war on children from rural communities of El Salvador. (posttraumatic stress disorder, anxiety, depression, behavior problems, psychosocial competence, war). *Dissertation Abstracts International: Section B: The Sciences and Engineering*. 1999;60(6):2983.
304. Ghasemi M. Impact of domestic violence on the psychological wellbeing of children in Iran. *J Fam Stud* [Internet]. 2009 Dec 17;15(3):284–95. Available from: <http://www.tandfonline.com/doi/abs/10.5172/jfs.15.3.284>
305. Gong X, Huebner ES, Tian L. Bullying Victimization and Developmental Trajectories of Internalizing and Externalizing Problems: The Moderating Role of Locus of Control Among Children. *Res Child Adolesc Psychopathol* [Internet]. 2021 Mar 6;49(3):351–66. Available from: <https://doi.org/10.1007/s10802-020-00752-2>
306. Gong X, Huebner ES, Tian L. Longitudinal relations between child maltreatment in families and psychological maltreatment by teachers: The mediating roles of internalizing and externalizing problems among Chinese children. *J Interpers Violence* [Internet]. 2023;38(3):2716–41. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc21&NEWS=N&AN=2023-40015-019>
307. Guo VY, Yu EYT, Wong RSM, Ip P, Tiwari AFY, Wong CKH, et al. Maternal mental quality of life mediates the associations between intimate partner abuse against mothers and their children's behaviours and quality of life in low-income Chinese families. *Quality of Life Research* [Internet]. 2017 Dec 24;26(12):3297–306. Available from: <http://link.springer.com/10.1007/s11136-017-1664-8>
308. Hayati Rezvan P, Tomlinson M, Christodoulou J, Almirol E, Stewart J, Gordon S, et al. Intimate Partner Violence and Food Insecurity Predict Early Behavior Problems Among South African Children over 5-years Post-Birth. *Child Psychiatry Hum Dev* [Internet]. 2021 Jun 18 [cited 2023 May 25];52(3):409–19. Available from: <https://link.springer.com/10.1007/s10578-020-01025-1>

309. Hecker T, Hermenau K, Isele D, Elbert T. Corporal punishment and children's externalizing problems: A cross-sectional study of Tanzanian primary school aged children. *Child Abuse Negl* [Internet]. 2014 May;38(5):884–92. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0145213413003499>
310. Hecker T, Boettcher VS, Landolt MA, Hermenau K. Child neglect and its relation to emotional and behavioral problems: A cross-sectional study of primary school-aged children in Tanzania. *Dev Psychopathol* [Internet]. 2019 Feb 26;31(1):325–39. Available from: https://www.cambridge.org/core/product/identifier/S0954579417001882/type/journal_article
311. Hermenau K, Hecker T, Ruf M, Schauer E, Elbert T, Schauer M. Childhood adversity, mental ill-health and aggressive behavior in an African orphanage: Changes in response to trauma-focused therapy and the implementation of a new instructional system. *Child Adolesc Psychiatry Ment Health* [Internet]. 2011 Dec 25;5(1):29. Available from: <https://capmh.biomedcentral.com/articles/10.1186/1753-2000-5-29>
312. Hesketh T, Zheng Y, Jun YX, Xing ZW, Dong ZX, Lu L. Behaviour problems in Chinese primary school children. *Soc Psychiatry Psychiatr Epidemiol* [Internet]. 2011 Aug 6;46(8):733–41. Available from: <http://link.springer.com/10.1007/s00127-010-0240-0>
313. Laurenzi CA, Skeen S, Sundin P, Hunt X, Weiss RE, Rotheram-Borus MJ, et al. Associations between young children's exposure to household violence and behavioural problems: Evidence from a rural Kenyan sample. *Glob Public Health* [Internet]. 2020 Feb 1;15(2):173–84. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8278625/pdf/nihms-1722168.pdf>
314. Li L, Lin X, Chi P, Heath MA, Fang X, Du H, et al. Maltreatment and Emotional and Behavioral Problems in Chinese Children With and Without Oppositional Defiant Disorder. *J Interpers Violence* [Internet]. 2016 Nov 10;31(18):2915–39. Available from: <http://journals.sagepub.com/doi/10.1177/0886260515624234>
315. Li X, Wang Y, Li J, Tang J, Zhang J, Wang M, et al. Violence exposure across multiple contexts as predictors of reactive and proactive aggression in Chinese preadolescents. *Aggress Behav* [Internet]. 2022;48(3):319–30. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed23&NEWS=N&AN=636993715>
316. Maciel MR, Mello AF, Fossaluzza V, Nobrega LP, Cividanes GC, Mari JJ, et al. Children working on the streets in Brazil: predictors of mental health problems. *Eur Child Adolesc Psychiatry* [Internet]. 2013 Mar 17;22(3):165–75. Available from: <http://link.springer.com/10.1007/s00787-012-0335-0>
317. Maldonado Martinez A. Structure and risk of internalizing problems in preschool boys and girls in Sao Paulo, Brazil. *Dissertation Abstracts International: Section B: The Sciences and Engineering* [Internet]. 2022;83(3):No-Specified. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc21&NEWS=N&AN=2021-94599-284>

318. Martins-Silva T, Bauer A, Matijasevich A, Munhoz TN, Barros AJD, Santos IS, et al. Early risk factors for conduct problem trajectories from childhood to adolescence: the 2004 Pelotas (BRAZIL) Birth Cohort. *Eur Child Adolesc Psychiatry* [Internet]. 2023; Available from: <https://www.springer.com/journal/787> <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emexb&NEWS=N&AN=2022854867>
319. Miller T, El-Masri M, Allodt F, Qouta S. II: Emotional and behavioural problems and trauma exposure of school-age Palestinian children in Gaza: Some preliminary findings. *Med Confl Surviv* [Internet]. 1999 Oct;15(4):368–78. Available from: <http://www.tandfonline.com/doi/abs/10.1080/13623699908409478>
320. Ong'ayi DMM. The associations between paternal depressive symptoms and children's behavior outcomes via intimate partner violence and paternal rejection in Kenyan families. *Dissertation Abstracts International Section A: Humanities and Social Sciences* [Internet]. 2023;84(7):No-Specified. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc21&NEWS=N&AN=2023-46641-003>
321. Perks SM, Jameson M. The effects of witnessing domestic violence on behavioural problems and depressive symptomatology. A community sample of pupils from St Lucia. *West Indian Med J* [Internet]. 1999 Dec;48(4):208–11. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/10639841>
322. Punamäki RL. Factors Affecting the Mental Health of Palestinian Children Exposed to Political Violence. *Int J Ment Health* [Internet]. 1989 Jun 4;18(2):63–79. Available from: <https://www.tandfonline.com/doi/full/10.1080/00207411.1989.11449124>
323. Qouta S, Punamäki RL, Miller T, El-Sarraj E. Does war beget child aggression? Military violence, gender, age and aggressive behavior in two Palestinian samples. *Aggress Behav* [Internet]. 2008 May 5;34(3):231–44. Available from: <https://doi.org/10.1002/ab.20236>
324. Roopnarine JL, Ong'ayi DMM, Krishnakumar A, Ali A, Primus MA. Maternal depressive symptoms and physical intimate partner violence and children's internalizing and externalizing behaviors in Guyanese families: Mediating role of constructive conflict behavior. *Am J Orthopsychiatry* [Internet]. 2023; Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emexb&NEWS=N&AN=640763799>
325. Saile R, Ertl V, Neuner F, Catani C. Children of the postwar years: A two-generational multilevel risk assessment of child psychopathology in northern Uganda. *Dev Psychopathol* [Internet]. 2016 May 27;28(2):607–20. Available from: https://www.cambridge.org/core/product/identifier/S0954579415001066/type/journal_article
326. Shan W, Zhang Y, Zhao J, Zhang Y, Cheung EFC, Chan RCK, et al. Association between Maltreatment, Positive Parent–Child Interaction, and Psychosocial Well-Being in Young Children. *J Pediatr* [Internet]. 2019 Oct;213:180-186.e1. Available from: <https://doi.org/10.1016/j.jpeds.2019.06.050>

327. Silva EP, Ludermir AB, Lima M de C, Eickmann SH, Emond A. Mental health of children exposed to intimate partner violence against their mother: A longitudinal study from Brazil. *Child Abuse Negl* [Internet]. 2019 Jun;92:1–11. Available from: <https://doi.org/10.1016/j.chabu.2019.03.002>
328. Skinner AT, Oburu P, Lansford JE, Bacchini D. Childrearing violence and child adjustment after exposure to Kenyan post-election violence. *Psychol Violence* [Internet]. 2014 Jan;4(1):37–50. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/a0033237>
329. Sriskandarajah V, Neuner F, Catani C. Parental care protects traumatized Sri Lankan children from internalizing behavior problems. *BMC Psychiatry* [Internet]. 2015 Dec 25;15(1):203. Available from: <http://bmcpsychotherapy.biomedcentral.com/articles/10.1186/s12888-015-0583-x>
330. Sun J, Jiang Y, Wang X, Zilioli S, Chi P, Chen L, et al. Cortisol reactivity as a mediator of peer victimization on child internalizing and externalizing problems: The role of gender differences. *Res Child Adolesc Psychopathol* [Internet]. 2022;50(3):283–94. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc20&NEWS=N&AN=2021-77868-001>
331. TANG CSK. Psychological Impact of Wife Abuse. *J Interpers Violence* [Internet]. 1997 Jun 2;12(3):466–78. Available from: <http://journals.sagepub.com/doi/10.1177/088626097012003010>
332. Thabet AAM, Vostanis P. Post-traumatic Stress Reactions in Children of War. *Journal of Child Psychology and Psychiatry* [Internet]. 1999 Mar 13;40(3):385–91. Available from: <https://doi.org/10.1111/1469-7610.00456>
333. Wadji DL, Ketcha Wanda GJM, Wicky C, Morina N, Martin-Soelch C. From the Mother to the Child: The Intergenerational Transmission of Experiences of Violence in Mother–Child Dyads Exposed to Intimate Partner Violence in Cameroon. *J Interpers Violence* [Internet]. 2020 Mar 12;37(5–6):NP3346–76. Available from: <http://journals.sagepub.com/doi/10.1177/0886260520948148>
334. Wang C, Boyanton D, Ross ASM, Liu JL, Sullivan K, Anh Do K. School climate, victimization, and mental health outcomes among elementary school students in China. *Sch Psychol Int* [Internet]. 2018 Dec 26;39(6):587–605. Available from: [10.1177/0143034318805517](https://doi.org/10.1177/0143034318805517)
335. Xing X, Wang M, Zhang Q, He X, Zhang W. Gender differences in the reciprocal relationships between parental physical aggression and children's externalizing problem behavior in China. *Journal of Family Psychology* [Internet]. 2011;25(5):699–708. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/a0025015>
336. Xing X, Wang M. Sex differences in the reciprocal relationships between mild and severe corporal punishment and children's internalizing problem behavior in a Chinese sample. *J Appl Dev Psychol* [Internet]. 2013;34(1):9–16. Available from: <https://www.sciencedirect.com/science/article/pii/S0193397312000925>

337. Zhang L, Fang J, Wan Y, Gong C, Su P, Tao F, et al. The patterns of adverse childhood experiences among Chinese children: Four-year longitudinal associations with psychopathological symptoms. *J Psychiatr Res* [Internet]. 2020 Mar;122:1–8. Available from: <https://doi.org/10.1016/j.jpsychires.2019.12.009>
338. Flores G. Language Barriers and Hospitalized Children: Are We Overlooking the Most Important Risk Factor for Adverse Events? *JAMA Pediatr* [Internet]. 2020 Dec 1 [cited 2023 Nov 14];174(12):e203238–e203238. Available from: <https://jamanetwork.com/journals/jamapediatrics/fullarticle/2771980>
339. Galvin BM, Randel AE, Collins BJ, Johnson RE. Changing the focus of locus (of control): A targeted review of the locus of control literature and agenda for future research. *J Organ Behav*. 2018 Sep 1;39(7):820–33.
340. Slone M, Mann S. Effects of War, Terrorism and Armed Conflict on Young Children: A Systematic Review. *Child Psychiatry Hum Dev* [Internet]. 2016 Dec 1 [cited 2022 Oct 31];47(6):950–65. Available from: <https://link.springer.com/article/10.1007/s10578-016-0626-7>
341. Sternberg KJ, Baradaran L, Abbott CB, Lamb M, Guterman E. Type of violence, age, and gender differences in the effects of family violence on children's behavior problems: A mega-analysis☆. *Developmental Review* [Internet]. 2006 Mar;26(1):89–112. Available from: <https://www.sciencedirect.com/science/article/pii/S0273229705000328>
342. Cerna-Turoff I, Fang Z, Meierkord A, Wu Z, Yanguela J, Bangirana CA, et al. Factors Associated With Violence Against Children in Low- and Middle-Income Countries: A Systematic Review and Meta-Regression of Nationally Representative Data. *Trauma Violence Abuse* [Internet]. 2021 Apr 19 [cited 2023 Oct 21];22(2):219–32. Available from: <http://journals.sagepub.com/doi/10.1177/1524838020985532>
343. Patel V, Flisher AJ, Hetrick S, McGorry P. Mental health of young people: a global public-health challenge. *The Lancet* [Internet]. 2007 Apr 14 [cited 2023 Oct 21];369(9569):1302–13. Available from: <http://www.thelancet.com/article/S0140673607603687/fulltext>
344. Grasso DJ, Dierkhising CB, Branson CE, Ford JD, Lee R. Developmental patterns of adverse childhood experiences and current symptoms and impairment in youth referred for trauma-specific services. *J Abnorm Child Psychol*. 2016 Jul 1;44(5):871–86.
345. Kaplow JB, Widom CS. Age of onset of child maltreatment predicts long-term mental health outcomes. *J Abnorm Psychol*. 2007;116(1):176.
346. Dunn EC, Nishimi K, Powers A, Bradley B. Is developmental timing of trauma exposure associated with depressive and post-traumatic stress disorder symptoms in adulthood? *J Psychiatr Res*. 2017 Jan 1;84:119–27.
347. Malemo Kalisya L, Lussy Justin P, Kimona C, Nyavandu K, Mukelulu Eugenie K, Jonathan KML, et al. Sexual Violence toward Children and Youth in War-Torn Eastern Democratic Republic of Congo. *PLoS One* [Internet]. 2011 [cited 2023 Oct 21];6(10):e26530. Available from: <https://doi.org/10.1371/journal.pone.0026530>

- 21];6(1):e15911. Available from:
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0015911>
348. Olema DK, Catani C, Ertl V, Saile R, Neuner F. The Hidden Effects of Child Maltreatment in a War Region: Correlates of Psychopathology in Two Generations Living in Northern Uganda. *J Trauma Stress* [Internet]. 2014 Feb 1 [cited 2023 Oct 21];27(1):35–41. Available from:
<https://onlinelibrary.wiley.com/doi/full/10.1002/jts.21892>
349. Stark L, Seff I, Reis C. Gender-based violence against adolescent girls in humanitarian settings: a review of the evidence. *Lancet Child Adolesc Health* [Internet]. 2021 Mar 1 [cited 2023 Oct 21];5(3):210–22. Available from:
<http://www.thelancet.com/article/S2352464220302455/fulltext>
350. Tourangeau R, Yan T. Sensitive Questions in Surveys. *Psychol Bull*. 2007 Sep;133(5):859–83.
351. Cook DA, Beckman TJ. Current Concepts in Validity and Reliability for Psychometric Instruments: Theory and Application. *Am J Med*. 2006 Feb 1;119(2):166.e7–166.e16.
352. Oh DL, Jerman P, Purewal Boparai SK, Koita K, Briner S, Bucci M, et al. Review of Tools for Measuring Exposure to Adversity in Children and Adolescents. *Journal of Pediatric Health Care*. 2018 Nov 1;32(6):564–83.
353. Meinck F, Neelakantan L, Steele B, Jochim J, Davies LM, Boyes M, et al. Measuring Violence Against Children: A COSMIN Systematic Review of the Psychometric Properties of Child and Adolescent Self-Report Measures. *Trauma Violence Abuse* [Internet]. 2023 Jul 21 [cited 2023 Dec 16];24(3):1832–47. Available from:
<https://doi.org/10.1177/15248380221082152>
354. Warnick EM, Bracken MB, Kasl S. Screening Efficiency of the Child Behavior Checklist and Strengths and Difficulties Questionnaire: A Systematic Review. *Child Adolesc Ment Health* [Internet]. 2008 Sep 1 [cited 2023 Oct 21];13(3):140–7. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1475-3588.2007.00461.x>
355. Google. Google map of the Drakenstein Municipality in South Africa.
356. Hall K, Sambu W. Demography of South Africa's children. *South African child gauge*. 2019;216–20.
357. Marais L, Twala C. Bloemfontein: The rise and fall of South Africa's judicial capital. *African Geographical Review*. 2021;40(1):49–62.
358. Brenzinger M. ELEVEN OFFICIAL LANGUAGES AND MORE: LEGISLATION AND LANGUAGE POLICIES IN SOUTH AFRICA. *Revista de Llengua i Dret*. 2017;(67).
359. du Plessis T. The emergence of South African Sign Language as South Africa's 12th official language. *Tydskrif vir Geesteswetenskappe*. 2023;63(3):585–614.

360. Lehohla P. Census 2011: population dynamics in South Africa. Statistics South Africa. 2015;1–112.
361. Leibbrandt M, Woolard I, Finn A, Argent J. Trends in South African Income Distribution and Poverty since the Fall of Apartheid. OECD Social, Employment and Migration Working Papers [Internet]. 2010;(101):1–91. Available from: <https://doi.org/10.1787/1815199X>
362. Malik K. Human development report 2013. The rise of the South: Human progress in a diverse world. The Rise of the South: Human Progress in a Diverse World (March 15, 2013) UNDP-HDRO Human Development Reports. 2013;
363. Alexander P. Rebellion of the poor: South Africa's service delivery protests—a preliminary analysis. *Rev Afr Polit Econ.* 2010;37(123):25–40.
364. Leibbrandt M, Finn A, Enterprise C for D and. Inequality in South Africa and Brazil : can we trust the numbers? CDE insight TA - TT -. Johannesburg SE - 10 pages ; 30 cm.: Centre for Development and Enterprise Johannesburg; 2012.
365. Mabaso M, Makola L, Naidoo I, Mlangeni LL, Jooste S, Simbayi L. HIV prevalence in South Africa through gender and racial lenses: results from the 2012 population-based national household survey. *Int J Equity Health* [Internet]. 2019;18(1):167. Available from: <https://doi.org/10.1186/s12939-019-1055-6>
366. Muchiri BW, dos Santos MML. Family management risk and protective factors for adolescent substance use in South Africa. *Subst Abuse Treat Prev Policy* [Internet]. 2018 Jun 19 [cited 2023 Sep 1];13(1):1–10. Available from: <https://link.springer.com/articles/10.1186/s13011-018-0163-4>
367. Kalichman SC, Simbayi LC, Kagee A, Toefy Y, Jooste S, Cain D, et al. Associations of poverty, substance use, and HIV transmission risk behaviors in three South African communities. *Soc Sci Med.* 2006 Apr 1;62(7):1641–9.
368. Ward CL, Artz L, Berg J, Boonzaier F. Violence, violence prevention, and safety: A research agenda for South Africa Penetrating cardiac trauma View project Gender Based Violence View project. 2012 [cited 2023 Aug 21];102(4). Available from: <https://www.researchgate.net/publication/223992970>
369. Health ND of, ICF. South Africa Demographic and Health Survey 2016 [Internet]. Pretoria: National Department of Health - NDoH - ICF; 2019. Available from: <http://dhsprogram.com/pubs/pdf/FR337/FR337.pdf>
370. South African Police Service. South African Police Service Annual Report 2016/2017 [Internet]. 2019 [cited 2024 Apr 12]. Available from: <https://www.gov.za/documents/annual-reports/south-african-police-service-annual-report-20162017-27-sep-2017>
371. Mathews S, Benvenuti P, Africa S. Violence against children in South Africa: Developing a prevention agenda. *South African child gauge.* 2014;1(2):26–34.

372. Foster D. Gender, class, 'race' and violence. In: *Youth violence: Sources and solutions in South Africa*. UCT press; 2012. p. 23–51.
373. Sapire H. Township Histories, Insurrection and Liberation in Late Apartheid South Africa. *South African Historical Journal* [Internet]. 2013 Jun 1 [cited 2024 Apr 12];65(2):167–98. Available from: <https://www.tandfonline.com/doi/abs/10.1080/02582473.2013.777089>
374. Bond P. South African People Power since the mid-1980s: two steps forward, one back. *Third World Q* [Internet]. 2012 Mar [cited 2024 Apr 12];33(2):243–64. Available from: <https://www.tandfonline.com/doi/abs/10.1080/01436597.2012.666011>
375. Burger R, van der Berg S, van der Walt S, Yu D. The Long Walk: Considering the Enduring Spatial and Racial Dimensions of Deprivation Two Decades After the Fall of Apartheid. *Soc Indic Res* [Internet]. 2017 Feb 1 [cited 2024 Apr 12];130(3):1101–23. Available from: <https://link.springer.com/article/10.1007/s11205-016-1237-1>
376. Vivek N.D. Transformation Deferred: Disparate Development in Post-Apartheid South Africa (1994-2004). *PanAfrican Journal of Governance and Development (PJGD)* [Internet]. 2024 Feb 29;5(1):128–55. Available from: <https://journals.ju.edu.et/index.php/panjogov/article/view/5364>
377. Ndzinga-Kanga M, van der Merwe H, Hartford D. Forging a Resilient Social Contract in South Africa: States and Societies Sustaining Peace in the Post-Apartheid Era. *Journal of Intervention and Statebuilding* [Internet]. 2020 Jan 1 [cited 2024 Apr 12];14(1):22–41. Available from: <https://www.tandfonline.com/doi/abs/10.1080/17502977.2019.1706436>
378. Sambo VT. An analysis of policies that address income inequality in South Africa. *Journal of Contemporary Management* [Internet]. 2020 Dec [cited 2024 Apr 12];17(se2):124–45. Available from: https://doi.org/10.35683/jcm20_4.145
379. Serumaga-Zake P, Kotze D, Madsen R. A descriptive study of the dynamics of relative poverty in the Western Cape province of South Africa. *Dev South Afr* [Internet]. 2005 Mar [cited 2024 Apr 12];22(1):143–60. Available from: <https://www.tandfonline.com/doi/abs/10.1080/03768350500044610>
380. Statistics South Africa. Mid-year population estimates 2019 [Internet]. Statistics SA. 2019 [cited 2024 Apr 12]. Available from: www.statssa.gov.za,info@statssa.gov.za,Tel+27123108911
381. Klasen S, Woolard I. Surviving Unemployment Without State Support: Unemployment and Household Formation in South Africa. *J Afr Econ* [Internet]. 2009 Jan 1 [cited 2024 Apr 12];18(1):1–51. Available from: <https://dx.doi.org/10.1093/jae/ejn007>
382. Western Cape Government. Provincial Strategic Plan 2019-2024. 2020;1–92.
383. Collings SJ, Valjee SR, Penning SL. Development and preliminary validation of a screen for interpersonal childhood trauma experiences among school-going youth in

- Durban, South Africa. *J Child Adolesc Ment Health* [Internet]. 2013 Jul 1 [cited 2024 Apr 12];25(1):23–34. Available from: <https://www.tandfonline.com/doi/abs/10.2989/17280583.2012.722552>
384. Goga K. The drug trade and governance in Cape Town. *Institute for Security Studies Papers*. 2014;2014(263):18.
385. Groenewald P, Bradshaw D, Daniels J, Matzopoulos R, Bourne D, Bleasdale D, et al. Cause of death and premature mortality in Cape Town, 2001–2006. Cape Town: South African Medical Research Council. 2008;2008.
386. Ward CL, Martin E, Theron C, Distiller GB. Factors Affecting Resilience in Children Exposed to Violence. *South African Journal of Psychology* [Internet]. 2007 Apr 1;37(1):165–87. Available from: <https://doi.org/10.1177/008124630703700112>
387. Kaminer D, du Plessis B, Hardy A, Benjamin A. Exposure to violence across multiple sites among young South African adolescents. *Peace and Conflict: Journal of Peace Psychology* [Internet]. 2013;19(2):112. Available from: <https://doi.org/10.1037/a0032487>
388. Kaminer D, Hardy A, Heath K, Mosdell J, Bawa U. Gender patterns in the contribution of different types of violence to posttraumatic stress symptoms among South African urban youth. *Child Abuse Negl* [Internet]. 2013 May;37(5):320–30. Available from: <https://www.sciencedirect.com/science/article/pii/S0145213412002712>
389. Xie H, Weybright EH, Caldwell LL, Wegner L, Smith EA. Parenting practice, leisure experience, and substance use among South African adolescents. *J Leis Res* [Internet]. 2020 Jan 1 [cited 2024 Apr 12];51(1):36–55. Available from: <https://www.tandfonline.com/doi/abs/10.1080/00222216.2019.1620144>
390. Stein DJ, Koen N, Donald KA, Adnams CM, Koopowitz S, Lund C, et al. Investigating the psychosocial determinants of child health in Africa: The Drakenstein Child Health Study. *J Neurosci Methods* [Internet]. 2015 Aug 30;252:27–35. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0165027015000990>
391. Ward CL, Dawes A, Matzopoulos R. Youth violence in South Africa: Setting the scene. *Youth violence*. 2013;1.
392. Cheng TL, Goodman E, Bogue CW, Chien AT, Dean JM, Kharbanda AB, et al. Race, Ethnicity, and Socioeconomic Status in Research on Child Health. *Pediatrics* [Internet]. 2015 Jan 1 [cited 2023 Oct 4];135(1):e225–37. Available from: [/pediatrics/article/135/1/e225/52883/Race-Ethnicity-and-Socioeconomic-Status-in](https://pediatrics.aappublications.org/article/135/1/e225/52883/Race-Ethnicity-and-Socioeconomic-Status-in)
393. Zar HJ, Barnett W, Myer L, Stein DJ, Nicol MP. Investigating the early-life determinants of illness in Africa: the Drakenstein Child Health Study. *Thorax* [Internet]. 2015 Jun 1 [cited 2023 Oct 11];70(6):592–4. Available from: <https://pubmed.ncbi.nlm.nih.gov/25228292/>

394. Gelaye B, Rondon MB, Araya R, Williams MA. Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *Lancet Psychiatry*. 2016 Oct 1;3(10):973–82.
395. Roos A, Faure S, Lochner C, Vythilingum B, Stein DJ. Predictors of distress and anxiety during pregnancy. *Afr J Psychiatry (Johannesbg)* [Internet]. 2013;16(2):118–22. Available from: <https://hdl.handle.net/10520/EJC132618>
396. Zar HJ, Pellowski JA, Cohen S, Barnett W, Vanker A, Koen N, et al. Maternal health and birth outcomes in a South African birth cohort study. Hill B, editor. *PLoS One* [Internet]. 2019 Nov 21 [cited 2022 Oct 19];14(11):e0222399. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0222399>
397. Petersen Williams P, Jordaan E, Mathews C, Lombard C, Parry CDH. Alcohol and Other Drug Use during Pregnancy among Women Attending Midwife Obstetric Units in the Cape Metropole, South Africa. Iskander J, editor. *Adv Prev Med* [Internet]. 2014;2014:1–10. Available from: <https://doi.org/10.1155/2014/871427>
398. Vythilingum B, Roos A, Faure SC, Geerts L, Stein DJ. Risk factors for substance use in pregnant women in South Africa. *SAMJ: South African Medical Journal* [Internet]. 2012;102(11):853–4. Available from: <https://hdl.handle.net/10520/EJC128951>
399. Groves AK, Moodley D, McNaughton-Reyes L, Martin SL, Foshee V, Maman S. Prevalence, rates and correlates of intimate partner violence among South African women during pregnancy and the postpartum period. *Matern Child Health J*. 2015;19(3):487–95.
400. Donald KA, Hoogenhout M, Du Plooy CP, Wedderburn CJ, Nhapi RT, Barnett W, et al. Drakenstein Child Health Study (DCHS): investigating determinants of early child development and cognition. *BMJ Paediatr Open* [Internet]. 2018 Jun 13;2(1):e000282. Available from: <http://bmjpaedsopen.bmj.com/lookup/doi/10.1136/bmjpo-2018-000282>
401. Maphumulo WT, Bhengu BR. Challenges of quality improvement in the healthcare of South Africa post-apartheid: A critical review. *Curationis* [Internet]. 2019 May 29 [cited 2023 Nov 5];42(1). Available from: <http://www.curationis.org.za/index.php/curationis/article/view/1901>
402. Gustavson K, Von Soest T, Karevold E, Roysamb E. Attrition and generalizability in longitudinal studies: Findings from a 15-year population-based study and a Monte Carlo simulation study. *BMC Public Health* [Internet]. 2012 Oct 29 [cited 2023 Nov 5];12(1):1–11. Available from: <https://link.springer.com/articles/10.1186/1471-2458-12-918>
403. Launes J, Hokkanen L, Laasonen M, Tuulio-Henriksson A, Virta M, Lipsanen J, et al. Attrition in a 30-year follow-up of a perinatal birth risk cohort: Factors change with age. *PeerJ* [Internet]. 2014 Jul 8 [cited 2023 Nov 5];2014(1):e480. Available from: <https://peerj.com/articles/480>

404. Smit J, Van den Berg CE, Bekker LG, Seedat S, Stein DJ. Translation and cross-cultural adaptation of a mental health battery in an African setting. *Afr Health Sci* [Internet]. 2006;6(4). Available from: <https://doi.org/10.5555/afhs.2006.6.4.215>
405. Zar HJ, Barnett W, Stadler A, Gardner-Lubbe S, Myer L, Nicol MP. Aetiology of childhood pneumonia in a well vaccinated South African birth cohort: a nested case-control study of the Drakenstein Child Health Study. *Lancet Respir Med* [Internet]. 2016 Jun 1;4(6):463–72. Available from: [https://doi.org/10.1016/S2213-2600\(16\)00096-5](https://doi.org/10.1016/S2213-2600(16)00096-5)
406. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O’Neal L, et al. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform.* 2019 Jul 1;95:103208.
407. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform.* 2009 Apr 1;42(2):377–81.
408. Fang X, Zheng X, Fry DA, Ganz G, Casey T, Hsiao C, et al. The economic burden of violence against children in South Africa. *Int J Environ Res Public Health.* 2017;14(11):1431.
409. Bruce D. Dictating the local balance of power: Election-related violence in South Africa. *SA Crime Quarterly* [Internet]. 2009;2009(28):3–9. Available from: <https://hdl.handle.net/10520/EJC47645>
410. Seedat M, Van Niekerk A, Jewkes R, Suffla S, Ratele K. Violence and injuries in South Africa: prioritising an agenda for prevention. *The Lancet* [Internet]. 2009;374(9694):1011–22. Available from: [https://doi.org/10.1016/S0140-6736\(09\)60948-X](https://doi.org/10.1016/S0140-6736(09)60948-X)
411. Bruce D, Dissel A, Menziwa M. The violent nature of crime in South Africa: a concept paper for the Justice, Crime Prevention and Security Cluster. Braamfontein: Centre for the Study of Violence and Reconciliation (CSVr). 2007;
412. Dawes A, De Sas Kropiwnicki Z, Kafaar Z, Richter L. Survey examines South Africa’s attitude towards corporal punishment. Article [Internet]. 2005;19(1):1–3. Available from: <http://hdl.handle.net/20.500.11910/7142>
413. Barnett W, Halligan S, Heron J, Fraser A, Koen N, Zar HJ, et al. Maltreatment in childhood and intimate partner violence: A latent class growth analysis in a South African pregnancy cohort. *Child Abuse Negl.* 2018;86(3):336–48.
414. Mathews S, Abrahams N, Jewkes R, Martin LJ, Lombard C. The epidemiology of child homicides in South Africa. *Bull World Health Organ* [Internet]. 2013;91:562–8. Available from: <https://doi.org/10.2471/BLT.12.117036>
415. Finkelhor D, Turner HA, Shattuck A, Hamby SL. Prevalence of Childhood Exposure to Violence, Crime, and Abuse: Results From the National Survey of Children’s

Exposure to Violence. *JAMA Pediatr* [Internet]. 2015 Aug 1;169(8):746–54. Available from: <https://doi.org/10.1001/jamapediatrics.2015.0676>

416. Ford JD, Ford JD. Polyvictimization and developmental trauma in childhood Polyvictimization and developmental trauma in childhood. *Eur J Psychotraumatol* [Internet]. 2021;12(1). Available from: <https://doi.org/10.1080/20008198.2020.1866394>
417. Haahr-Pedersen I, Ershadi AAE, Hyland P, Hansen M, Perera C, Sheaf G, et al. Polyvictimization and psychopathology among children and adolescents: A systematic review of studies using the Juvenile Victimization Questionnaire. Achenbach Achenbach, Adams, Aho, Alvarez-Lister, Alvarez-Lister, Anda, Andrews, Babchishin, Bashir, Beck, Briere, Briere, Briggs-Gowan, Chan, Chase, Chen, Cloitre, Cloitre, Contractor, Cuevas, Cyr, Cyr, Cyr, Davies, Debowska, DeHart, Dierkhising, Finkelhol A, editor. *Child Abuse Negl* [Internet]. 2016/10/04. 2020 Sep 1 [cited 2020 Apr 27];107(1):104589. Available from: <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc17&NEWS=N&AN=2020-69735-001>
418. Kaminer D, du Plessis B, Hardy A, Benjamin A. Exposure to violence across multiple sites among young South African adolescents. *Peace and Conflict: Journal of Peace Psychology* [Internet]. 2013;19(2):112. Available from: <https://doi.org/10.1037/a0032487>
419. Donald KA, Hoogenhout M, du Plooy CP, Wedderburn CJ, Nhapi RT, Barnett W, et al. Drakenstein Child Health Study (DCHS): investigating determinants of early child development and cognition. *BMJ Paediatr Open*. 2018 Jun 13;2(1):e000282.
420. Stein DJ, Koen N, Donald KA, Adnams CM, Koopowitz S, Lund C, et al. Investigating the psychosocial determinants of child health in Africa: The Drakenstein Child Health Study. *J Neurosci Methods*. 2015;252:27–35.
421. Coen S, Banister E. What a difference sex and gender make: a gender, sex and health research casebook. 2012 [cited 2023 Jan 10]; Available from: <https://open.library.ubc.ca/soa/cIRcle/collections/ubccommunityandpartnerspublicati/52387/items/1.0132684>
422. Myer L, Stein DJ, Grimsrud A, Seedat S, Williams DR. Social determinants of psychological distress in a nationally-representative sample of South African adults. *Soc Sci Med* [Internet]. 2008;66(8):1828–40. Available from: <https://www.sciencedirect.com/science/article/pii/S027795360800052X>
423. Amaya-Jackson L. Child exposure to violence checklist. Adapted from Richter's Things I've seen and heard. Unpublished instrument, trauma evaluation, treatment & research program, Center for Child & Family Health, Durham, NC. 1998;
424. Fincham DS, Altes LK, Stein DJ, Seedat S. Posttraumatic stress disorder symptoms in adolescents: risk factors versus resilience moderation. *Compr Psychiatry* [Internet]. 2009 May;50(3):193–9. Available from: <https://doi.org/10.1016/j.comppsych.2008.09.001>

425. Bruwer B, Emsley R, Kidd M, Lochner C, Seedat S. Psychometric properties of the Multidimensional Scale of Perceived Social Support in youth. *Compr Psychiatry* [Internet]. 2008;49(2):195–201. Available from: <https://doi.org/10.1016/j.comppsych.2007.09.002>
426. Kaminer D, Hardy A, Heath K, Mosdell J, Bawa U. Gender patterns in the contribution of different types of violence to posttraumatic stress symptoms among South African urban youth. *Child Abuse Negl.* 2013;37(5):320–30.
427. Kaminer D, du Plessis B, Hardy A, Benjamin A. Exposure to violence across multiple sites among young South African adolescents. *Peace and Conflict.* 2013;19(2):112–24.
428. Kaminer D, du Plessis B, Hardy A, Benjamin A. Exposure to violence across multiple sites among young South African adolescents. *Peace and Conflict: Journal of Peace Psychology* [Internet]. 2013;19(2):112. Available from: <https://doi.org/10.1037/a0032487>
429. South African Police Service. Crime statistics of Republic of South Africa. Pretoria; 2021.
430. Stansfeld SA, Rothon C, Das-Munshi J, Mathews C, Adams A, Clark C, et al. Exposure to violence and mental health of adolescents: South African Health and Well-being Study. *BJPsych Open* [Internet]. 2017 Sep 2;3(5):257–64. Available from: <https://doi.org/10.1192/bjpo.bp.117.004861>
431. Atwoli L, Stein DJ, Williams DR, McLaughlin KA, Petukhova M, Kessler RC, et al. Trauma and posttraumatic stress disorder in South Africa: analysis from the South African Stress and Health Study. *BMC Psychiatry.* 2013;13(1):1–12.
432. Barnett W, Halligan S, Heron J, Fraser A, Koen N, Zar HJ, et al. Maltreatment in childhood and intimate partner violence: A latent class growth analysis in a South African pregnancy cohort. *Child Abuse Negl* [Internet]. 2018 Dec 1 [cited 2023 Apr 28];86(3):336–48. Available from: <https://doi.org/10.1016/j.chab.2018.08.020>
433. Hungerford A, Ogle RL, Clements CM. Children’s Exposure to Intimate Partner Violence: Relations Between Parent-Child Concordance and Children’s Adjustment. *Violence Vict* [Internet]. 2010 Apr 1 [cited 2023 Dec 20];25(2):185–201. Available from: <https://connect.springerpub.com/content/sgrvv/25/2/185>
434. Peisch V, Parent J, Forehand R, Golub A, Reid M, Price M. Intimate Partner Violence in Cohabiting Families: Reports by Multiple Informants and Associations with Adolescent Outcomes. *J Fam Violence* [Internet]. 2016 Aug 1 [cited 2023 Dec 20];31(6):747–57. Available from: <https://link.springer.com/article/10.1007/s10896-016-9808-0>
435. Haahr-Pedersen I, Ershadi AE, Hyland P, Hansen M, Perera C, Sheaf G, et al. Polyvictimization and psychopathology among children and adolescents: A systematic review of studies using the Juvenile Victimization Questionnaire. Achenbach Achenbach, Adams, Aho, Alvarez-Lister, Alvarez-Lister, Anda, Andrews, Babchishin, Bashir, Beck, Briere, Briere, Briggs-Gowan, Chan, Chase, Chen, Cloitre, Cloitre,

Contractor, Cuevas, Cyr, Cyr, Davies, Debowska, DeHart, Dierkhising, Finkelhol A, editor. *Child Abuse Negl.* 2020 Sep;107:104589.

436. Kaminer D, Hardy A, Heath K, Mosdell J, Bawa U. Gender patterns in the contribution of different types of violence to posttraumatic stress symptoms among South African urban youth. *Child Abuse Negl.* 2013;37(5):320–30.
437. Grasso DJ, Dierkhising CB, Branson CE, Ford JD, Lee R. Developmental patterns of adverse childhood experiences and current symptoms and impairment in youth referred for trauma-specific services. *J Abnorm Child Psychol.* 2016;44(5):871–86.
438. Fowler PJ, Tompsett CJ, Braciszewski JM, Jacques-Tiura AJ, Baltes BB. Community violence: A meta-analysis on the effect of exposure and mental health outcomes of children and adolescents. *Dev Psychopathol.* 2009 Jan 15;21(1):227–59.
439. Leoschut L, Kafaar Z. The frequency and predictors of poly-victimisation of South African children and the role of schools in its prevention. *Psychol Health Med.* 2017;22(sup1):81–93.
440. Appleyard K, Egeland B, van Dulmen MHM, Alan Sroufe L. When more is not better: The role of cumulative risk in child behavior outcomes. *Journal of child psychology and psychiatry.* 2005;46(3):235–45.
441. Teicher MH, Tomoda A, Andersen SL. Neurobiological consequences of early stress and childhood maltreatment: are results from human and animal studies comparable? *Ann N Y Acad Sci.* 2006;1071(1):313–23.
442. Haahr-Pedersen I, Ershadi A, Hyland P, Hansen M, Perera C, Sheaf G, et al. Polyvictimization and psychopathology among children and adolescents: A systematic review of studies using the Juvenile Victimization Questionnaire. Vol. 107, *Child Abuse and Neglect*. Elsevier Ltd; 2020. p. 104589.
443. Falconer NS, Casale M, Kuo C, Nyberg BJ, Hillis SD, Cluver LD. Factors That Protect Children From Community Violence: Applying the INSPIRE Model to a Sample of South African Children. *J Interpers Violence.* 2020 Jan 16;088626051989842.
444. Shields N, Nadasen K, Pierce L. The effects of community violence on children in Cape Town, South Africa. *Child Abuse Negl.* 2008;32(5):589–601.
445. Asagba RB, Noibi OW, Ogueji IA. Gender Differences in Children's Exposure to Domestic Violence in Nigeria. *J Child Adolesc Trauma [Internet].* 2021; Available from: <https://doi.org/10.1007/s40653-021-00386-6>
446. Lokot M, Bhatia A, Kenny L, Cislakhi B. Corporal punishment, discipline and social norms: A systematic review in low- and middle-income countries. *Aggress Violent Behav.* 2020 Nov 1;55:101507.
447. Hillis S, Mercy J, Amobi A, Kress H. Global Prevalence of Past-year Violence Against Children: A Systematic Review and Minimum Estimates. *Pediatrics.* 2016 Mar 1;137(3).

448. Hinsberger M, Sommer J, Kaminer D, Holtzhausen L, Weierstall R, Seedat S, et al. Perpetuating the cycle of violence in South African low-income communities: attraction to violence in young men exposed to continuous threat. *Eur J Psychotraumatol*. 2016 Dec 7;7(1):29099.
449. Mathews S, Benvenuti P, Africa S. Violence against children in South Africa: Developing a prevention agenda. *South African child gauge*. 2014;1(2):26–34.
450. Cowell RA, Cicchetti D, Rogosch FA, Toth SL. Childhood maltreatment and its effect on neurocognitive functioning: Timing and chronicity matter. *Dev Psychopathol [Internet]*. 2015 May 6 [cited 2023 Aug 18];27(2):521–33. Available from: <https://www.cambridge.org/core/journals/development-and-psychopathology/article/childhood-maltreatment-and-its-effect-on-neurocognitive-functioning-timing-and-chronicity-matter/0F2AB6DD7059AAF06F25FA9BF309351B>
451. Dunn EC, Nishimi K, Neumann A, Renaud A, Cecil CAM, Susser ES, et al. Time-Dependent Effects of Exposure to Physical and Sexual Violence on Psychopathology Symptoms in Late Childhood: In Search of Sensitive Periods in Development. *J Am Acad Child Adolesc Psychiatry [Internet]*. 2020 [cited 2023 Aug 21];59(2):283-295.e4. Available from: www.jaacap.org
452. Shahinfar A, Fox NA, Leavitt LA. Preschool children's exposure to violence: Relation of behavior problems to parent and child reports. *American Journal of Orthopsychiatry [Internet]*. 2000 Jan 1 [cited 2023 Jul 28];70(1):115–25. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1037/h0087690>
453. South African Human Rights Commission. Trend analysis report 2020/ 2021 [Internet]. 2021 [cited 2023 Aug 21]. Available from: <https://www.sahrc.org.za/home/21/files/SAHRC TAR 2020-21 FINAL.PDF>
454. Vibhakar V, Allen LR, Gee B, Meiser-Stedman R. A systematic review and meta-analysis on the prevalence of depression in children and adolescents after exposure to trauma. *J Affect Disord [Internet]*. 2019 Aug 1;255(January):77–89. Available from: <https://doi.org/10.1016/j.jad.2019.05.005>
455. Fong VC, Hawes D, Allen JL. A Systematic Review of Risk and Protective Factors for Externalizing Problems in Children Exposed to Intimate Partner Violence. *Trauma Violence Abuse [Internet]*. 2019 Apr 9 [cited 2023 May 30];20(2):149–67. Available from: <http://journals.sagepub.com/doi/10.1177/1524838017692383>
456. Dunn EC, McLaughlin KA, Slopen N, Rosand J, Smoller JW. DEVELOPMENTAL TIMING OF CHILD MALTREATMENT AND SYMPTOMS OF DEPRESSION AND SUICIDAL IDEATION IN YOUNG ADULTHOOD: RESULTS FROM THE NATIONAL LONGITUDINAL STUDY OF ADOLESCENT HEALTH. *Depress Anxiety [Internet]*. 2013 Apr;30(10):n/a-n/a. Available from: <https://onlinelibrary.wiley.com/doi/10.1002/da.22102>
457. Manly JT, Kim JE, Rogosch FA, Cicchetti D, Todd Manly J, Kim JE, et al. Dimensions of child maltreatment and children's adjustment: Contributions of

- developmental timing and subtype. *Dev Psychopathol* [Internet]. 2001 [cited 2022 Sep 7];13(4):759–82. Available from:
<https://www.cambridge.org/core/journals/development-and-psychopathology/article/dimensions-of-child-maltreatment-and-childrens-adjustment-contributions-of-developmental-timing-and-subtype/2FBEA046C5975B908DE0F0E0C5EE06DB>
458. Mercy JA, Hillis SD, Butchart A, Bellis MA, Ward CL, Fang X, et al. Interpersonal Violence: Global Impact and Paths to Prevention. *Disease Control Priorities, Third Edition (Volume 7): Injury Prevention and Environmental Health* [Internet]. 2017 Oct 27 [cited 2023 Jul 26];71–96. Available from:
<https://www.ncbi.nlm.nih.gov/books/NBK525208/>
459. Mercy JA, Butchart A, Rosenberg ML, Dahlberg L, Harvey A. Preventing violence in developing countries: a framework for action. *Int J Inj Contr Saf Promot* [Internet]. 2008 [cited 2023 Jul 26];15(4):197–208. Available from:
<https://pubmed.ncbi.nlm.nih.gov/19051083/>
460. Stein DJ, Koen N, Donald KA, Adnams CM, Koopowitz S, Lund C, et al. Investigating the psychosocial determinants of child health in Africa: The Drakenstein Child Health Study. *J Neurosci Methods* [Internet]. 2015 Aug 30;252:27–35. Available from: <https://doi.org/10.1016/j.jneumeth.2015.03.016>
461. Tsunga L, Lake M, Halligan SL, Malcolm-Smith S, Hoffman N, Heron J, et al. Early Childhood Violence Exposure Patterns in The Drakenstein Child Health Study (DCHS). *Wellcome Open Res* [Internet]. 2023 Sep 19 [cited 2023 Mar 22];8:36. Available from: <https://wellcomeopenresearch.org/articles/8-36/v2>
462. Finkelhor D, Ormrod RK, Turner HA. Poly-victimization: A neglected component in child victimization. *Child Abuse Negl*. 2007 Jan 1;31(1):7–26.
463. Turner HA, Finkelhor D, Ormrod R. Poly-Victimization in a National Sample of Children and Youth. *Am J Prev Med*. 2010 Mar 1;38(3):323–30.
464. Achenbach TM, Rescorla LA. Manual for the ASEBA preschool forms and profiles. Vol. 30. Burlington, VT: University of Vermont, Research center for children, youth ...; 2000.
465. Cox JL, Holden JM, Sagovsky R. Detection of Postnatal Depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *The British Journal of Psychiatry* [Internet]. 1987 [cited 2023 Jun 12];150(6):782–6. Available from:
<https://www.cambridge.org/core/journals/the-british-journal-of-psychiatry/article/detection-of-postnatal-depression/E18BC62858DBF2640C33DCC8B572F02A>
466. Ali R, Awwad E, Babor TF, Bradley F, Butau T, Farrell M, et al. The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): Development, reliability and feasibility. *Addiction*. 2002;97(9):1183–94.

467. Wedderburn CJ, Yeung S, Rehman AM, Stadler JAM, Nhapi RT, Barnett W, et al. Neurodevelopment of HIV-exposed uninfected children in South Africa: outcomes from an observational birth cohort study. *Lancet Child Adolesc Health* [Internet]. 2019 [cited 2022 Oct 19];3(11):803–13. Available from: <https://www.sciencedirect.com/science/article/pii/S2352464219302500>
468. Myers B, Koen N, Donald KA, Nhapi RT, Workman L, Barnett W, et al. Effect of hazardous alcohol use during pregnancy on growth outcomes at birth: Findings from a South African cohort study. *Wiley Online Library* [Internet]. 2017 Feb 1 [cited 2022 Oct 19];42(2):369–77. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/acer.13566>
469. Malcolm-Smith S, Lake MT, Krwece A, Du Plooy CP, Hoffman N, Donald KA, et al. Externalizing behavior in preschool children in a South African birth cohort: Predictive pathways in a high-risk context. *Dev Psychopathol* [Internet]. 2022 Mar 15 [cited 2022 Aug 24];1–18. Available from: <https://www.cambridge.org/core/journals/development-and-psychopathology/article/externalizing-behavior-in-preschool-children-in-a-south-african-birth-cohort-predictive-pathways-in-a-highrisk-context/67B851C20DF9783D799F40DF3A922456>
470. Shuffrey LC, Sania A, Brito NH, Potter M, Springer P, Lucchini M, et al. Association of maternal depression and anxiety with toddler social-emotional and cognitive development in South Africa: A prospective cohort study. *BMJ Open* [Internet]. 2022 Apr 1 [cited 2023 Jun 30];12(4):e058135. Available from: <https://bmjopen.bmjjournals.org/content/12/4/e058135>
471. Walker SP, Wachs TD, Grantham-McGregor S, Black MM, Nelson CA, Huffman SL, et al. Inequality in early childhood: risk and protective factors for early child development. *The Lancet* [Internet]. 2011 Oct;378(9799):1325–38. Available from: www.thelancet.com
472. van Buuren S, Groothuis-Oudshoorn K. mice: Multivariate Imputation by Chained Equations in R. *J Stat Softw* [Internet]. 2011 Dec 12 [cited 2023 Apr 6];45(3):1–67. Available from: <https://www.jstatsoft.org/index.php/jss/article/view/v045i03>
473. Rubin DB. Multiple imputation for nonresponse in surveys. Wiley series in probability and mathematical statistics. Applied probability and statistics. New York: John Wiley & Sons; 1987.
474. Atwoli L, Stein DJ, Williams DR, McLaughlin KA, Petukhova M, Kessler RC, et al. Trauma and posttraumatic stress disorder in South Africa: Analysis from the South African Stress and Health Study. *BMC Psychiatry* [Internet]. 2013;13(1):1–12. Available from: <https://link.springer.com/articles/10.1186/1471-244X-13-182>
475. Hayati Rezvan P, Tomlinson M, Christodoulou J, Almirol E, Stewart J, Gordon S, et al. Intimate Partner Violence and Food Insecurity Predict Early Behavior Problems Among South African Children over 5-years Post-Birth. *Child Psychiatry Hum Dev* [Internet]. 2021 Jun 1 [cited 2023 May 25];52(3):409–19. Available from:

<http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emexb&NEWS=N&AN=632397973>

476. Falconer NS, Casale M, Kuo C, Nyberg BJ, Hillis SD, Cluver LD. Factors That Protect Children From Community Violence: Applying the INSPIRE Model to a Sample of South African Children. *J Interpers Violence* [Internet]. 2020 Jan 16;36(23–24):088626051989842. Available from: <http://journals.sagepub.com/doi/10.1177/0886260519898425>
477. Gershoff ET, Grogan-Kaylor A. Spanking and child outcomes: Old controversies and new meta-analyses. *Journal of Family Psychology* [Internet]. 2016 Jun 1;30(4):453–69. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/fam0000191>
478. Danese A, McEwen BS. Adverse childhood experiences, allostasis, allostatic load, and age-related disease. *Physiol Behav* [Internet]. 2012 Apr 12 [cited 2023 Aug 17];106(1):29–39. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0031938411004045>
479. Finkelhor D, Ormrod R, Turner H, Holt M. Pathways to Poly-Victimization. *Child Maltreat* [Internet]. 2009 Nov 16 [cited 2023 Sep 22];14(4):316–29. Available from: <https://journals.sagepub.com/doi/abs/10.1177/1077559509347012>
480. van Breda AD, Theron LC. A critical review of South African child and youth resilience studies, 2009–2017. *Child Youth Serv Rev* [Internet]. 2018 Aug 1 [cited 2023 Nov 1];91:237–47. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0190740918301877>
481. Poulopou MS. Emotional and Behavioural Difficulties in Preschool. *J Child Fam Stud* [Internet]. 2015 Feb 1 [cited 2023 Nov 1];24(2):225–36. Available from: <https://link.springer.com/article/10.1007/s10826-013-9828-9>
482. McCrory EJ, Gerin MI, Viding E. Annual Research Review: Childhood maltreatment, latent vulnerability and the shift to preventative psychiatry – the contribution of functional brain imaging. *Journal of Child Psychology and Psychiatry* [Internet]. 2017 Apr 1 [cited 2023 May 9];58(4):338–57. Available from: <https://doi.org/10.1111/jcpp.12713>
483. Suliman S, Mkabile SG, Fincham DS, Ahmed R, Stein DJ, Seedat S. Cumulative effect of multiple trauma on symptoms of posttraumatic stress disorder, anxiety, and depression in adolescents. *Compr Psychiatry* [Internet]. 2009;50(2):121–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/19216888/>
484. Williams SL, Williams DR, Stein DJ, Seedat S, Jackson PB, Moomal H. Multiple traumatic events and psychological distress: The South Africa stress and health study. *J Trauma Stress* [Internet]. 2007 Oct 22;20(5):845–55. Available from: <https://pubmed.ncbi.nlm.nih.gov/17955545/>
485. Lagattuta KH, Sayfan L, Bamford C. Do you know how I feel? Parents underestimate worry and overestimate optimism compared to child self-report. *J Exp Child Psychol*

- [Internet]. 2012 Oct 1 [cited 2023 Apr 28];113(2):211–32. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0022096512000616>
486. Tafere Y. Educational Trajectories from Childhood to Early Adulthood: Aspirations, Gender and Poverty in Ethiopia. 2017; Available from: www.younglives.org.uk
487. Bruce D, Dissel A, Menziwa M, Reconciliation C for the S of V and. The Violent Nature of Crime in South Africa: A Concept Paper for the Justice, Crime Prevention and Security Cluster. Braamfontein: Centre for the Study of Violence and Reconciliation (CSV). Centre for the Study of Violence and Reconciliation; 2007.
488. Marin MF, Lord C, Andrews J, Juster RP, Sindi S, Arsenault-Lapierre G, et al. Chronic stress, cognitive functioning and mental health. *Neurobiol Learn Mem* [Internet]. 2011 Nov 1 [cited 2023 Mar 7];96(4):583–95. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1074742711000517>
489. Sharkey P. The acute effect of local homicides on children's cognitive performance. *Proc Natl Acad Sci U S A* [Internet]. 2010 Jun 29 [cited 2023 Aug 18];107(26):11733–8. Available from: <https://www.pnas.org/doi/abs/10.1073/pnas.1000690107>
490. McCoy DC, Raver CC, Sharkey P. Children's Cognitive Performance and Selective Attention Following Recent Community Violence. *J Health Soc Behav* [Internet]. 2015 Mar 16 [cited 2022 Sep 9];56(1):19–36. Available from: <https://journals.sagepub.com/doi/full/10.1177/0022146514567576>
491. Bowman B, Matzopoulos R, Butchart A, Mercy JA. The impact of violence on development in low- to middle-income countries. <https://doi.org/10.1080/17457300802417911> [Internet]. 2008 [cited 2023 Aug 17];15(4):209–19. Available from: <https://www.tandfonline.com/doi/abs/10.1080/17457300802417911>
492. Kaufman AS, Kaufman NL. Kaufman Assessment Battery for Children, Second Edition. In: Encyclopedia of Special Education [Internet]. 2014. Available from: <https://doi.org/10.1002/9781118660584.ese1324>
493. Greenop K, Fry J, De Sousa D. The Kaufman Assessment Battery in South Africa. *Psychological assessment in South Africa: research and applications*. 2012;86–103.
494. Van Wyhe KS, Van De Water T, Boivin MJ, Cotton MF, Thomas KGF. Cross-cultural assessment of HIV-associated cognitive impairment using the Kaufman assessment battery for children: A systematic review [Internet]. Vol. 20, *Journal of the International AIDS Society*. John Wiley & Sons, Ltd; 2017 [cited 2023 Aug 3]. p. 21412. Available from: <https://onlinelibrary.wiley.com/doi/full/10.7448/IAS.20.1.21412>
495. Debeaudrap P, Bodeau-Livinec F, Pasquier E, Germanaud D, Ndiang ST, Nlend AN, et al. Neurodevelopmental outcomes in HIV-infected and uninfected African children. *AIDS* [Internet]. 2018 [cited 2022 Oct 3];32(18):2749–57. Available from: https://journals.lww.com/aidsonline/Fulltext/2018/11280/Neurodevelopmental_outcomes_in_HIV_infected_and.10.aspx

496. Dunn LM, Dunn DM. PPVT-4: Peabody picture vocabulary test. Pearson Assessments; 2007.
497. Dawes A, Biersteker L, Hendricks L. Towards integrated early childhood development. An evaluation of the Sobambisana initiative. Cape Town: IlifaLabantwana <http://ilifalabantwana.co.za/an-evaluation-of-the-sobambisana-initiative> (accessed 25 October 2016). 2012;
498. Tomlinson M, Rotheram-Borus MJ, le Roux IM, Youssef M, Nelson SH, Scheffler A, et al. Thirty-Six-Month Outcomes of a Generalist Paraprofessional Perinatal Home Visiting Intervention in South Africa on Maternal Health and Child Health and Development. *Prevention Science [Internet]*. 2016 Nov 1 [cited 2023 Aug 8];17(8):937–48. Available from: <https://link.springer.com/article/10.1007/s11121-016-0676-x>
499. Brahmbhatt H, Boivin M, Ssemijja V, Kagaayi J, Kigozi G, Serwadda D, et al. Impact of HIV and Atiretroviral Therapy on Neurocognitive Outcomes Among School Aged Children. *J Acquir Immune Defic Syndr [Internet]*. 2017 May 5 [cited 2023 Aug 3];75(1):1. Available from: [/pmc/articles/PMC5388581/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5388581/)
500. Mitchell JM, Tomlinson M, Bland RM, Houle B, Stein A, Rochat TJ. Confirmatory factor analysis of the Kaufman assessment battery in a sample of primary school-aged children in rural South Africa. *South African Journal of Psychology [Internet]*. 2018 Dec 17 [cited 2023 Nov 24];48(4):434–52. Available from: <http://journals.sagepub.com/doi/10.1177/0081246317741822>
501. Wechsler D. Wechsler preschool and primary scale of intelligence—fourth edition. The Psychological Corporation San Antonio, TX. 2012;
502. Williams ME, Sando L, Soles TG. Cognitive Tests in Early Childhood: Psychometric and Cultural Considerations. *J Psychoeduc Assess [Internet]*. 2014 Feb 11 [cited 2023 Aug 8];32(5):455–76. Available from: https://journals.sagepub.com/doi/full/10.1177/0734282913517526?casa_token=vmjF9ZPt5kAAAAA%3AF6BEKIW9Nxb_5Y9DBTaqA1KNinAGMHsZ1jKWvkRohzdlLs0d1QiiBpEZzBBTEy9UL1IXvfwKFg
503. Pileggi LA, Malcolm-Smith S, Solms M. Investigating the role of social-affective attachment processes in cradling bias: The absence of cradling bias in children with Autism Spectrum Disorders. <https://doi.org/10.1080/1357650X.2014.948449> [Internet]. 2014 Mar 4 [cited 2023 Aug 8];20(2):154–70. Available from: <https://www.tandfonline.com/doi/abs/10.1080/1357650X.2014.948449>
504. Hoogenhout M, Malcolm-Smith S. Theory of mind in autism spectrum disorder: Does DSM classification predict development? *Res Autism Spectr Disord*. 2014 Jun 1;8(6):597–607.
505. Gerstadt CL, Hong YJ, Diamond A. The relationship between cognition and action: Performance of children 3 1/2-7 years old on a Stroop-like day-night test. *Cognition*. 1994;53(2):129–53.

506. Rhoades BL, Greenberg MT, Domitrovich CE. The contribution of inhibitory control to preschoolers' social-emotional competence. *J Appl Dev Psychol* [Internet]. 2009;30(3):310–20. Available from: <https://www.sciencedirect.com/science/article/pii/S0193397308001482>
507. Hughes C, Ensor R. Does Executive Function Matter for Preschoolers' Problem Behaviors? *J Abnorm Child Psychol* [Internet]. 2008;36(1):1–14. Available from: <https://doi.org/10.1007/s10802-007-9107-6>
508. Thorell LB, Wåhlstedt C. Executive functioning deficits in relation to symptoms of ADHD and/or ODD in preschool children. *Infant Child Dev* [Internet]. 2006 Sep 1 [cited 2023 Aug 8];15(5):503–18. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/icd.475>
509. Zelazo PD. The Dimensional Change Card Sort (DCCS): a method of assessing executive function in children. *Nature Protocols* 2006 1:1 [Internet]. 2006 Jun 27 [cited 2023 Aug 8];1(1):297–301. Available from: <https://www.nature.com/articles/nprot.2006.46>
510. Frye D, Zelazo PD, Palfai T. Theory of mind and rule-based reasoning. *Cogn Dev*. 1995 Oct 1;10(4):483–527.
511. Grant DA, Berg EA. Wisconsin Card Sorting Test (WCST). 1993;
512. Beck DM, Schaefer C, Pang K, Carlson SM. Executive Function in Preschool Children: Test–Retest Reliability. <http://dx.doi.org/101080/152483722011563485> [Internet]. 2011 Apr [cited 2023 Aug 8];12(2):169–93. Available from: <https://www.tandfonline.com/doi/abs/10.1080/15248372.2011.563485>
513. Zelazo PD, Bauer PJ. National Institutes of Health Toolbox cognition battery (NIH Toolbox CB): Validation for children between 3 and 15 years. Wiley Hoboken, NJ; 2013.
514. Lafayette Instrument Inc. Grooved pegboard test user instructions. Lafayette: Lafayette Instrument. 2002.
515. Wang YC, Magasi SR, Bohannon RW, Reuben DB, McCreath HE, Bubela DJ, et al. Assessing Dexterity Function: A Comparison of Two Alternatives for the NIH Toolbox. *Journal of Hand Therapy*. 2011 Oct 1;24(4):313–21.
516. Meyer A, Sagvolden T. Fine motor skills in South African children with symptoms of ADHD: Influence of subtype, gender, age, and hand dominance. *Behavioral and Brain Functions* [Internet]. 2006 Oct 9 [cited 2023 Aug 8];2(1):1–13. Available from: <https://behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-2-33>
517. Hendricks G, Malcolm-Smith S, Stein DJ, Zar HJ, Wedderburn CJ, Nhapi RT, et al. Prenatal alcohol exposure is associated with early motor, but not language development in a South African cohort. *Acta Neuropsychiatr* [Internet]. 2020 Jun 6 [cited 2022 Oct 19];32(3):145–52. Available from:

<https://www.cambridge.org/core/journals/acta-neuropsychiatrica/article/prenatal-alcohol-exposure-is-associated-with-early-motor-but-not-language-development-in-a-south-african-cohort/1F9EC84C3DB1804C27CD194E94ADF37A>

518. Naudé PJW, Pariante C, Hoffman N, Koopowitz SM, Donald KA, Zar HJ, et al. Antenatal maternal depression, early life inflammation and neurodevelopment in a South African birth cohort. *Brain Behav Immun* [Internet]. 2022 Oct [cited 2022 Oct 19];105:160–8. Available from: <https://www.sciencedirect.com/science/article/pii/S0889159122001751>
519. Christensen GM, Rowcliffe C, Chen J, Vanker A, Koen N, Jones MJ, et al. In-utero exposure to indoor air pollution or tobacco smoke and cognitive development in a South African birth cohort study. *Science of the Total Environment* [Internet]. 2022 [cited 2022 Oct 19];834. Available from: <https://www.sciencedirect.com/science/article/pii/S0048969722024871>
520. Christensen DL, Schieve LA, Devine O, Drews-Botsch C. Socioeconomic status, child enrichment factors, and cognitive performance among preschool-age children: Results from the Follow-Up of Growth and Development Experiences study. *Res Dev Disabil* [Internet]. 2014 Jul;35(7):1789–801. Available from: <http://dx.doi.org/10.1016/j.ridd.2014.02.003>
521. Donald KA, Wedderburn CJ, Barnett W, Nhapi RT, Rehman AM, Stadler JAMM, et al. Risk and protective factors for child development: An observational South African birth cohort. Batura N, editor. *PLoS Med* [Internet]. 2019 Sep 27 [cited 2020 Oct 14];16(9):e1002920. Available from: <https://dx.plos.org/10.1371/journal.pmed.1002920>
522. Scarborough AA, Lloyd EC, Barth RP. Maltreated infants and toddlers: Predictors of developmental delay. *Journal of Developmental and Behavioral Pediatrics* [Internet]. 2009 Dec [cited 2023 Aug 9];30(6):489–98. Available from: https://journals.lww.com/jrnldbp/Fulltext/2009/12000/Maltreated_Infants_and_Toddlers__Predictors_of.2.aspx
523. Belsky J. Early-Life Adversity Accelerates Child and Adolescent Development. <https://doi.org/10.1177/0963721419837670> [Internet]. 2019 Apr 8 [cited 2023 Sep 20];28(3):241–6. Available from: https://journals.sagepub.com/doi/full/10.1177/0963721419837670?casa_token=iLHWf4Un-6YAAAAAA%3AyoTKaZEkSoIh4i11G3gKX3eSNb7Jor3UvsdxTJEbjSaifiykAihwuwg7TiArBkHufytdEPdosg
524. Colich NL, Rosen ML, Williams ES, McLaughlin KA. Biological aging in childhood and adolescence following experiences of threat and deprivation: A systematic review and meta-analysis. *Psychol Bull*. 2020 Sep 1;146(9):721–64.
525. Thijssen S, Muetzel RL, Bakermans-Kranenburg MJ, Jaddoe VW V, Tiemeier H, Verhulst FC, et al. Insensitive parenting may accelerate the development of the amygdala–medial prefrontal cortex circuit. *Dev Psychopathol*. 2017;29(2):505–18.

526. Day FR, Elks CE, Murray A, Ong KK, Perry JRB. Puberty timing associated with diabetes, cardiovascular disease and also diverse health outcomes in men and women: the UK Biobank study. *Sci Rep* [Internet]. 2015 Jun 18;5(1):11208. Available from: <https://www.nature.com/articles/srep11208>
527. Marioni RE, Shah S, McRae AF, Ritchie SJ, Muniz-Terrera G, Harris SE, et al. The epigenetic clock is correlated with physical and cognitive fitness in the Lothian Birth Cohort 1936. *Int J Epidemiol*. 2015;44(4):1388–96.
528. Ellis BJ, Del Giudice M. Developmental adaptation to stress: An evolutionary perspective. *Annu Rev Psychol*. 2019;70:111–39.
529. Danese A, Moffitt TE, Arseneault L, Bleiberg BA, Dinardo PB, Gandelman SB, et al. The Origins of Cognitive Deficits in Victimized Children: Implications for Neuroscientists and Clinicians. *Am J Psychiatry*. 2017;174:349–61.
530. Armstrong R, Arnott W, Copland DA, McMahon K, Khan A, Najman JM, et al. Change in receptive vocabulary from childhood to adulthood: associated mental health, education and employment outcomes. *Int J Lang Commun Disord* [Internet]. 2017 Sep 1 [cited 2023 Oct 9];52(5):561–72. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/1460-6984.12301>
531. Atwoli L, Stein DJ, Williams DR, McLaughlin KA, Petukhova M, Kessler RC, et al. Trauma and posttraumatic stress disorder in South Africa: analysis from the South African Stress and Health Study. *BMC Psychiatry* [Internet]. 2013 Jul 3 [cited 2023 Oct 12];13(1):1–12. Available from: <https://pubmed.ncbi.nlm.nih.gov/23819543>
532. Shields N, Nadasen K, Pierce L. The effects of community violence on children in Cape Town, South Africa. *Child Abuse Negl* [Internet]. 2008 May;32(5):589–601. Available from: <https://doi.org/10.1016/j.chab.2007.07.010>
533. Donenberg G, Naidoo P, Kendall A, Emerson E, Ward CL, Kagee A, et al. Pathways from witnessing community violence to mental health problems among South African adolescents. *South African Medical Journal* [Internet]. 2020 [cited 2023 Apr 26];110(2):145–53. Available from: <https://doi.org/10.7196/SAMJ.2020.v110i2.13929>
534. Gann LH. Policing South Africa: The South African Police and the Transition from Apartheid. *Orbis* [Internet]. 1994 Nov 18;38:679+. Available from: <https://link.gale.com/apps/doc/A16443498/AONE?u=anon~1595a862&sid=googleScholar&xid=1b9724b9>
535. Standing A. Organised crime: A study from the Cape Flats. Institute for Security Studies; 2006.
536. Meinck F, Cluver LD, Boyes ME. Household illness, poverty and physical and emotional child abuse victimisation: findings from South Africa's first prospective cohort study. *BMC Public Health*. 2015;15(1):1–13.
537. Burton P, Ward CL, Artz L, Leoschut L. The Optimus Study on Child Abuse, Violence and Neglect in South Africa (Research Report). Optimus Study. 2016;1–32.

538. Kim JC, Watts CH, Hargreaves JR, Ndhlovu LX, Phetla G, Morison LA, et al. Understanding the impact of a microfinance-based intervention on women's empowerment and the reduction of intimate partner violence in South Africa. *Am J Public Health* [Internet]. 2007 Jan 10 [cited 2023 Nov 20];97(10):1794–802. Available from: <https://ajph.aphapublications.org/doi/10.2105/AJPH.2006.095521>
539. Gass JD, Stein DJ, Williams DR, Seedat S. Gender Differences in Risk for Intimate Partner Violence Among South African Adults. <http://dx.doi.org/10.1177/0886260510390960> [Internet]. 2010 Dec 13 [cited 2023 Nov 20];26(14):2764–89. Available from: https://journals.sagepub.com/doi/abs/10.1177/0886260510390960?casa_token=Di6izDlm-sMAAAAAA%3APGBJ-n31kE2kHdSvkfukjyW44S5Eyd2M7FN91aqKzCws_BACrKL1xpY-qFHQ0DRY628UpTMYK1g
540. Jewkes RK, Dunkle K, Nduna M, Shai N. Intimate partner violence, relationship power inequity, and incidence of HIV infection in young women in South Africa: A cohort study. *The Lancet* [Internet]. 2010 Jul 3 [cited 2023 Nov 20];376(9734):41–8. Available from: <http://www.thelancet.com/article/S014067361060548X/fulltext>
541. Richter L, Morrell R. *Baba: men and fatherhood in South Africa*. HSRC Press; 2006.
542. Daryanani I, Hamilton JL, Abramson LY, Alloy LB. Single Mother Parenting and Adolescent Psychopathology. *J Abnorm Child Psychol* [Internet]. 2016 Oct 1 [cited 2023 Nov 23];44(7):1411–23. Available from: <https://link.springer.com/article/10.1007/s10802-016-0128-x>
543. van der Merwe A, Dawes A. Youth violence: A review of risk factors, causal pathways and effective intervention. *J Child Adolesc Ment Health* [Internet]. 2007;19(2):95–113. Available from: <https://doi.org/10.2989/17280580709486645>
544. Morrell R, Jewkes R, Lindegger G. Hegemonic masculinity/masculinities in South Africa: Culture, power, and gender politics. *Men Masc*. 2012;15(1):11–30.
545. Richter L, Dawes A, de Kadt J. Promoting mental health in scarce-resource contexts: emerging evidence and practice. In: Petersen I, Bhana A, Flisher AJ, Swartz L, Richter L, editors. HSRC Press. Cape Town; 2010. p. 99–123.
546. Constitutional Court. *Freedom of Religion South Africa v Minister of Justice and Constitutional Development and Others*. Vol. 6, Court proceedings. 2019. p. 1–46.
547. Richter LM, Mathews S, Kagura J, Nonterah E. A longitudinal perspective on violence in the lives of South African children from the Birth to Twenty Plus cohort study in Johannesburg-Soweto. *South African Medical Journal* [Internet]. 2018 [cited 2023 Nov 20];108(3):181–6. Available from: <https://www.ajol.info/index.php/samj/article/view/170647>
548. Lokot M, Bhatia A, Kenny L, Cislaghi B. Corporal punishment, discipline and social norms: A systematic review in low- and middle-income countries. *Aggress Violent*

- Behav [Internet]. 2020 Nov 1 [cited 2022 Oct 21];55:101507. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1359178920302111>
549. Dawes A, De Z, Kropiwnicki S, Kafaar Z, Richter L. Survey examines South Africa's attitude towards Corporal Punishment. 2005 [cited 2023 Nov 20];1. Available from: www.hsrc.ac.za.
550. Roman NV, Makwakwa T, Lacante M. Perceptions of parenting styles in South Africa: The effects of gender and ethnicity. Tidwell N, editor. Cogent Psychol [Internet]. 2016 Dec 31 [cited 2023 Nov 20];3(1):1153231. Available from: <https://www.tandfonline.com/action/journalInformation?journalCode=oaps20>
551. Miller P, Votruba-Drzal E. The Role of Family Income Dynamics in Predicting Trajectories of Internalizing and Externalizing Problems. J Abnorm Child Psychol [Internet]. 2017 Apr 1 [cited 2023 Nov 20];45(3):543–56. Available from: <https://link.springer.com/article/10.1007/s10802-016-0181-5>
552. Tandon M, Cardeli E, Luby J. Internalizing Disorders in Early Childhood: A Review of Depressive and Anxiety Disorders. Child Adolesc Psychiatr Clin N Am [Internet]. 2009 Jul [cited 2023 Nov 20];18(3):593. Available from: [/pmc/articles/PMC3184300/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3184300/)
553. Lieberman AF, Chu A, Van Horn P, Harris WW. Trauma in early childhood: Empirical evidence and clinical implications. Dev Psychopathol [Internet]. 2011 May [cited 2023 Nov 18];23(2):397–410. Available from: <https://www.cambridge.org/core/journals/development-and-psychopathology/article/trauma-in-early-childhood-empirical-evidence-and-clinical-implications/59035175D8B665AD64A11C04EDAE7BB6>
554. Danese A, J Lewis S, Lewis SJ, J Lewis S. Psychoneuroimmunology of Early-Life Stress: The Hidden Wounds of Childhood Trauma? Neuropsychopharmacology [Internet]. 2017 Jan 1;42(1):99–114. Available from: <https://doi.org/10.1038/npp.2016.198>
555. Bick J, Nelson CA. Early adverse experiences and the developing brain [Internet]. Vol. 41, Neuropsychopharmacology. Nature Publishing Group; 2016 [cited 2023 Sep 13]. p. 177–96. Available from: <https://www.nature.com/articles/npp2015252>
556. Hertzman C. The Biological Embedding of Early Experience. Ann N Y Acad Sci. 1999;896(1):85–95.
557. McEwen BS. Brain on stress: How the social environment gets under the skin. Proc Natl Acad Sci U S A [Internet]. 2012 Oct 16 [cited 2023 Aug 17];109(SUPPL.2):17180–5. Available from: www.pnas.org/cgi/doi/10.1073/pnas.1121254109
558. McCrory EJ, Viding E. The theory of latent vulnerability: Reconceptualizing the link between childhood maltreatment and psychiatric disorder. Dev Psychopathol [Internet]. 2015 May 6 [cited 2023 May 9];27(2):493–505. Available from: <https://www.cambridge.org/core/journals/development-and-psychopathology/article/theory-of-latent-vulnerability-reconceptualizing-the-link->

between-childhood-maltreatment-and-psychiatric-disorder/552648FD22ACD298D00125693C2CB743

559. Enlow MB, Egeland B, Blood EA, Wright RORJRO, Wright RORJRO. Interpersonal trauma exposure and cognitive development in children to age 8 years: a longitudinal study. *J Epidemiol Community Health* [Internet]. 2012 Nov 1 [cited 2023 Mar 5];66(11):1005–10. Available from: <http://jech.bmjjournals.org/>
560. Schwartz AE, Laurito A, Lacoe J, Sharkey P, Ellen IG. The academic effects of chronic exposure to neighbourhood violence. *Urban Studies*. 2022;59(14):3005–21.
561. Margolin G, Vickerman KA, Oliver PH, Gordis EB. Violence Exposure in Multiple Interpersonal Domains: Cumulative and Differential Effects. *Journal of Adolescent Health* [Internet]. 2010 Aug;47(2):198–205. Available from: <http://www.sciencedirect.com/science/article/pii/S1054139X10000807>
562. Saltzman KM, Weems CF, Carrion VG. IQ and Posttraumatic Stress Symptoms in Children Exposed to Interpersonal Violence. *Child Psychiatry Hum Dev* [Internet]. 2006 Mar;36(3):261–72. Available from: <https://doi.org/10.1007/s10578-005-0002-5>
563. Mathews T, Dempsey M, Overstreet S. Effects of exposure to community violence on school functioning: The mediating role of posttraumatic stress symptoms. *Behaviour research and therapy* [Internet]. 2009 Jul;47(7):586–91. Available from: <http://dx.doi.org/10.1016/j.brat.2009.04.001>
564. Ratner HH, Chiodo L, Covington C, Sokol RJ, Ager J, Delaney-Black Virginia, et al. Violence Exposure, IQ, Academic Performance, and Children's Perception of Safety: Evidence of Protective Effects. *Merrill Palmer Q* [Internet]. 2006 Apr 1 [cited 2022 Sep 9];52(2). Available from: https://go.gale.com/ps/i.do?p=AONE&sw=w&issn=0272930X&v=2.1&it=r&id=GAL_E%7CA147301095&sid=googleScholar&linkaccess=fulltext
565. Overstreet S, Braun S. A preliminary examination of the relationship between exposure to community violence and academic functioning. *School Psychology Quarterly* [Internet]. 1999;14(4):380–96. Available from: <http://doi.apa.org/getdoi.cfm?doi=10.1037/h0089015>
566. Ebonwu J, Mumbauer A, Uys M, Wainberg ML, Medina-Marino A. Determinants of late antenatal care presentation in rural and peri-urban communities in South Africa: A cross-sectional study. El Bcheraoui C, editor. *PLoS One* [Internet]. 2018 Mar 8 [cited 2023 Nov 22];13(3):e0191903. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0191903>
567. Solarin I, Black V. “They told me to come back”: Women’s antenatal care booking experience in inner-city Johannesburg. *Matern Child Health J* [Internet]. 2013 Feb 19 [cited 2023 Nov 22];17(2):359–67. Available from: <https://link.springer.com/article/10.1007/s10995-012-1019-6>
568. Muhwava LS, Morojele N, London L. Psychosocial factors associated with early initiation and frequency of antenatal care (ANC) visits in a rural and urban setting in

- South Africa: A cross-sectional survey. *BMC Pregnancy Childbirth* [Internet]. 2016 Jan 25 [cited 2023 Nov 22];16(1):1–9. Available from: <https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-016-0807-1>
569. Danese A, Moffitt TE, Arseneault L, Bleiberg BA, Dinardo PB, Gandelman SB, et al. The Origins of Cognitive Deficits in Victimized Children: Implications for Neuroscientists and Clinicians. *Am J Psychiatry* [Internet]. 2017 Apr 1 [cited 2022 Oct 31];174(4):349–61. Available from: <https://www.eriskstudy.com/media/1081/danese2016-childvictimisation-cognition.pdf>
570. Ryan J, Chaudieu I, Ancelin ML, Saffery R. Biological underpinnings of trauma and post-traumatic stress disorder: Focusing on genetics and epigenetics. *Epigenomics* [Internet]. 2016 Nov 1 [cited 2023 Nov 21];8(11):1553–69. Available from: <https://www.futuremedicine.com/doi/10.2217/epi-2016-0083>
571. Van Winkel R, Van Nierop M, Myin-Germeys I, Van Os J. Childhood Trauma as a Cause of Psychosis: Linking Genes, Psychology, and Biology. *CanJPschiatry* [Internet]. 2013 [cited 2023 Nov 21];58(1):44–51. Available from: www.LaRCP.ca44WLaRevuecanadiennede
572. Rad MS, Martingano AJ, Ginges J. Toward a psychology of Homo sapiens: Making psychological science more representative of the human population. *Proc Natl Acad Sci U S A* [Internet]. 2018 Nov 6 [cited 2023 Nov 23];115(45):11401–5. Available from: <https://www.pnas.org/doi/abs/10.1073/pnas.1721165115>
573. Ingvarsdotter K, Johnsdotter S, Östman M. Lost in interpretation: The use of interpreters in research on mental ill health. *International Journal of Social Psychiatry* [Internet]. 2012 [cited 2023 Nov 23];58(1):34–40. Available from: <http://isp.sagepub.com>
574. Fitzpatrick KM, Boldizar JP. The prevalence and consequences of exposure to violence among African-American youth. *J Am Acad Child Adolesc Psychiatry*. 1993;32(2):424–30.
575. Barnett W, Brittain K, Sorsdahl K, Zar HJ, Stein DJ. Maternal participant experience in a South African birth cohort study enrolling healthy pregnant women and their infants. *Philosophy, Ethics, and Humanities in Medicine* [Internet]. 2016 Jul 19 [cited 2022 Oct 19];11(1). Available from: <https://link.springer.com/article/10.1186/s13010-016-0036-2>
576. Shahinfar A, Fox NA, Leavitt LA. Preschool Children's Exposure to Violence: Relation of Behavior Problems to Parent and Child Reports. *American Journal of Orthopsychiatry* [Internet]. 2000 Jan 1 [cited 2023 Nov 23];70(1):115–25. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1037/h0087690>
577. Stover CS, Berkowitz S. Assessing violence exposure and trauma symptoms in young children: A critical review of measures. *J Trauma Stress* [Internet]. 2005 Dec 1 [cited 2023 Nov 23];18(6):707–17. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/jts.20079>

578. Allen JL, Rapee RM, Sandberg S. Assessment of maternally reported life events in children and adolescents: A comparison of interview and checklist methods. *J Psychopathol Behav Assess* [Internet]. 2012 Jun 8 [cited 2023 Nov 23];34(2):204–15. Available from: <https://link.springer.com/article/10.1007/s10862-011-9270-5>
579. Wolfe J. Trauma, traumatic memory, and research: where do we go from here? *J Trauma Stress* [Internet]. 1995;8(4):717–26. Available from: <https://doi.org/10.1007/BF02102896>
580. Wolfer TA. “It happens all the time”: Overcoming the limits of memory and method for chronic community violence experience. *J Interpers Violence* [Internet]. 1999;14(10):1070–94. Available from: <https://doi.org/10.1177/088626099014010005>
581. Sanders-Phillips K, Kliewer W. Violence and Racial Discrimination in South African Youth: Profiles of a Continuum of Exposure. *J Child Fam Stud* [Internet]. 2019 May 1 [cited 2020 Nov 9];29(5):1336–49. Available from: <http://dx.doi.org/10.1007/s10826-019-01559-6>
582. Rescorla LA, Genaro B, Ivanova MY, International ASEBA Consortium. International Comparisons of Emotionally Reactive Problems in Preschoolers: CBCL/1½–5 Findings from 21 Societies. *Journal of Clinical Child & Adolescent Psychology* [Internet]. 2020 Nov 1 [cited 2023 Nov 22];49(6):773–86. Available from: <https://www.tandfonline.com/doi/abs/10.1080/15374416.2019.1650366>
583. Jansen E, Frantz I, Hutchings J, Lachman J, Williams M, Taut D, et al. Preventing child mental health problems in southeastern Europe: Feasibility study (phase 1 of MOST framework). *Fam Process* [Internet]. 2022 Sep 1 [cited 2023 Nov 22];61(3):1162–79. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/famp.12720>
584. Rochat TJ, Houle B, Stein A, Coovadia H, Coutsoudis A, Desmond C, et al. Exclusive Breastfeeding and Cognition, Executive Function, and Behavioural Disorders in Primary School-Aged Children in Rural South Africa: A Cohort Analysis. *PLoS Med* [Internet]. 2016 Jun 1 [cited 2023 Nov 22];13(6):e1002044. Available from: <https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002044>
585. Pavlova B, Uher R. Assessment of Psychopathology: Is Asking Questions Good Enough? *JAMA Psychiatry* [Internet]. 2020 Jun 1 [cited 2023 Nov 22];77(6):557–8. Available from: <https://jamanetwork.com/journals/jamapsychiatry/fullarticle/2762530>
586. Schmidt LJ, Garratt AM, Fitzpatrick R. Instruments for Mental Health: A review. Report from the Patientreported Health Instruments Group (formerly the Patient-assessed Health Outcomes Programme) to the Department of Health. 2000;
587. Sharp C, Croudace TJ, Goodyer IM, Amtmann D. The Strengths and Difficulties Questionnaire: Predictive validity of parent and teacher ratings for help-seeking behaviour over one year. *Educational and Child Psychology*. 2005;22(3):28.
588. Truman J, Robinson K, Evans AL, Smith D, Cunningham L, Millward R, et al. The Strengths and Difficulties Questionnaire: A pilot study of a new computer version of

the self-report scale. *Eur Child Adolesc Psychiatry* [Internet]. 2003 [cited 2023 Nov 22];12(1):9–14. Available from: <https://link.springer.com/article/10.1007/s00787-003-0303-9>

589. Edelbrock C, Costello AJ, Dulcan MK, Kalas R, Conover NC. Age Differences in the Reliability of the Psychiatric Interview of the Child. *Child Dev.* 1985 Feb;56(1):265.
590. Ajayi OR, Matthews G, Taylor M, Kvalsvig J, Davidson LL, Kauchali S, et al. Factors associated with the health and cognition of 6-year-old to 8-year-old children in KwaZulu-Natal, South Africa. *Tropical Medicine and International Health*. 2017 May 1;22(5):631–7.
591. Piper JD, Mazhanga C, Mapako G, Mapurisa I, Mashedze T, Munyama E, et al. Piloting the adaptation of the Kaufman Assessment Battery for Children—2nd edition (KABC-II) to assess school-age neurodevelopment in rural Zimbabwe. *Wellcome Open Res.* 2022 Nov 9;7:274.
592. End Corporal Punishment. Countdown - End Corporal Punishment of Children [Internet]. [cited 2024 Apr 22]. Available from: <https://endcorporalpunishment.org/countdown/>
593. Osborn D, Cutter A, Ullah F. Universal sustainable development goals. Understanding the transformational challenge for developed countries. 2015;2(1):1–25.
594. Fernandez S. Addressing the Legacy of Apartheid. Representative Bureaucracy and Performance [Internet]. 2020 [cited 2023 Nov 23];69–111. Available from: https://link.springer.com/chapter/10.1007/978-3-030-32134-5_3
595. Ward C, Sanders MR, Gardner F, Mikton C, Dawes A. Preventing child maltreatment in low- and middle-income countries. *Child Abuse Negl* [Internet]. 2016 Apr;54:97–107. Available from: http://www.who.int/violence_injury_prevention/violence/child/plh/en/
596. Loomis AM. The Role of Preschool as a Point of Intervention and Prevention for Trauma-Exposed Children: Recommendations for Practice, Policy, and Research. *Topics Early Child Spec Educ* [Internet]. 2018 Jul 23 [cited 2023 May 10];38(3):134–45. Available from: <https://journals.sagepub.com/doi/10.1177/0271121418789254>
597. Karch D, Albers L, Renner G, Lichtenauer N, Von Kries R. The Efficacy of Cognitive Training Programs in Children and Adolescents: A Meta-analysis. *Dtsch Arztebl Int* [Internet]. 2013 Sep 27 [cited 2023 Nov 23];110(39):643. Available from: [/pmc/articles/PMC3804756/](https://pmc/articles/PMC3804756/)
598. Dreyer BP. Early childhood stimulation in the developing and developed world: If not now, when? [Internet]. Vol. 127, *Pediatrics*. American Academy of Pediatrics; 2011 [cited 2023 Aug 19]. p. 975–7. Available from: <https://dx.doi.org/10.1542/peds.2011-0385>

599. Hillis S, Mercy J, Amobi A, Kress H. Global prevalence of past-year violence against children: A systematic review and minimum estimates. Vol. 137, Pediatrics. American Academy of Pediatrics; 2016.
600. Chiang LF, Kress H, Sumner SA, Gleckel J, Kawemama P, Gordon RN. Violence against children surveys (VACS): Towards a global surveillance system. Injury Prevention. 2016;22:i17–22.
601. Gollub EL, Green J, Richardson L, Kaplan I, Shervington D. Indirect violence exposure and mental health symptoms among an urban public-school population: Prevalence and correlates. Seedat S, editor. PLoS One. 2019 Nov 27;14(11):e0224499.
602. Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. The Lancet. 2002 Oct 5;360(9339):1083–8.
603. Mathers CD, Inoue M, Guigoz Y, Lozano R, Tomaskovic L. Statistical annex. R LozanoWorld report on violence and health. 2002;255–325.
604. Pinheiro PS. World report on violence against children. 2006;
605. García-Moreno C, Jansen HAFM, Ellsberg M, Heise L, Watts C. WHO multi-country study on women's health and domestic violence against women. World Health Organization; 2005.
606. Mathews S, Abrahams N, Martin L, Vetten L, van der Merwe L, Jewkes R. "Every six hours a woman is killed by her intimate partner": A National Study of Female Homicide in South Africa. Medical Research Council Policy Brief. 2004 Jan 1;5.
607. Sidel VW. The international arms trade and its impact on health. BMJ. 1995;311(7021):1677–80.
608. Duffield M. Global governance and the new wars: The merging of development and security. Zed Books Ltd.; 2014.
609. Kaldor M, Hampson FO. New & old wars: organized violence in a global era. International Journal. 1999;54(4):706.
610. Machel G. The Impact of War on Children (London: Hurst and Company). Association with UNICEF. 2001;
611. Yingying S, D'Arcy C, Shuai Y, Xiangfei M. How does childhood maltreatment influence ensuing cognitive functioning among people with the exposure of childhood maltreatment? A systematic review of prospective cohort studies. J Affect Disord. 2019;252:278–93.
612. Young-Southward G, Eaton C, O'Connor R, Minnis H. Investigating the causal relationship between maltreatment and cognition in children: A systematic review. Vol. 107, Child Abuse and Neglect. Elsevier Ltd; 2020.

613. Sanchez YM, Lambert SF, Cooley-Strickland M. Adverse Life Events, Coping and Internalizing and Externalizing Behaviors in Urban African American Youth. *J Child Fam Stud.* 2013;22(1):38–47.
614. Maguire SA, Williams B, Naughton AM, Cowley LE, Tempest V, Mann MK, et al. A systematic review of the emotional, behavioural and cognitive features exhibited by school-aged children experiencing neglect or emotional abuse. *Child Care Health Dev.* 2015;41(5):641–53.
615. Lourenco LM, Baptista MN, Senra LX, Almeida AA, Basilio C, de Castro Bhona Luciana Xavier; ORCID: <http://orcid.org/0000-0002-5058-1574> FMAIO <http://orcid.org/Senra>. Consequences of exposure to domestic violence for children: A systematic review of the literature. Archer Bandura, Costa, Costa, Cui, Deslandes, Edleson, Garcia-Moreno, Ghazarian, Graham-Bermann, Graham-Bermann, Grundy, Holt, Kelleher, Krug, Lourenco, Maldonado, McDonald, Minayo, O'Donnell, Reichenheim, Reveles, Salisbury, Saltzman, Sani, Sani, Senra, B, editor. Paideia. 2013;23(55):263–71.
616. Pingley T. The impact of Witnessing Domestic Violence on Children: A Systematic Review. Master of Social Work Clinical Research Papers. 2017;1:1–35.
617. DAC List of ODA Recipients - OECD [Internet]. [cited 2020 Oct 20]. Available from: <http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/daclist.htm>
618. About LDCs - UN-OHRLLS [Internet]. [cited 2020 Oct 20]. Available from: <http://unohrlls.org/about-ldc/>
619. Berlin JA. Invited commentary: Benefits of heterogeneity in meta-analysis of data from epidemiologic studies. *Am J Epidemiol.* 1995 Aug 15;142(4):383–7.
620. Dekkers OM, Vandebroucke JP, Cevallos M, Renehan AG, Altman DG, Egger M. COSMOS-E: Guidance on conducting systematic reviews and meta-analyses of observational studies of etiology. *PLoS Med.* 2019 Feb 1;16(2).
621. Kim SY, Park JE, Lee YJ, Seo HJ, Sheen SS, Hahn S, et al. Testing a tool for assessing the risk of bias for nonrandomized studies showed moderate reliability and promising validity. *J Clin Epidemiol.* 2013;66(4):408–14.

Appendices

Systematic Review Protocol: Violence exposure and cognitive and behavioural outcomes among children LMICs

• **Background and rationale**

Research into the impact of violence exposure in childhood typically investigates individual types of violence (i.e. maltreatment) limiting our understanding of the magnitude of the problem. There is a growing move towards the use of more comprehensive measurement tools covering a range of forms of violence in research to address this gap as shown by (Chiang et al., 2016; Gollub et al., 2019; Hillis et al., 2016b).

The prevalence and distribution of violence and its subtypes differs between LMICs and HICs. 90 percent of violent-related deaths globally occur in LMICs and the mortality rate due to violence in these settings is nearly 2.5 times higher than the rates in HICs (Krug et al., 2002c; Mathers et al., 2002b). The mortality rates of children under four years of age differ according to gender: those of boys are 10 percent lower in LMICs and those of girls are 20 percent higher in LMICs compared to HIC settings. Regions of LMICs also show differences; for example, the homicide rates of children (both sexes) in Africa are twice as high as the global average (Mathers et al., 2002b). A slightly different picture emerges for adolescents; among 15-17-year-olds, the homicide rates for males in LMICs are thrice as high as those of males in HICs and for females in LMICs the rates are nearly double those in HICs (Pinheiro, 2006). Moreover, certain types of violence, such as IPV and sexual violence are reportedly more common in LMICs than HICs (García-Moreno et al., 2005; S. Mathews et al., 2004). Some forms of violence, such as collective violence, feature almost exclusively in LMICs where countries have been at war, levels of poverty are high and destruction of the economic and social infrastructure as well as health services is evident (Sidel, 1995). The health consequences of violence on civilians, especially children in these settings are even more dire as they are often targeted by armed groups (Duffield, 2014; Kaldor & Hampson, 1999) and children who survive are exposed to multiple traumatic events (Machel, 2001).

Most existing reviews of studies assessing the impact of violence exposure in childhood and adolescence on cognition and behaviour focus on research conducted HICs; this is shown in recent systematic reviews on childhood maltreatment and cognitive outcomes (Haahr-Pedersen et al., 2020d; Yingying et al., 2019; Young-Southward, Eaton, O'Connor, & Minnis, 2020) and childhood violence exposure and behavioural outcomes (Fisher et al.,

2016; Maguire et al., 2015b; Sanchez et al., 2013). Others fail to indicate the regions or countries in which reviewed studies are based (Evans et al., 2008a; Irigaray, Pachecob, et al., 2013; Liming & Grube, 2018; Wood & Sommers, 2011) which indirectly generalises results across different countries and different contexts. Secondly, most reviews primarily focus on maltreatment as the only exposure (Irigaray, Pachecob, et al., 2013; Yingying et al., 2019; Young-Southward, Eaton, O'Connor, & Minnis, 2020) or single violence exposure forms such as IPV (Wood & Sommers, 2011), domestic violence (Evans et al., 2008b; Lourenco, Baptista, Senra, Almeida, et al., 2013; Pingley, 2017b) and bullying (Fisher et al., 2016; Haahr-Pedersen et al., 2020d) as opposed to multiple forms of violence.

Here, a systematic review of the research into the associations between all types of childhood violence exposure with cognitive and behavioural outcomes assessed in children up to 11 years of age, living in LMICs is planned. By focusing on children from this age group, the aim is to see the impact of violence during early development. By targeting LMICs the intention to shine a light on these regions plagued by violence that have been neglected in the literature and whose violence exposure prevalence rates are particularly high. This study contributes to a broader research initiative aimed at supporting the SDG, which advocate for addressing violence in childhood. This includes efforts to eradicate, reduce, and prevent violence universally.

- **Review question(s)**

To systematically review studies examining associations of violence exposure in children (up to 11 years-old) with cognitive and behavioural outcomes in the early till middle childhood period (birth – 11 years) living in LMIC settings. Specifically, the proposed systematic review will answer the following questions:

1. What is the relationship between children's exposure to violence and their cognitive performance and behavioural outcomes in LMICs?
2. What factors moderate (effect modifiers) the relationship between children's exposure to violence and their cognitive performance and behavioural outcomes in LMICs?

- **Searches**

Articles will be sourced from the following databases: MEDLINE, PsycINFO, and EMBASE. The search strategy will be created with a Medicine and Health Sciences librarian who has expertise in systematic review searching.

The search strategy will include words relating to *violence exposure* (e.g., interpersonal violence, child abuse, community violence, physical abuse, sexual abuse, adverse childhood experiences, gun violence, community violence, maltreatment, neglect, bullying, domestic violence, parental intimate partner violence) *cognitive ability* (e.g intellectual functioning, e.g., memory, verbal ability, attention, speech, executive functioning), behaviour (externalising and internalising symptoms) and children (e.g., pre-schooler). The databases will be searched from no specified year to the current date and the searches will be limited to references published in the English language.

The search strategy will include countries classified as LMICs, defined according to the Organisation for Economic Co-operation and Development (OECD)'s definition based on gross national income (GNI) per capita (DAC List of ODA Recipients - OECD, n.d.). These include:

- a) Least developed countries which “comprise of more than 880 million people (about 12 per cent of world population), but account for less than 2 percent of world GDP and about 1 percent of global trade in goods” (About LDCs - UN-OHRLLS, n.d.),
- b) Other low-income countries (per capita GNI <= \$1 005 in 2016)
- c) Lower middle-income countries and territories (per capita GNI \$1 006-\$3 955 in 2016)
- d) Upper middle-income countries and territories (per capita GNI \$1 006-\$3 955 (per capita GNI \$3 956-\$12 235 in 2016)

Relevant references will be stored and managed using EndNote and Covidence/Rayaan application programs.

- **Types of studies to be included**

The PRISMA template will be used to illustrate the selection process for the systematic review. The following studies will be included:

1. Journal articles published in English.

2. Studies conducted in LMICs
3. Any comparative studies (including both violence exposed and non-exposed groups, and/or examining dose-response relationships) to examine the difference between the influence of childhood violence exposure on cognitive functioning and behaviour.
This therefore includes cohort, case-control and cross-sectional studies.
4. No restrictions will be imposed on the dates of the studies

Exclusion criteria:

1. Studies only conducted in high income countries (HICs)
2. Studies that do not specify the types of violence exposure in the results/analyses.
3. Children with special conditions (such as disability or serious mental health problems) will be excluded from the review
4. Review or discussion articles where results are not from original research, articles based on qualitative research, articles presenting health professionals or social workers' views about violence against children will also not be included.
5. Qualitative studies

- **Condition or domain being studied**

Violence exposure refers to the experience of any of a wide range of interpersonal violence, including maltreatment (physical abuse, sexual abuse, emotional abuse, and neglect), victimization outside the home, witnessing domestic violence, and witnessing community violence (see Table 2.1).

Cognitive functioning refers to intellectual processes, skills and abilities that involve acquiring and using information such as attention, learning, memory, executive functioning, and verbal ability.

Behaviour refers to internalising problems (such as depressive and anxiety symptoms) or externalising problems (such as aggression and delinquency).

- **Participants/population**

The population under review comprises children in LMICs. For the current review, children are defined as people up to 11 years of age. Countries are classified as low- or lower-middle income countries in accordance with the classification by the OECD in 2020 (see above).

- **Intervention(s), exposure(s)**

Violence exposure in childhood (occurring before the age of 11), regardless of the setting (home, school, community, institution) where the violence occurred including: (1) sexual violence (including unwanted touching, forced sex, attempted unwanted sex, sexual harassment or pressurised/coerced sex), (2) emotional violence (including verbal abuse, psychological abuse), (3) physical violence (including corporal punishment, violent discipline, and physically abusive behaviours), (4) bullying (including physical or verbal bullying), (5) adolescent relationship violence (including dating violence in all forms: physical, verbal, sexual and coercive behaviours), (6) witnessing domestic violence or parental intimate partner violence, (7) witnessing community violence (including sexual assault, burglary, mugging, the sound of gunshots and gang violence) (8) Collective violence committed by larger groups of individuals or by states (including social, political and economic violence).

Definitions of different types of violence used in the study are presented in Table 2.1.

Comparator(s)/control

Not applicable.

Main outcome(s)

1. The cognitive functioning of children including IQ, memory, attention, executive functioning and verbal ability. The measurement tool/test will also be recorded.
 2. Childhood externalising and internalising behaviours. This will be measured by assessments that quantify externalising and internalising symptoms, such as the Child Behaviour Checklist (CBCL).
- * For both of these outcomes, there should be a clear indication of a temporal relationship between exposure and outcome with exposure to violence occurring prior to the outcome in cohort studies.

- **Measures of effect**

- Relative risks, odds ratios, mean differences, or other reported measures of effect of the main outcomes including 95%CIs and/or SEs.
- Any effect modifiers will be noted, and strata specific data will be extracted.

- **Additional outcome(s)**

None

- **Data extraction (selection and coding)**

1. An initial reviewer will screen abstracts identified via database searches to eliminate material irrelevant to the review objectives.
2. Screening of the remainder of the abstracts will be done by two independent reviewers.
3. Where there are discrepancies, they will be resolved through discussion and inter-rater reliability will be calculated using Cohen's Kappa
4. Full text articles will be requested for all studies remaining after abstract screening and evaluated by two reviewers. Once again, disagreements will be resolved through discussion and inter-rater reliability will be calculated using Cohen's Kappa.
5. Authors will be contacted where further study details are required, and for additional data analysis to be done according to the review objectives.
6. Data will be extracted from all included studies using a protocol checklist.
7. Data extraction will be done by two independent reviewers.
8. Information will include:
 - a. Bibliographic information (consisting of journal or preprint server, publication year, volume and page numbers, and digital object identifier (doi))
 - b. Study design (definition based on an assessment of what the study did, and not the study's description in the title or database index)
 - c. Study setting and geographical location
 - d. Characteristics of study participants (demographics including age and sex)
 - e. Definitions and measures used to assess violence exposure and selected outcomes
 - f. Reporting period for violence exposure and selected outcomes

- g. Who is reporting exposure and outcome?
 - h. Violence exposure and estimates of association (i.e. odds ratios, relative risks, and correlation coefficients) with uncertainty information (i.e. confidence intervals, p- values or standard errors)
 - i. Confounders included in analyses
 - j. information related to assessing the risk of bias (see below)
- **Assessing Study Quality and Bias**
 - **Study quality**

Studies will not be excluded based on quality as this may result in a subjective risk of bias (RoB) assessment leading to studies being inappropriately excluded. When investigating between-study heterogeneity, the inclusion of all studies may reveal valuable insights (Berlin, 1995).

- **Risk of Bias**

No studies will be included or excluded from the review based on their RoB, as recommended by the Cochrane Collaboration. Potential sources of bias in relation to both the ability of studies to address the primary review question, and methodological sources of variation will be considered. The seven general principles to assessing RoB suggested by (Dekkers et al., 2019) based on previous works and theoretical issues will be mostly followed. In the present review, RoB will be assessed using the Risk of Bias Assessment tool for Nonrandomized Studies (RoBANS). The RoBANS contains six domains of evaluation:

1. The selection of participants
2. Confounding variables
3. The measurement of exposure
4. The blinding of the outcome assessments
5. Incomplete outcome data
6. Selective outcome reporting

The RoBANS is compatible with the Cochrane risk-of-bias tool and is also applicable to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach (S. Y. Kim et al., 2013).

- **Strategy for data synthesis**

The results of the included studies will be synthesized via a narrative synthesis. A table will be drawn up for each group of outcomes (cognitive and behavioural) recording descriptive information about the studies including, but not limited to, sample size, study design, participant age at exposure and outcome assessment, violence exposure type(s), instruments used for assessment of the exposure and outcome, and main findings.

Findings of included studies will be summarized quantitatively by recording each study's effect measures as reported (i.e. Odds Ratios, Relative risk ratios and/or mean difference). A meta-analysis will be considered if n of studies ≥ 5 and the exposure measurement is sufficiently similar. A random-effects model will be used to pool results in that case.

- **Analysis of subgroups or subsets**

Where there is sufficient data, planned 'subgroup' analysis will include:

- Age at exposure
- Sex
- Source of report of exposure
- Geographical area/country
- War vs. nonwar settings
- Institutionalised vs. non-institutionalised settings

Sex Stratified Analyses

Appendix Table 1 Sociodemographics and Violence Exposure Descriptive Statistics in Observed Data Stratified By Sex

		Female (N=480)	Male (N=498)
Household Monthly Income	< R1000 (52.56 USD)	32.9%	37.3%
	R1000-5000	54.0%	51.0%
	>R5000 (258.66 USD)	13.1%	11.6%
Maternal Education	Primary	6.9%	7.6%
	Some Secondary	54.2%	56.6%
	Completed Secondary	32.3%	31.1%
	Any Tertiary	6.7%	4.6%
Employment	Currently Unemployed	74.8%	72.9%
	Currently Employed	25.2%	27.1%
Marital status	Single	57.9%	62.9%
	Married/cohabiting	42.1%	37.1%
Prenatal Tobacco Exposure	Exposure	27.5%	31.5%
	No Exposure	72.5%	68.5%
Prenatal Alcohol Exposure	Exposure	12.1%	13.7%
	No Exposure	87.9%	86.3%
Child HIV Exposure	HIV exposed uninfected	20.8%	23.1%
	HIV unexposed	79.2%	76.9%
Maternal Antenatal Depression	Above threshold	23.4%	24.1%
	Below threshold	76.6%	75.9%
		Female (N=371)	Male (N=375)
Any Violence	Exposed	80.1%	84.8%
Witnessing Community Violence	Exposed	71.4%	77.5%
Community Victimisation	Exposed	11.1%	14.4%
Witnessing Domestic Violence	Exposed	30.2%	35.2%
Domestic Victimisation	Exposed	25.9%	36.8%
Polyvictimisation	None	19.9%	15.2%
	1 type	40.2%	35.6%
	2 types	23.7%	25.7%
	3 types	13.7%	17.1%
	4 types	2.4%	6.4%

Appendix Table 2 Mental Health Descriptive Statistics in Observed Data Stratified By Sex

		Female (N=415)	Male (N=436)
Internalising Behaviour Problems	Mean (SD)	42.6 (13.0)	44.9 (12.9)
	Subclinical problems	4.1%	7.1%
	Clinical symptoms	9.9%	10.8%
	Non-clinical symptoms	86.0%	82.1%
Externalising Behaviour Problems	Mean (SD)	39.9 (9.81)	42.8 (10.7)
	Subclinical problems	2.4%	3.4%
	Clinical symptoms	2.2%	5.0%
	Non-clinical symptoms	95.4%	91.5%

Appendix Table 3 Cognitive Scores Descriptive Statistics in Observed Data Stratified By Sex

	Female	Male
Nonverbal intelligence (standard scores)	(N=283)	(N=299)
Mean (SD)	78.0 (12.5)	74.5 (12.2)
Min, Max	48.0, 115.0	48.0, 112.0
Expressive language (scaled scores)	(N=301)	(N=327)
Mean (SD)	6.1 (1.2)	6.0(1.4)
Min, Max	1.0, 11.0	2.0, 11.0
Learning (scaled scores)	(N=307)	(N=330)
Mean (SD)	7.3 (2.6)	7.2 (2.9)
Min, Max	2.0, 15.0	2.0, 15.0
Memory (scaled scores)	(N=294)	(N=316)
Mean (SD)	9.7 (1.8)	9.8 (1.9)
Min, Max	4.0, 15.0	3.0, 16.0
Working Memory (scaled scores)	(N=307)	(N=331)
Mean (SD)	7.9 (2.0)	7.5 (2.2)
Min, Max	1.0, 14.0	1.0, 16.0
Receptive language (raw scores)	(N=296)	(N=320)
Median [Q1 - Q3]	42.0 [38.0 - 45.0]	41.0 [35.0 - 44.0]
Min, Max	14.0, 58.0	9.0, 57.0
Inhibition Stroop (no. of trials)	(N=278)	(N=293)
Median [Q1 - Q3]	9.0 [6.0 - 10.0]	8.0 [5.0 - 10.0]
Min, Max	0, 10.0	0, 10.0
Selective Attention (no. of targets)	(N=284)	(N=291)
Median [Q1 - Q3]	31.0 [27.0 - 38.0]	29.0 [24.0 - 35.0]
Min, Max	16.0, 68.0	9.0, 61.0
Dominant Motor (time in mins)	(N=303)	(N=326)
Median [Q1 - Q3]	1.5 [1.2 - 2.4]	1.3 [1.1 - 1.9]
Min, Max	0.7, 5.0	0.3, 5.0
Nondominant Motor (time in mins)	(N=302)	(N=321)
Median [Q1 - Q3]	1.8 [1.3 - 3.0]	1.5 [1.1 - 2.4]
Min, Max	0.8, 5.0	0.2, 5.0
Cognitive Flexibility (no. of trials)	(N=304)	(N=328)
Median [Q1 - Q3]	0 [0 - 5.0]	0 [0 - 5.0]
Min, Max	0, 6.0	0, 6.0

Appendix Table 4 Sociodemographics and Violence Exposure Descriptive Statistics in Imputed Data Stratified By Sex

		Girls (N=480)	Boys (N=490)
Household Monthly Income	<R1000/m	32.9%	37.3%
	R1000-5000/m	54.0%	37.3%
	>R5000/m	13.1%	11.6%
Maternal Education	Primary	6.9%	7.6%
	Some Secondary	54.2%	56.6%
	Completed Secondary	32.3%	31.1%
	Any Tertiary	6.7%	4.6%
Employment	Unemployed	74.8%	72.9%
	Employed	25.2%	27.1%
Marital status	Married/cohabiting	42.1%	37.1%
	Single	57.9%	62.9%
Prenatal Tobacco Exposure	Exposure	27.5%	31.5%
	No Exposure	72.5%	68.5%
Prenatal Alcohol Exposure	Exposure	12.1%	13.7%
	No Exposure	87.9%	86.3%
Child HIV Exposure	HIV exposed uninfected	20.8%	23.1%
	HIV unexposed	79.2%	76.9%
Maternal Antenatal Depression	Above threshold	23.3%	24.1%
	Below threshold	76.7%	75.9%
Any Violence	Exposed	80.5%	85.5%
Witnessing Community Violence	Exposed	71.5%	77.5%
Community Victimisation	Exposed	11.2%	15.0%
Witnessing Domestic Violence	Exposed	30.8%	35.2%
Domestic Victimization	Exposed	26.1%	36.9%
Polyvictimisation	None	19.5%	14.5%
	1 type	40.0%	35.0%
	2 types	24.4%	27.5%
	3 types	13.7%	17.3%
	4 types	2.4%	5.7%

Appendix Table 5 Mental Health Descriptive Statistics in Imputed Data Stratified By Sex

		Girls (N=480)	Boys (N=490)
Internalising Behaviour Problems	Mean (SD)	42.6 (13.0)	44.8 (12.8)
	Subclinical problems	4.0%	7.1%
	Clinical symptoms	9.9%	10.7%
	Non-clinical symptoms	86.1%	82.2%
Externalising Behaviour Problems	Mean (SD)	39.9 (9.84)	42.8 (10.7)
	Subclinical problems	2.4%	3.4%
	Clinical symptoms	2.2%	5.0%
	Non-clinical symptoms	95.4%	91.6%

Appendix Table 6 Cognitive Scores Descriptive Statistics in Imputed Data Stratified By Sex

		Female (N=480)	Male (N=498)
Nonverbal intelligence (standard scores)	Mean (SD)	78.1 (12.8)	74.5 (12.3)
	Min, Max	48.0, 115.0	48.0, 115.0
Expressive language (scaled scores)	Mean (SD)	6.1 (1.3)	6.0 (1.4)
	Min, Max	1.0, 11.0	2.0, 11.0
Learning (scaled scores)	Mean (SD)	7.4 (2.7)	7.2 (2.9)
	Min, Max	2.0, 15.0	2.0, 15.0
Memory (scaled scores)	Mean (SD)	9.8 (1.8)	9.8 (1.9)
	Min, Max	4.0, 15.0	3.0, 16.0
Working Memory (scaled scores)	Mean (SD)	7.9 (2.1)	7.4 (2.3)
	Min, Max	1.0, 14.0	1.0, 16.0
Receptive language (raw scores)	Median [Q1 - Q3]	42.0 [38.0 - 45.0]	41.0 [35.0 - 44.0]
	Min, Max	14.0, 58.0	9.0, 57.0
Inhibition Stroop (no. of trials)	Median [Q1 - Q3]	9.0 [6.0 - 10.0]	8.0 [5.0 - 10.0]
	Min, Max	0, 10.0	0, 10.0
Selective Attention (no. of targets)	Median [Q1 - Q3]	31.0 [27.0 - 38.0]	29.0 [24.0 - 35.0]
	Min, Max	16.0, 68.0	9.0, 61.0
Dominant Motor (time in mins)	Median [Q1 - Q3]	1.5 [1.2 - 2.4]	1.4 [1.1 - 2.0]
	Min, Max	0.7, 5.0	0.3, 5.0
Nondominant Motor (time in mins)	Median [Q1 - Q3]	1.8 [1.3 - 3.0]	1.5 [1.2 - 2.6]
	Min, Max	0.8, 5.0	0.2, 5.0
Cognitive Flexibility (no. of trials)	Median [Q1 - Q3]	0 [0 - 5.0]	0 [0 - 5.0]
	Min, Max	0, 6.0	0, 6.0

Appendix Table 7 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in females using observed data

		Internalising Behaviour Problems				Externalising Behaviour Problems			
		β	SE	95% CI	<i>p</i>	β	SE	95% CI	<i>p</i>
Overall Violence Exposure	Unadjusted	0.31	0.31	-0.30, 0.93	0.319	0.40	0.24	-0.07, 0.87	0.094
	Adjusted*	0.33	0.34	-0.33, 0.99	0.328	0.30	0.25	-0.20, 0.79	0.242
Witnessing Community Violence	Unadjusted	0.20	0.51	-0.80, 1.21	0.689	0.33	0.39	-0.43, 1.09	0.393
	Adjusted	0.27	0.55	-0.82, 1.36	0.630	0.15	0.42	-0.68, 0.97	0.726
Community Victimisation	Unadjusted	-2.16	1.80	-5.71, 1.38	0.231	-1.80	1.37	-4.49, 0.89	0.189
	Adjusted	-2.47	1.84	-6.09, 1.15	0.180	-1.68	1.38	-4.40, 1.05	0.226
Witnessing Domestic Violence	Unadjusted	1.20	1.18	-1.13, 3.53	0.312	2.10	0.89	0.34, 3.85	0.019
	Adjusted	1.25	1.25	-1.20, 3.70	0.316	1.85	0.93	0.01, 3.68	0.049
Domestic Victimization	Unadjusted	1.47	0.81	-0.13, 3.07	0.071	1.23	0.62	0.02, 2.44	0.047
	Adjusted	1.42	0.85	-0.25, 3.09	0.094	1.05	0.64	-0.21, 2.31	0.101
Polyvictimisation	Unadjusted	-0.00	0.72	-1.42, 1.41	0.997	0.79	0.54	-0.27, 1.86	0.145
	Adjusted	-0.01	0.77	-1.52, 1.50	0.988	0.58	0.58	-0.55, 1.71	0.315

Note: *Models adjusted for household monthly income, maternal education, maternal employment status, maternal marital status, prenatal smoking exposure, prenatal alcohol exposure, maternal antenatal depression and HIV exposure. *N* = 301

Appendix Table 8 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in males using observed data

		Internalising Behaviour Problems				Externalising Behaviour Problems			
		β	SE	95% CI	p	β	SE	95% CI	p
Overall Violence Exposure	Unadjusted	0.63	0.26	0.12, 1.14	0.015	0.77	0.21	0.35, 1.19	<0.001
	Adjusted*	0.57	0.28	0.01, 1.12	0.047	0.59	0.23	0.14, 1.05	0.011
Witnessing Community Violence	Unadjusted	0.74	0.42	-0.08, 1.55	0.078	0.90	0.34	0.22, 1.57	0.009
	Adjusted	0.76	0.46	-0.14, 1.67	0.098	0.71	0.38	-0.03, 1.45	0.059
Community Victimisation	Unadjusted	3.40	1.59	0.27, 6.53	0.033	2.66	1.32	0.06, 5.26	0.045
	Adjusted	2.47	1.62	-0.72, 5.67	0.129	1.86	1.33	-0.75, 4.47	0.162
Witnessing Domestic Violence	Unadjusted	0.60	1.15	-1.66, 2.86	0.603	1.67	0.95	-0.21, 3.54	0.081
	Adjusted	0.21	1.19	-2.14, 2.55	0.862	0.86	0.97	-1.06, 2.77	0.379
Domestic Victimization	Unadjusted	1.51	0.68	0.17, 2.84	0.027	1.79	0.56	0.70, 2.89	0.001
	Adjusted	1.17	0.71	-0.23, 2.57	0.101	1.35	0.58	0.21, 2.48	0.020
Polyvictimisation	Unadjusted	1.62	0.65	0.33, 2.90	0.014	1.80	0.54	0.75, 2.86	0.001
	Unadjusted	1.25	0.70	-0.13, 2.63	0.075	1.19	0.57	0.06, 2.31	0.038

Note: *Models adjusted for household monthly income, maternal education, maternal employment status, maternal marital status, prenatal smoking exposure, prenatal alcohol exposure, maternal antenatal depression and HIV exposure. N = 312

Appendix Table 9 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in females using imputed data

		Internalising Behaviour Problems				Externalising Behaviour Problems			
		β	SE	95% CI	<i>p</i>	β	SE	95% CI	<i>p</i>
Overall Violence Exposure	Unadjusted	0.25	0.30	-0.35, 0.85	0.416	0.32	0.23	-0.13, 0.77	0.157
	Adjusted*	0.16	0.32	-0.46, 0.78	0.617	0.20	0.24	-0.26, 0.67	0.394
Witnessing Community Violence	Unadjusted	0.26	0.50	-0.73, 1.24	0.609	0.34	0.37	-0.39, 1.06	0.363
	Adjusted	0.12	0.53	-0.92, 1.16	0.820	0.11	0.39	-0.65, 0.87	0.774
Community Victimisation	Unadjusted	-1.84	1.65	-5.08, 1.40	0.265	-1.44	1.24	-3.87, 1.00	0.246
	Adjusted	-2.25	1.67	-5.53, 1.04	0.179	-1.50	1.25	-3.95, 0.96	0.231
Witnessing Domestic Violence	Unadjusted	0.54	1.16	-1.74, 2.83	0.641	1.57	0.88	-0.17, 3.30	0.076
	Adjusted	0.53	1.20	-1.84, 2.90	0.661	1.41	0.90	-0.37, 3.19	0.120
Domestic Victimization	Unadjusted	1.22	0.78	-0.32, 2.76	0.120	0.95	0.60	-0.23, 2.14	0.115
	Adjusted	1.02	0.80	-0.54, 2.59	0.199	0.76	0.62	-0.45, 1.98	0.215
Polyvictimisation	Unadjusted	0.14	0.69	-1.22, 1.50	0.840	0.73	0.52	-0.29, 1.76	0.162
	Unadjusted	-0.11	0.71	-1.51, 1.29	0.877	0.43	0.53	-0.62, 1.48	0.420

Note: *Models adjusted for household monthly income, maternal education, maternal employment status, maternal marital status, prenatal smoking exposure, prenatal alcohol exposure, maternal antenatal depression and HIV exposure. *N* = 480

Appendix Table 10 Results of adjusted linear regression analyses examining violence exposure and internalising and externalising behaviour problems in males using imputed data

		Internalising Behaviour Problems				Externalising Behaviour Problems			
		β	SE	95% CI	p	β	SE	95% CI	p
Overall Violence Exposure	Unadjusted	0.79	0.24	0.32, 1.26	0.001	0.87	0.20	0.47, 1.27	<0.0001
	Adjusted*	0.61	0.26	0.11, 1.12	0.017	0.64	0.21	0.21, 1.06	0.003
Witnessing Community Violence	Unadjusted	0.96	0.38	0.2, 1.71	0.013	1.08	0.33	0.44, 1.73	0.001
	Adjusted	0.74	0.42	-0.08, 1.56	0.077	0.74	0.34	0.06, 1.42	0.033
Community Victimisation	Unadjusted	3.07	1.41	0.3, 5.84	0.030	2.50	1.21	0.12, 4.88	0.039
	Adjusted	2.29	1.41	-0.49, 5.07	0.106	1.90	1.20	-0.47, 4.26	0.115
Witnessing Domestic Violence	Unadjusted	1.26	1.07	-0.83, 3.36	0.237	1.89	0.90	0.1, 3.67	0.038
	Adjusted	0.62	1.09	-1.52, 2.76	0.569	1.09	0.89	-0.66, 2.85	0.221
Domestic Victimization	Unadjusted	1.65	0.63	0.42, 2.89	0.009	1.77	0.53	0.74, 2.81	0.001
	Adjusted	1.32	0.64	0.05, 2.59	0.041	1.39	0.52	0.36, 2.42	0.008
Polyvictimisation	Unadjusted	1.83	0.58	0.69, 2.97	0.002	1.91	0.50	0.93, 2.89	<0.001
	Unadjusted	1.36	0.61	0.15, 2.57	0.028	1.35	0.52	0.32, 2.37	0.010

Note: *Models adjusted for household monthly income, maternal education, maternal employment status, maternal marital status, prenatal smoking exposure, prenatal alcohol exposure, maternal antenatal depression and HIV exposure. N = 498

Violence Exposure Types and Cognitive Outcomes in Females (N = 480)

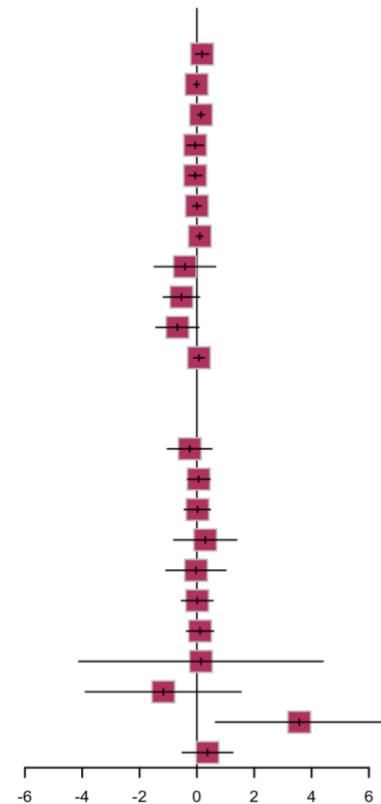
Beta coefficient [95%-CI] SE p

Witnessing Community Violence

Cognitive flexibility	0.18 [-0.05; 0.41]	0.120	0.130
Dominant motor	-0.01 [-0.10; 0.08]	0.050	0.790
Expressive language	0.14 [0.03; 0.25]	0.050	0.011
Inhibition	-0.06 [-0.34; 0.22]	0.140	0.665
Learning	-0.06 [-0.28; 0.17]	0.110	0.618
Memory	0.00 [-0.15; 0.14]	0.070	0.962
Nondominant motor	0.10 [-0.01; 0.20]	0.050	0.079
Nonverbal Intelligence	-0.42 [-1.49; 0.65]	0.540	0.435
Receptive language	-0.54 [-1.17; 0.09]	0.320	0.093
Selective attention	-0.68 [-1.43; 0.07]	0.380	0.076
Working memory	0.07 [-0.11; 0.25]	0.090	0.434

Community Victimisation

Cognitive flexibility	-0.25 [-1.03; 0.52]	0.390	0.522
Dominant motor	0.06 [-0.33; 0.46]	0.200	0.747
Expressive language	0.02 [-0.44; 0.47]	0.230	0.935
Inhibition	0.29 [-0.81; 1.39]	0.560	0.607
Learning	-0.03 [-1.08; 1.01]	0.530	0.950
Memory	0.01 [-0.54; 0.56]	0.280	0.960
Nondominant motor	0.11 [-0.36; 0.58]	0.240	0.649
Nonverbal Intelligence	0.14 [-4.12; 4.40]	2.150	0.949
Receptive language	-1.17 [-3.89; 1.54]	1.370	0.394
Selective attention	3.57 [0.65; 6.49]	1.470	0.017
Working memory	0.37 [-0.51; 1.25]	0.440	0.400



β per one unit change in the violence subscore in adjusted model

Appendix Figure 1 Forest plot estimates of associations between community violence and cognitive functions in females using imputed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Females (N = 480)

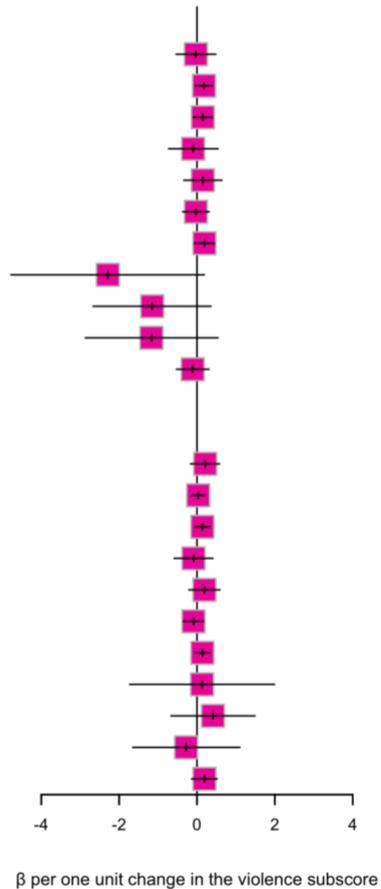
Beta coefficient [95%-CI] **SE** **p**

Witnessing Domestic Violence

Cognitive flexibility	-0.03 [-0.54; 0.48]	0.260	0.897
Dominant motor	0.18 [-0.04; 0.40]	0.110	0.106
Expressive language	0.15 [-0.09; 0.40]	0.120	0.221
Inhibition	-0.10 [-0.73; 0.54]	0.320	0.764
Learning	0.15 [-0.34; 0.64]	0.250	0.557
Memory	-0.03 [-0.37; 0.31]	0.170	0.862
Nondominant motor	0.19 [-0.07; 0.45]	0.130	0.150
Nonverbal Intelligence	-2.29 [-4.78; 0.19]	1.260	0.070
Receptive language	-1.15 [-2.67; 0.36]	0.770	0.135
Selective attention	-1.17 [-2.87; 0.54]	0.860	0.179
Working memory	-0.11 [-0.53; 0.31]	0.210	0.603

Domestic Victimization

Cognitive flexibility	0.21 [-0.17; 0.58]	0.190	0.278
Dominant motor	0.03 [-0.13; 0.20]	0.080	0.700
Expressive language	0.14 [-0.05; 0.33]	0.100	0.161
Inhibition	-0.09 [-0.59; 0.41]	0.250	0.717
Learning	0.19 [-0.21; 0.59]	0.200	0.346
Memory	-0.09 [-0.35; 0.17]	0.130	0.512
Nondominant motor	0.14 [-0.04; 0.33]	0.090	0.127
Nonverbal Intelligence	0.13 [-1.73; 1.99]	0.940	0.892
Receptive language	0.41 [-0.67; 1.49]	0.550	0.451
Selective attention	-0.28 [-1.65; 1.10]	0.690	0.692
Working memory	0.19 [-0.14; 0.52]	0.170	0.255



Appendix Figure 2 Forest plot estimates of associations between domestic violence and cognitive functions in females using imputed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Females (N = 480)

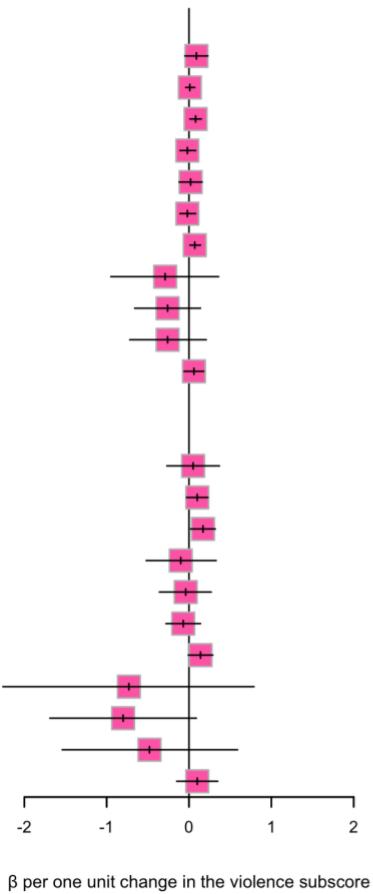
Beta coefficient [95%-CI] **SE** **p**

CECV total

Cognitive flexibility	0.09 [-0.05; 0.23]	0.070	0.217
Dominant motor	0.01 [-0.04; 0.07]	0.030	0.615
Expressive language	0.08 [0.01; 0.15]	0.030	0.018
Inhibition	-0.02 [-0.11; 0.08]	0.050	0.735
Learning	0.02 [-0.12; 0.16]	0.070	0.816
Memory	-0.02 [-0.11; 0.08]	0.050	0.735
Nondominant motor	0.07 [0.01; 0.14]	0.030	0.027
Nonverbal Intelligence	-0.29 [-0.95; 0.36]	0.330	0.379
Receptive language	-0.26 [-0.66; 0.14]	0.200	0.200
Selective attention	-0.26 [-0.72; 0.21]	0.240	0.280
Working memory	0.06 [-0.06; 0.18]	0.060	0.309

Polyvictimisation

Cognitive flexibility	0.05 [-0.27; 0.37]	0.160	0.756
Dominant motor	0.10 [-0.03; 0.23]	0.070	0.134
Expressive language	0.17 [0.02; 0.32]	0.080	0.025
Inhibition	-0.10 [-0.52; 0.33]	0.210	0.656
Learning	-0.04 [-0.36; 0.27]	0.160	0.783
Memory	-0.07 [-0.28; 0.14]	0.110	0.537
Nondominant motor	0.14 [-0.01; 0.29]	0.080	0.071
Nonverbal Intelligence	-0.73 [-2.26; 0.79]	0.770	0.344
Receptive language	-0.80 [-1.69; 0.09]	0.450	0.078
Selective attention	-0.48 [-1.54; 0.59]	0.540	0.377
Working memory	0.10 [-0.15; 0.35]	0.130	0.438



Appendix Figure 3 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using imputed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Females (N = 480)

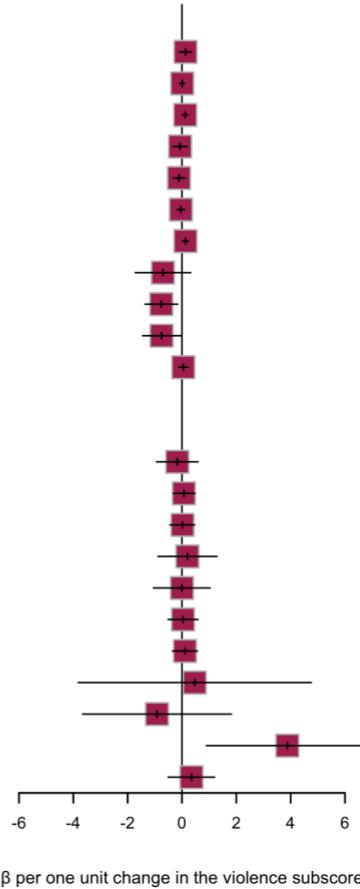
Beta coefficient [95%-CI] **SE** **p**

Witnessing Community Violence

Cognitive flexibility	0.13 [-0.09; 0.35]	0.110	0.248
Dominant motor	0.01 [-0.08; 0.10]	0.040	0.786
Expressive language	0.12 [0.01; 0.22]	0.050	0.025
Inhibition	-0.07 [-0.33; 0.19]	0.130	0.590
Learning	-0.11 [-0.32; 0.11]	0.110	0.319
Memory	-0.04 [-0.18; 0.10]	0.070	0.594
Nondominant motor	0.13 [0.02; 0.23]	0.050	0.016
Nonverbal Intelligence	-0.70 [-1.72; 0.32]	0.520	0.176
Receptive language	-0.76 [-1.36; -0.16]	0.300	0.013
Selective attention	-0.75 [-1.45; -0.04]	0.360	0.039
Working memory	0.05 [-0.11; 0.22]	0.090	0.520

Community Victimisation

Cognitive flexibility	-0.17 [-0.94; 0.59]	0.390	0.656
Dominant motor	0.07 [-0.32; 0.47]	0.200	0.721
Expressive language	0.02 [-0.44; 0.47]	0.230	0.940
Inhibition	0.20 [-0.88; 1.29]	0.550	0.709
Learning	0.00 [-1.05; 1.04]	0.530	0.997
Memory	0.04 [-0.51; 0.59]	0.280	0.891
Nondominant motor	0.11 [-0.35; 0.57]	0.230	0.630
Nonverbal Intelligence	0.47 [-3.82; 4.76]	2.170	0.828
Receptive language	-0.92 [-3.66; 1.82]	1.380	0.507
Selective attention	3.88 [0.90; 6.85]	1.500	0.011
Working memory	0.35 [-0.51; 1.20]	0.430	0.419



Appendix Figure 4 Forest plot estimates of associations between community violence and cognitive functions in females using imputed data

Violence Exposure Types and Cognitive Outcomes in Females (N = 480)

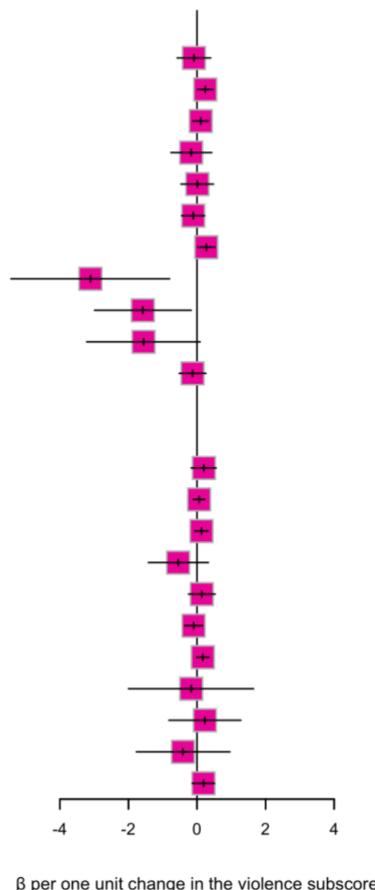
Beta coefficient [95%-CI] **SE** **p**

Witnessing Domestic Violence

Cognitive flexibility	-0.09 [-0.58; 0.40]	0.250	0.719
Dominant motor	0.24 [0.02; 0.46]	0.110	0.031
Expressive language	0.11 [-0.12; 0.34]	0.120	0.353
Inhibition	-0.17 [-0.76; 0.43]	0.300	0.576
Learning	0.01 [-0.47; 0.48]	0.240	0.983
Memory	-0.11 [-0.45; 0.22]	0.170	0.504
Nondominant motor	0.27 [0.02; 0.52]	0.130	0.035
Nonverbal Intelligence	-3.11 [-5.43; -0.80]	1.180	0.009
Receptive language	-1.58 [-2.99; -0.17]	0.720	0.028
Selective attention	-1.56 [-3.22; 0.09]	0.840	0.064
Working memory	-0.13 [-0.52; 0.26]	0.200	0.499

Domestic Victimization

Cognitive flexibility	0.20 [-0.17; 0.56]	0.180	0.285
Dominant motor	0.06 [-0.11; 0.22]	0.080	0.485
Expressive language	0.13 [-0.06; 0.32]	0.100	0.165
Inhibition	-0.55 [-1.42; 0.33]	0.440	0.219
Learning	0.14 [-0.25; 0.53]	0.200	0.470
Memory	-0.10 [-0.36; 0.16]	0.130	0.439
Nondominant motor	0.17 [-0.01; 0.35]	0.090	0.070
Nonverbal Intelligence	-0.17 [-2.00; 1.65]	0.920	0.850
Receptive language	0.23 [-0.82; 1.28]	0.530	0.667
Selective attention	-0.41 [-1.77; 0.96]	0.690	0.558
Working memory	0.19 [-0.14; 0.51]	0.160	0.260



Appendix Figure 5 Forest plot estimates of associations between domestic violence and cognitive functions in females using imputed data

Violence Exposure Types and Cognitive Outcomes in Females (N = 480)

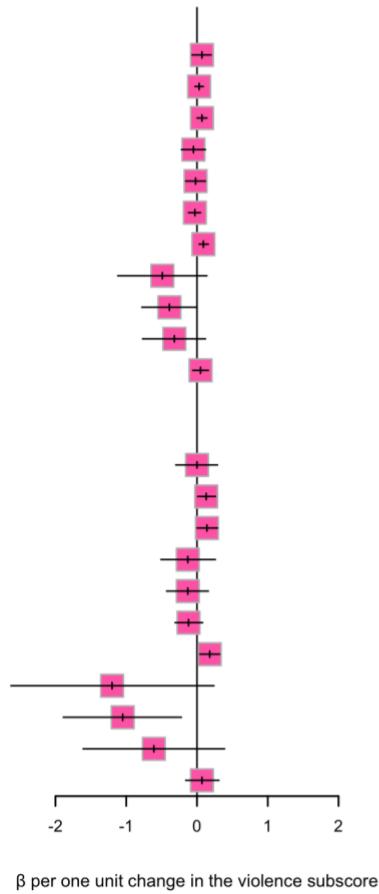
Beta coefficient [95%-CI] **SE** **p**

CECV total

Cognitive flexibility	0.07 [-0.07; 0.20]	0.070	0.321
Dominant motor	0.03 [-0.03; 0.09]	0.030	0.277
Expressive language	0.07 [0.00; 0.14]	0.030	0.036
Inhibition	-0.05 [-0.22; 0.12]	0.080	0.548
Learning	-0.02 [-0.16; 0.12]	0.070	0.769
Memory	-0.03 [-0.12; 0.05]	0.040	0.433
Nondominant motor	0.09 [0.03; 0.16]	0.030	0.004
Nonverbal Intelligence	-0.49 [-1.12; 0.14]	0.320	0.127
Receptive language	-0.39 [-0.78; -0.01]	0.190	0.044
Selective attention	-0.32 [-0.77; 0.12]	0.230	0.153
Working memory	0.05 [-0.06; 0.16]	0.060	0.383

Polyvictimisation

Cognitive flexibility	0.00 [-0.30; 0.29]	0.150	0.974
Dominant motor	0.13 [0.01; 0.26]	0.060	0.041
Expressive language	0.14 [0.00; 0.29]	0.070	0.052
Inhibition	-0.13 [-0.51; 0.26]	0.200	0.521
Learning	-0.13 [-0.43; 0.16]	0.150	0.375
Memory	-0.12 [-0.31; 0.08]	0.100	0.254
Nondominant motor	0.18 [0.04; 0.32]	0.070	0.012
Nonverbal Intelligence	-1.20 [-2.63; 0.24]	0.730	0.102
Receptive language	-1.05 [-1.89; -0.22]	0.420	0.014
Selective attention	-0.61 [-1.61; 0.39]	0.510	0.231
Working memory	0.07 [-0.16; 0.31]	0.120	0.533



Appendix Figure 6 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using imputed data

Violence Exposure Types and Cognitive Outcomes in Males (N = 498)

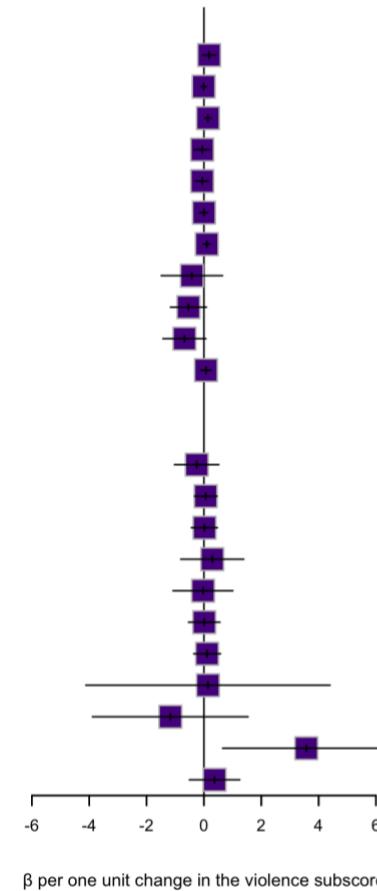
Beta coefficient [95%-CI] **SE** **p**

Witnessing Community Violence

Cognitive flexibility	0.18 [-0.05; 0.41]	0.120	0.130
Dominant motor	-0.01 [-0.10; 0.08]	0.050	0.790
Expressive language	0.14 [0.03; 0.25]	0.050	0.011
Inhibition	-0.06 [-0.34; 0.22]	0.140	0.665
Learning	-0.06 [-0.28; 0.17]	0.110	0.618
Memory	0.00 [-0.15; 0.14]	0.070	0.962
Nondominant motor	0.10 [-0.01; 0.20]	0.050	0.079
Nonverbal Intelligence	-0.42 [-1.49; 0.65]	0.540	0.435
Receptive language	-0.54 [-1.17; 0.09]	0.320	0.093
Selective attention	-0.68 [-1.43; 0.07]	0.380	0.076
Working memory	0.07 [-0.11; 0.25]	0.090	0.434

Community Victimisation

Cognitive flexibility	-0.25 [-1.03; 0.52]	0.390	0.522
Dominant motor	0.06 [-0.33; 0.46]	0.200	0.747
Expressive language	0.02 [-0.44; 0.47]	0.230	0.935
Inhibition	0.29 [-0.81; 1.39]	0.560	0.607
Learning	-0.03 [-1.08; 1.01]	0.530	0.950
Memory	0.01 [-0.54; 0.56]	0.280	0.960
Nondominant motor	0.11 [-0.36; 0.58]	0.240	0.649
Nonverbal Intelligence	0.14 [-4.12; 4.40]	2.150	0.949
Receptive language	-1.17 [-3.89; 1.54]	1.370	0.394
Selective attention	3.57 [0.65; 6.49]	1.470	0.017
Working memory	0.37 [-0.51; 1.25]	0.440	0.400



Appendix Figure 7 Forest plot estimates of associations between community violence and cognitive functions in males using imputed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Males (N = 498)

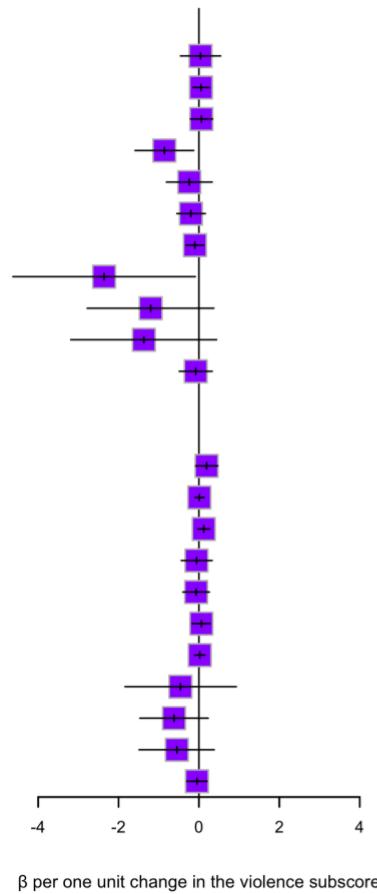
Beta coefficient [95%-CI] SE p

Witnessing Domestic Violence

Cognitive flexibility	0.04 [-0.46; 0.54]	0.250	0.872
Dominant motor	0.05 [-0.15; 0.26]	0.100	0.617
Expressive language	0.06 [-0.21; 0.34]	0.140	0.637
Inhibition	-0.86 [-1.59; -0.13]	0.370	0.022
Learning	-0.24 [-0.81; 0.33]	0.290	0.403
Memory	-0.20 [-0.55; 0.16]	0.180	0.281
Nondominant motor	-0.10 [-0.32; 0.12]	0.110	0.370
Nonverbal Intelligence	-2.36 [-4.63; -0.09]	1.150	0.042
Receptive language	-1.20 [-2.78; 0.37]	0.800	0.134
Selective attention	-1.37 [-3.19; 0.44]	0.920	0.137
Working memory	-0.08 [-0.49; 0.33]	0.210	0.706

Domestic Victimization

Cognitive flexibility	0.19 [-0.08; 0.47]	0.140	0.171
Dominant motor	0.01 [-0.10; 0.13]	0.060	0.820
Expressive language	0.12 [-0.03; 0.27]	0.080	0.119
Inhibition	-0.06 [-0.44; 0.33]	0.200	0.775
Learning	-0.07 [-0.40; 0.26]	0.170	0.670
Memory	0.06 [-0.17; 0.28]	0.110	0.622
Nondominant motor	0.02 [-0.11; 0.15]	0.060	0.756
Nonverbal Intelligence	-0.46 [-1.84; 0.93]	0.700	0.516
Receptive language	-0.62 [-1.47; 0.23]	0.430	0.152
Selective attention	-0.55 [-1.49; 0.38]	0.480	0.246
Working memory	-0.05 [-0.30; 0.20]	0.130	0.712



Appendix Figure 8 Forest plot estimates of associations between domestic violence and cognitive functions in males using imputed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Males (N = 498)

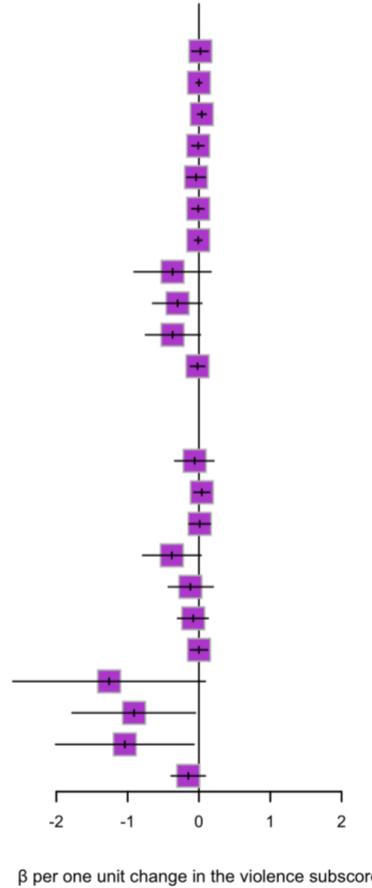
Beta coefficient [95%-CI] **SE** **p**

CECV total

Cognitive flexibility	0.02 [-0.10; 0.13]	0.060	0.758
Dominant motor	0.00 [-0.04; 0.04]	0.020	0.998
Expressive language	0.04 [-0.02; 0.10]	0.030	0.183
Inhibition	-0.01 [-0.10; 0.07]	0.040	0.750
Learning	-0.04 [-0.17; 0.09]	0.070	0.541
Memory	-0.01 [-0.10; 0.07]	0.040	0.750
Nondominant motor	-0.01 [-0.06; 0.04]	0.020	0.738
Nonverbal Intelligence	-0.37 [-0.91; 0.17]	0.270	0.175
Receptive language	-0.30 [-0.65; 0.04]	0.180	0.086
Selective attention	-0.37 [-0.75; 0.02]	0.190	0.061
Working memory	-0.02 [-0.12; 0.08]	0.050	0.667

Polyvictimisation

Cognitive flexibility	-0.06 [-0.34; 0.21]	0.140	0.655
Dominant motor	0.04 [-0.07; 0.15]	0.060	0.476
Expressive language	0.01 [-0.14; 0.16]	0.080	0.877
Inhibition	-0.38 [-0.79; 0.03]	0.210	0.071
Learning	-0.12 [-0.43; 0.20]	0.160	0.469
Memory	-0.08 [-0.30; 0.13]	0.110	0.446
Nondominant motor	0.00 [-0.12; 0.12]	0.060	0.999
Nonverbal Intelligence	-1.26 [-2.61; 0.09]	0.680	0.067
Receptive language	-0.91 [-1.78; -0.05]	0.440	0.038
Selective attention	-1.04 [-2.01; -0.07]	0.490	0.036
Working memory	-0.15 [-0.39; 0.09]	0.120	0.227



Appendix Figure 9 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using imputed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Males (N = 498)

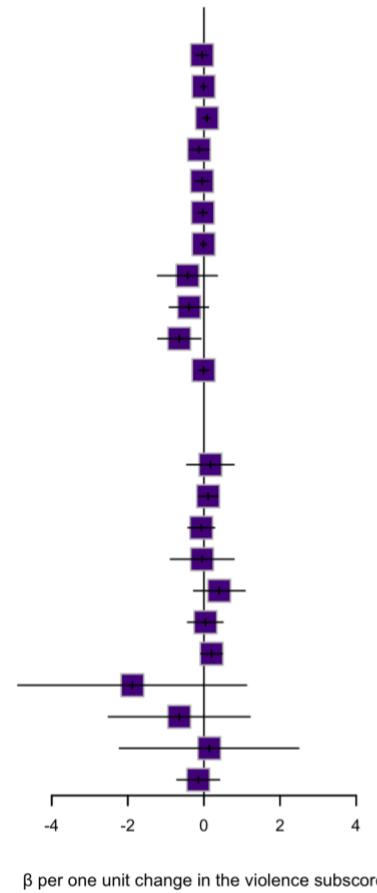
Beta coefficient [95%-CI] **SE** **p**

Witnessing Community Violence

Cognitive flexibility	-0.05 [-0.22; 0.12]	0.090	0.561
Dominant motor	-0.01 [-0.08; 0.05]	0.030	0.693
Expressive language	0.08 [-0.01; 0.17]	0.040	0.074
Inhibition	-0.13 [-0.38; 0.13]	0.130	0.323
Learning	-0.05 [-0.23; 0.14]	0.090	0.610
Memory	-0.03 [-0.16; 0.09]	0.060	0.608
Nondominant motor	-0.01 [-0.09; 0.06]	0.040	0.701
Nonverbal Intelligence	-0.43 [-1.22; 0.35]	0.400	0.279
Receptive language	-0.39 [-0.91; 0.12]	0.260	0.131
Selective attention	-0.65 [-1.21; -0.08]	0.290	0.025
Working memory	-0.01 [-0.15; 0.13]	0.070	0.865

Community Victimisation

Cognitive flexibility	0.17 [-0.45; 0.79]	0.310	0.592
Dominant motor	0.11 [-0.14; 0.36]	0.130	0.388
Expressive language	-0.07 [-0.42; 0.28]	0.180	0.693
Inhibition	-0.05 [-0.88; 0.79]	0.420	0.909
Learning	0.40 [-0.27; 1.08]	0.340	0.242
Memory	0.04 [-0.43; 0.50]	0.240	0.872
Nondominant motor	0.20 [-0.08; 0.48]	0.140	0.168
Nonverbal Intelligence	-1.88 [-4.89; 1.12]	1.520	0.218
Receptive language	-0.65 [-2.51; 1.21]	0.940	0.494
Selective attention	0.14 [-2.22; 2.49]	1.190	0.909
Working memory	-0.15 [-0.71; 0.41]	0.280	0.594



Appendix Figure 10 Forest plot estimates of associations between community violence and cognitive functions in males using imputed data

Violence Exposure Types and Cognitive Outcomes in Males (N = 498)

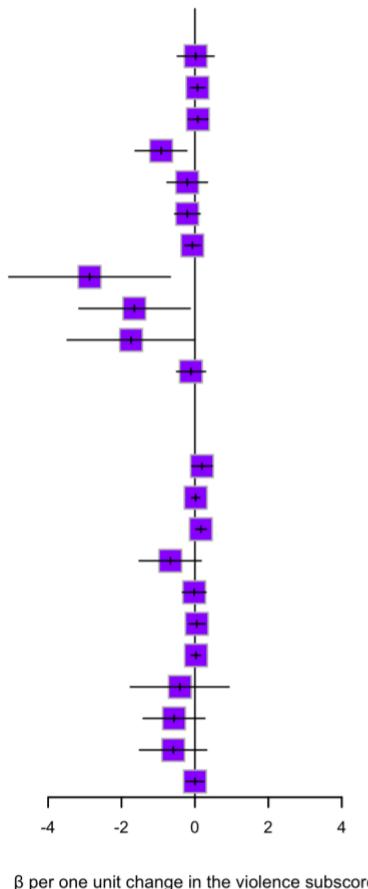
Beta coefficient [95%-CI] **SE** **p**

Witnessing Domestic Violence

Cognitive flexibility	0.02 [-0.48; 0.52]	0.250	0.942
Dominant motor	0.07 [-0.12; 0.27]	0.100	0.463
Expressive language	0.08 [-0.18; 0.35]	0.140	0.537
Inhibition	-0.92 [-1.63; -0.22]	0.360	0.011
Learning	-0.21 [-0.76; 0.34]	0.280	0.450
Memory	-0.21 [-0.55; 0.14]	0.180	0.240
Nondominant motor	-0.07 [-0.28; 0.15]	0.110	0.539
Nonverbal Intelligence	-2.87 [-5.07; -0.67]	1.120	0.011
Receptive language	-1.65 [-3.16; -0.13]	0.770	0.033
Selective attention	-1.74 [-3.48; 0.00]	0.880	0.051
Working memory	-0.11 [-0.50; 0.29]	0.200	0.604

Domestic Victimization

Cognitive flexibility	0.19 [-0.08; 0.47]	0.140	0.170
Dominant motor	0.02 [-0.09; 0.13]	0.060	0.757
Expressive language	0.16 [0.02; 0.31]	0.070	0.030
Inhibition	-0.67 [-1.52; 0.17]	0.430	0.117
Learning	-0.02 [-0.34; 0.30]	0.160	0.911
Memory	0.05 [-0.16; 0.27]	0.110	0.636
Nondominant motor	0.03 [-0.10; 0.15]	0.060	0.668
Nonverbal Intelligence	-0.41 [-1.76; 0.93]	0.680	0.544
Receptive language	-0.57 [-1.41; 0.27]	0.430	0.183
Selective attention	-0.59 [-1.51; 0.32]	0.460	0.203
Working memory	0.00 [-0.24; 0.24]	0.120	0.994



Appendix Figure 11 Forest plot estimates of associations between domestic violence and cognitive functions in males using imputed data

Violence Exposure Types and Cognitive Outcomes in Males (N = 498)

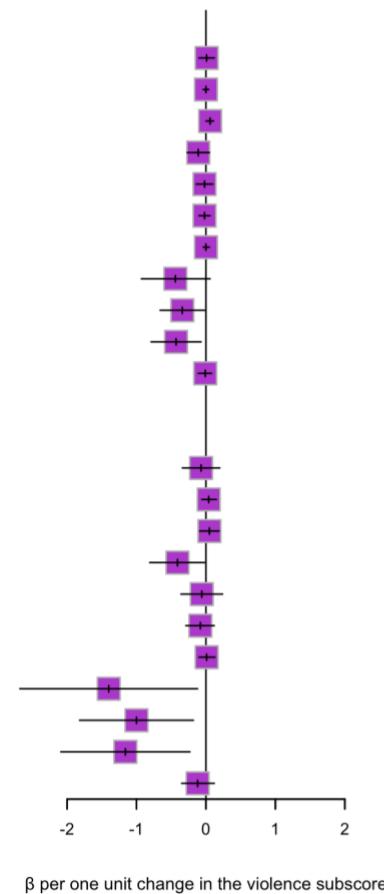
Beta coefficient [95%-CI] **SE** **p**

CECV total

Cognitive flexibility	0.01 [-0.10; 0.12]	0.050	0.827
Dominant motor	0.00 [-0.04; 0.04]	0.020	0.844
Expressive language	0.06 [0.00; 0.11]	0.030	0.039
Inhibition	-0.11 [-0.27; 0.05]	0.080	0.172
Learning	-0.02 [-0.14; 0.10]	0.060	0.720
Memory	-0.02 [-0.10; 0.06]	0.040	0.702
Nondominant motor	0.00 [-0.04; 0.05]	0.020	0.993
Nonverbal Intelligence	-0.44 [-0.93; 0.06]	0.250	0.085
Receptive language	-0.34 [-0.66; -0.02]	0.160	0.036
Selective attention	-0.43 [-0.79; -0.07]	0.180	0.018
Working memory	-0.01 [-0.11; 0.08]	0.050	0.747

Polyvictimisation

Cognitive flexibility	-0.07 [-0.34; 0.20]	0.140	0.607
Dominant motor	0.04 [-0.06; 0.15]	0.050	0.397
Expressive language	0.05 [-0.09; 0.19]	0.070	0.470
Inhibition	-0.41 [-0.81; -0.02]	0.200	0.041
Learning	-0.06 [-0.36; 0.24]	0.150	0.708
Memory	-0.08 [-0.29; 0.12]	0.100	0.415
Nondominant motor	0.01 [-0.10; 0.13]	0.060	0.818
Nonverbal Intelligence	-1.40 [-2.68; -0.12]	0.650	0.032
Receptive language	-1.00 [-1.82; -0.18]	0.410	0.017
Selective attention	-1.16 [-2.09; -0.23]	0.470	0.015
Working memory	-0.12 [-0.35; 0.12]	0.120	0.327



Appendix Figure 12 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using imputed data

Violence Exposure Types and Cognitive Outcomes in Females (Ns Vary)

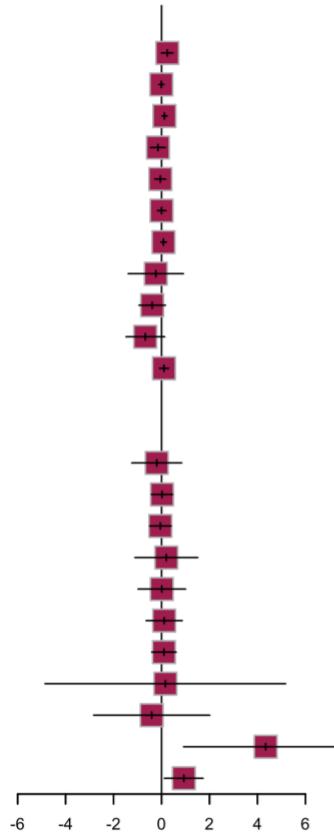
Beta coefficient [95%-CI] SE p

Witnessing Community Violence

Cognitive flexibility	0.24 [0.00; 0.47]	0.120	0.047
Dominant motor	-0.01 [-0.11; 0.09]	0.050	0.892
Expressive language	0.12 [0.02; 0.23]	0.050	0.015
Inhibition	-0.15 [-0.46; 0.15]	0.150	0.317
Learning	-0.05 [-0.28; 0.17]	0.110	0.647
Memory	0.00 [-0.17; 0.18]	0.090	0.973
Nondominant motor	0.08 [-0.03; 0.20]	0.060	0.149
Nonverbal Intelligence	-0.24 [-1.39; 0.91]	0.580	0.678
Receptive language	-0.39 [-0.94; 0.16]	0.280	0.165
Selective attention	-0.68 [-1.48; 0.13]	0.410	0.098
Working memory	0.10 [-0.08; 0.29]	0.090	0.263

Community Victimisation

Cognitive flexibility	-0.20 [-1.24; 0.84]	0.530	0.704
Dominant motor	0.02 [-0.42; 0.46]	0.220	0.921
Expressive language	-0.05 [-0.49; 0.40]	0.230	0.830
Inhibition	0.20 [-1.11; 1.51]	0.660	0.763
Learning	0.01 [-0.98; 1.00]	0.500	0.984
Memory	0.11 [-0.64; 0.86]	0.380	0.777
Nondominant motor	0.10 [-0.41; 0.61]	0.260	0.705
Nonverbal Intelligence	0.16 [-4.86; 5.17]	2.540	0.951
Receptive language	-0.41 [-2.83; 2.01]	1.230	0.737
Selective attention	4.34 [0.92; 7.76]	1.740	0.013
Working memory	0.93 [0.12; 1.73]	0.410	0.024



β per one unit change in the violence subscore in adjusted model

Appendix Figure 13 Forest plot estimates of associations between community violence and cognitive functions in females using observed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Females (Ns Vary)

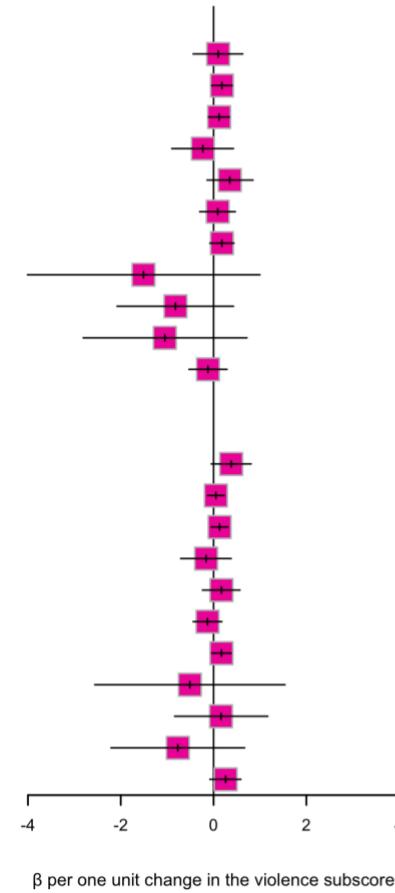
Beta coefficient [95%-CI] SE p

Witnessing Domestic Violence

Cognitive flexibility	0.10 [-0.44; 0.63]	0.270	0.720
Dominant motor	0.18 [-0.04; 0.40]	0.110	0.103
Expressive language	0.12 [-0.11; 0.34]	0.120	0.314
Inhibition	-0.23 [-0.90; 0.43]	0.340	0.491
Learning	0.35 [-0.14; 0.85]	0.250	0.162
Memory	0.09 [-0.30; 0.47]	0.200	0.651
Nondominant motor	0.18 [-0.08; 0.44]	0.130	0.171
Nonverbal Intelligence	-1.51 [-4.01; 1.00]	1.270	0.237
Receptive language	-0.82 [-2.08; 0.43]	0.640	0.198
Selective attention	-1.05 [-2.81; 0.72]	0.900	0.244
Working memory	-0.12 [-0.53; 0.29]	0.210	0.558

Domestic Victimization

Cognitive flexibility	0.38 [-0.05; 0.81]	0.220	0.082
Dominant motor	0.05 [-0.13; 0.23]	0.090	0.615
Expressive language	0.13 [-0.05; 0.31]	0.090	0.166
Inhibition	-0.16 [-0.71; 0.38]	0.270	0.550
Learning	0.17 [-0.24; 0.57]	0.210	0.417
Memory	-0.13 [-0.44; 0.18]	0.160	0.412
Nondominant motor	0.17 [-0.04; 0.38]	0.110	0.103
Nonverbal Intelligence	-0.51 [-2.56; 1.54]	1.040	0.627
Receptive language	0.16 [-0.84; 1.17]	0.510	0.753
Selective attention	-0.77 [-2.21; 0.67]	0.730	0.292
Working memory	0.26 [-0.08; 0.59]	0.170	0.131



Appendix Figure 14 Forest plot estimates of associations between domestic violence and cognitive functions in females using observed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Females (Ns Vary)

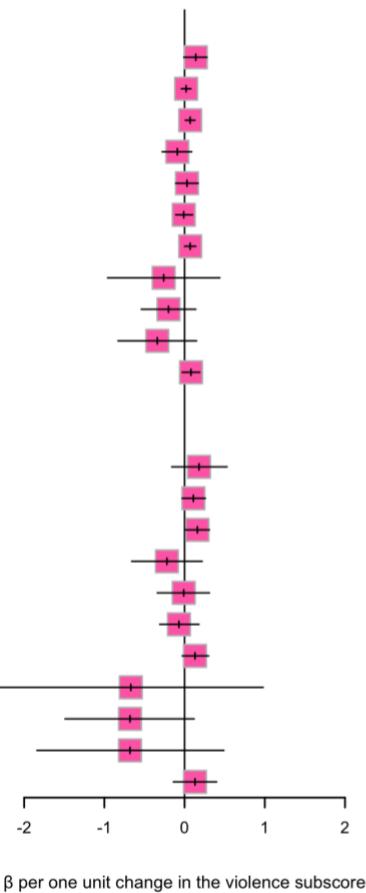
Beta coefficient [95%-CI] SE p

CECV total

Cognitive flexibility	0.14 [-0.01; 0.28]	0.070	0.061
Dominant motor	0.02 [-0.04; 0.08]	0.030	0.581
Expressive language	0.07 [0.01; 0.13]	0.030	0.026
Inhibition	-0.09 [-0.28; 0.09]	0.090	0.333
Learning	0.03 [-0.11; 0.17]	0.070	0.702
Memory	-0.01 [-0.11; 0.10]	0.050	0.924
Nondominant motor	0.07 [0.00; 0.14]	0.040	0.060
Nonverbal Intelligence	-0.26 [-0.96; 0.44]	0.360	0.459
Receptive language	-0.20 [-0.54; 0.14]	0.170	0.251
Selective attention	-0.34 [-0.83; 0.15]	0.250	0.177
Working memory	0.08 [-0.03; 0.19]	0.060	0.174

Polyvictimisation

Cognitive flexibility	0.18 [-0.16; 0.53]	0.180	0.297
Dominant motor	0.11 [-0.03; 0.26]	0.070	0.123
Expressive language	0.16 [0.01; 0.31]	0.080	0.035
Inhibition	-0.22 [-0.66; 0.22]	0.220	0.336
Learning	-0.01 [-0.34; 0.31]	0.170	0.945
Memory	-0.07 [-0.31; 0.18]	0.130	0.606
Nondominant motor	0.13 [-0.03; 0.30]	0.090	0.117
Nonverbal Intelligence	-0.67 [-2.32; 0.98]	0.840	0.424
Receptive language	-0.68 [-1.49; 0.12]	0.410	0.093
Selective attention	-0.68 [-1.84; 0.49]	0.590	0.254
Working memory	0.13 [-0.14; 0.40]	0.140	0.341



Appendix Figure 15 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using observed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Females (Ns Vary)

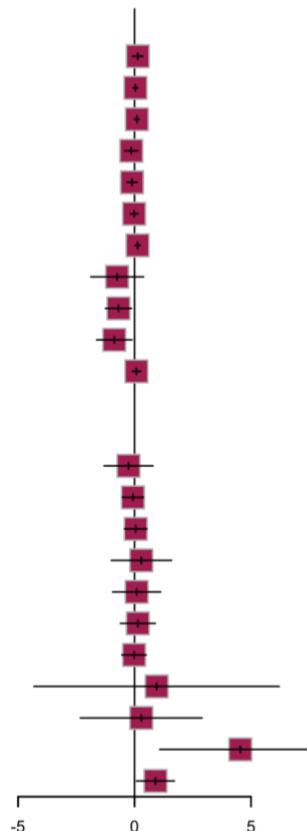
Beta coefficient [95%-CI] SE p

Witnessing Community Violence

Cognitive flexibility	0.14 [-0.09; 0.36]	0.110	0.229
Dominant motor	0.04 [-0.06; 0.14]	0.050	0.434
Expressive language	0.10 [-0.01; 0.20]	0.050	0.073
Inhibition	-0.14 [-0.43; 0.14]	0.140	0.316
Learning	-0.11 [-0.34; 0.11]	0.110	0.312
Memory	-0.02 [-0.18; 0.15]	0.080	0.833
Nondominant motor	0.13 [0.02; 0.24]	0.060	0.020
Nonverbal Intelligence	-0.75 [-1.88; 0.39]	0.580	0.195
Receptive language	-0.69 [-1.25; -0.13]	0.280	0.015
Selective attention	-0.87 [-1.63; -0.11]	0.390	0.025
Working memory	0.08 [-0.09; 0.26]	0.090	0.357

Community Victimization

Cognitive flexibility	-0.26 [-1.31; 0.79]	0.530	0.624
Dominant motor	-0.07 [-0.52; 0.38]	0.230	0.755
Expressive language	0.05 [-0.43; 0.53]	0.250	0.838
Inhibition	0.29 [-1.00; 1.59]	0.660	0.655
Learning	0.09 [-0.94; 1.12]	0.520	0.867
Memory	0.14 [-0.61; 0.89]	0.380	0.714
Nondominant motor	-0.02 [-0.55; 0.50]	0.270	0.932
Nonverbal Intelligence	0.95 [-4.32; 6.21]	2.670	0.723
Receptive language	0.29 [-2.33; 2.90]	1.330	0.830
Selective attention	4.54 [1.08; 7.99]	1.750	0.010
Working memory	0.90 [0.09; 1.71]	0.410	0.030



β per one unit change in the violence subscore

Appendix Figure 16 Forest plot estimates of associations between community violence and cognitive functions in females using observed data

Violence Exposure Types and Cognitive Outcomes in Females (Ns Vary)

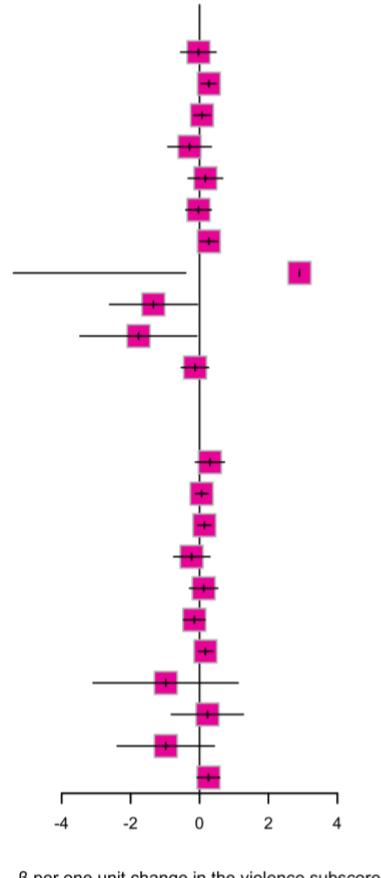
Beta coefficient [95%-CI] SE p

Witnessing Domestic Violence

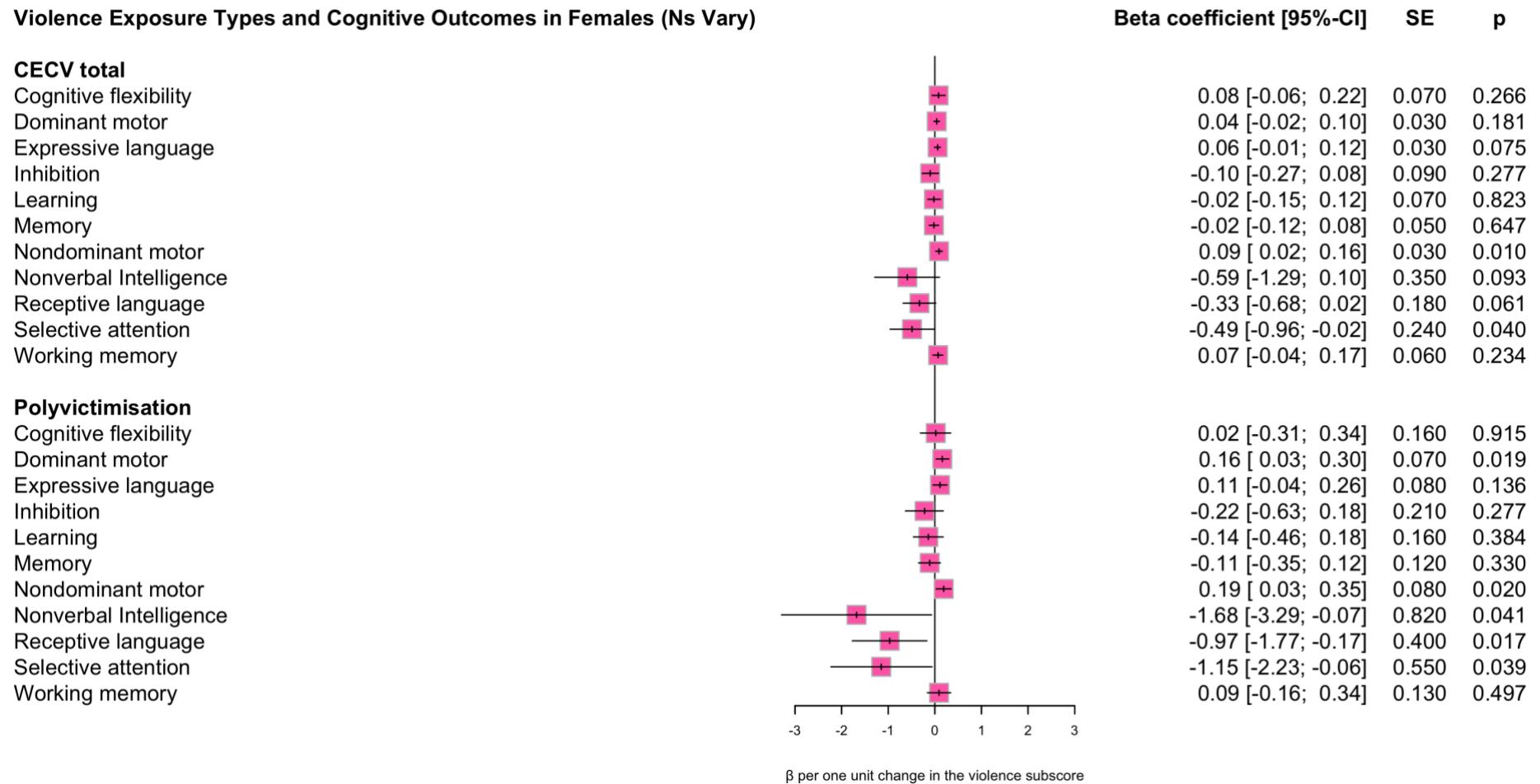
Cognitive flexibility	-0.03 [-0.55; 0.48]	0.260	0.896
Dominant motor	0.27 [0.05; 0.48]	0.110	0.015
Expressive language	0.07 [-0.16; 0.31]	0.120	0.540
Inhibition	-0.29 [-0.92; 0.34]	0.320	0.369
Learning	0.17 [-0.33; 0.67]	0.250	0.505
Memory	-0.03 [-0.40; 0.34]	0.190	0.879
Nondominant motor	0.27 [0.02; 0.52]	0.130	0.035
Nonverbal Intelligence	2.90 [-5.40; -0.40]	1.270	0.023
Receptive language	-1.34 [-2.61; -0.06]	0.650	0.040
Selective attention	-1.77 [-3.47; -0.08]	0.860	0.040
Working memory	-0.13 [-0.53; 0.26]	0.200	0.513

Domestic Victimization

Cognitive flexibility	0.30 [-0.12; 0.72]	0.210	0.161
Dominant motor	0.06 [-0.12; 0.24]	0.090	0.490
Expressive language	0.14 [-0.05; 0.33]	0.100	0.157
Inhibition	-0.23 [-0.75; 0.30]	0.270	0.396
Learning	0.12 [-0.29; 0.53]	0.210	0.561
Memory	-0.15 [-0.46; 0.15]	0.150	0.314
Nondominant motor	0.17 [-0.03; 0.38]	0.110	0.098
Nonverbal Intelligence	-0.98 [-3.09; 1.12]	1.070	0.358
Receptive language	0.23 [-0.82; 1.27]	0.530	0.667
Selective attention	-0.98 [-2.39; 0.43]	0.710	0.173
Working memory	0.26 [-0.07; 0.58]	0.170	0.123



Appendix Figure 17 Forest plot estimates of associations between domestic violence and cognitive functions in females using observed data



Appendix Figure 18 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in females using observed data

Violence Exposure Types and Cognitive Outcomes in Males (Ns Vary)

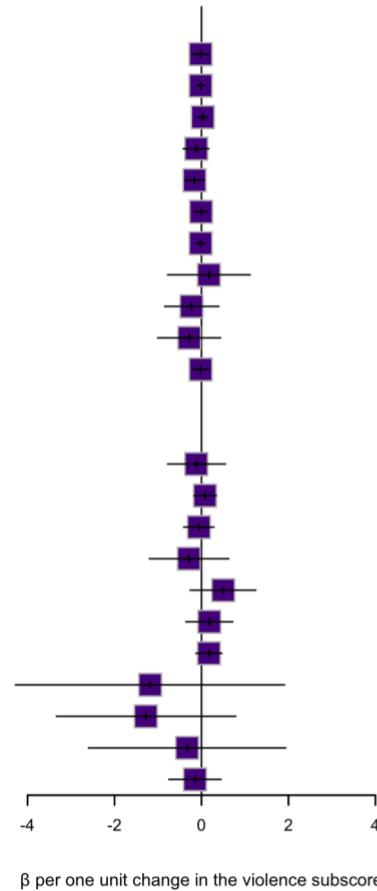
Beta coefficient [95%-CI] SE p

Witnessing Community Violence

Cognitive flexibility	-0.02 [-0.22; 0.18]	0.100	0.839
Dominant motor	-0.02 [-0.09; 0.06]	0.040	0.686
Expressive language	0.03 [-0.08; 0.13]	0.050	0.630
Inhibition	-0.12 [-0.42; 0.17]	0.150	0.406
Learning	-0.16 [-0.38; 0.06]	0.110	0.158
Memory	-0.01 [-0.17; 0.15]	0.080	0.934
Nondominant motor	-0.02 [-0.11; 0.07]	0.050	0.715
Nonverbal Intelligence	0.17 [-0.78; 1.12]	0.480	0.727
Receptive language	-0.23 [-0.85; 0.40]	0.320	0.474
Selective attention	-0.28 [-1.01; 0.44]	0.370	0.442
Working memory	-0.02 [-0.20; 0.16]	0.090	0.831

Community Victimisation

Cognitive flexibility	-0.12 [-0.78; 0.55]	0.340	0.732
Dominant motor	0.08 [-0.17; 0.34]	0.130	0.518
Expressive language	-0.06 [-0.41; 0.29]	0.180	0.744
Inhibition	-0.29 [-1.20; 0.63]	0.460	0.537
Learning	0.50 [-0.26; 1.25]	0.380	0.196
Memory	0.18 [-0.36; 0.72]	0.270	0.515
Nondominant motor	0.17 [-0.13; 0.47]	0.150	0.275
Nonverbal Intelligence	-1.18 [-4.28; 1.91]	1.570	0.453
Receptive language	-1.28 [-3.34; 0.79]	1.050	0.226
Selective attention	-0.33 [-2.60; 1.94]	1.150	0.775
Working memory	-0.15 [-0.75; 0.45]	0.300	0.626



Appendix Figure 19 Forest plot estimates of associations between community violence and cognitive functions in males using observed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Males (Ns Vary)

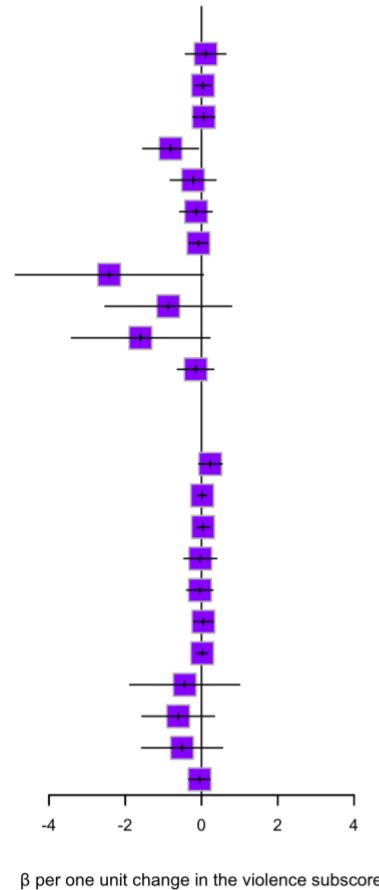
Beta coefficient [95%-CI] SE p

Witnessing Domestic Violence

Cognitive flexibility	0.11 [-0.42; 0.64]	0.270	0.678
Dominant motor	0.04 [-0.16; 0.24]	0.100	0.685
Expressive language	0.06 [-0.22; 0.34]	0.140	0.674
Inhibition	-0.81 [-1.54; -0.08]	0.370	0.029
Learning	-0.22 [-0.82; 0.38]	0.300	0.477
Memory	-0.14 [-0.57; 0.28]	0.210	0.500
Nondominant motor	-0.08 [-0.32; 0.16]	0.120	0.502
Nonverbal Intelligence	-2.42 [-4.88; 0.05]	1.250	0.054
Receptive language	-0.87 [-2.53; 0.79]	0.840	0.305
Selective attention	-1.60 [-3.41; 0.22]	0.920	0.085
Working memory	-0.15 [-0.63; 0.32]	0.240	0.526

Domestic Victimization

Cognitive flexibility	0.23 [-0.07; 0.54]	0.160	0.135
Dominant motor	0.02 [-0.10; 0.13]	0.060	0.783
Expressive language	0.04 [-0.12; 0.21]	0.080	0.599
Inhibition	-0.03 [-0.46; 0.40]	0.220	0.889
Learning	-0.04 [-0.39; 0.30]	0.180	0.801
Memory	0.05 [-0.20; 0.30]	0.130	0.678
Nondominant motor	0.02 [-0.12; 0.16]	0.070	0.752
Nonverbal Intelligence	-0.44 [-1.88; 1.00]	0.730	0.549
Receptive language	-0.61 [-1.56; 0.34]	0.480	0.210
Selective attention	-0.51 [-1.57; 0.55]	0.540	0.344
Working memory	-0.05 [-0.33; 0.22]	0.140	0.698



Appendix Figure 20 Forest plot estimates of associations between domestic violence and cognitive functions in males using observed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Males (Ns Vary)

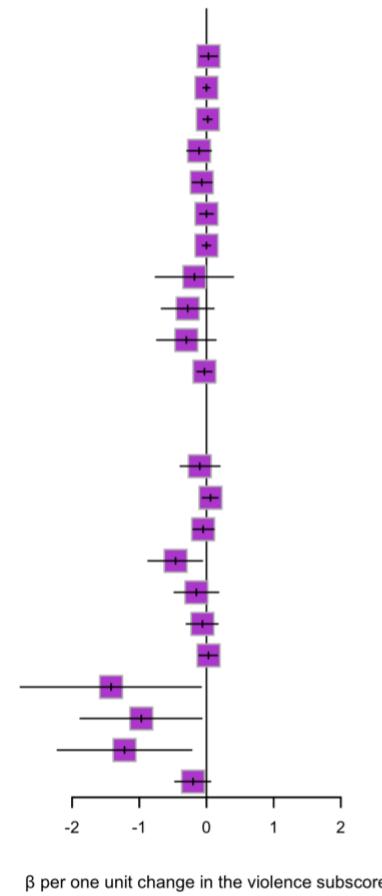
Beta coefficient [95%-CI] SE p

CECV total

Cognitive flexibility	0.03 [-0.09; 0.16]	0.060	0.612
Dominant motor	0.00 [-0.05; 0.05]	0.020	0.941
Expressive language	0.02 [-0.05; 0.08]	0.030	0.580
Inhibition	-0.11 [-0.29; 0.07]	0.090	0.224
Learning	-0.07 [-0.21; 0.08]	0.070	0.360
Memory	0.00 [-0.10; 0.10]	0.050	0.939
Nondominant motor	0.00 [-0.06; 0.06]	0.030	0.956
Nonverbal Intelligence	-0.18 [-0.76; 0.40]	0.290	0.537
Receptive language	-0.28 [-0.67; 0.11]	0.200	0.154
Selective attention	-0.30 [-0.74; 0.14]	0.220	0.182
Working memory	-0.03 [-0.14; 0.08]	0.060	0.596

Polyvictimisation

Cognitive flexibility	-0.10 [-0.39; 0.20]	0.150	0.512
Dominant motor	0.06 [-0.06; 0.17]	0.060	0.329
Expressive language	-0.05 [-0.20; 0.11]	0.080	0.540
Inhibition	-0.46 [-0.87; -0.06]	0.210	0.026
Learning	-0.15 [-0.48; 0.18]	0.170	0.376
Memory	-0.06 [-0.30; 0.17]	0.120	0.589
Nondominant motor	0.03 [-0.11; 0.16]	0.070	0.715
Nonverbal Intelligence	-1.42 [-2.77; -0.08]	0.680	0.038
Receptive language	-0.97 [-1.88; -0.07]	0.460	0.036
Selective attention	-1.22 [-2.22; -0.22]	0.510	0.017
Working memory	-0.20 [-0.47; 0.06]	0.130	0.129



β per one unit change in the violence subscore

Appendix Figure 21 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using observed data

Notes: Models adjusted for, maternal antenatal depression, maternal education, marital status, household income, employment status, prenatal alcohol, tobacco and HIV exposure. p = p-value

Violence Exposure Types and Cognitive Outcomes in Males (Ns Vary)

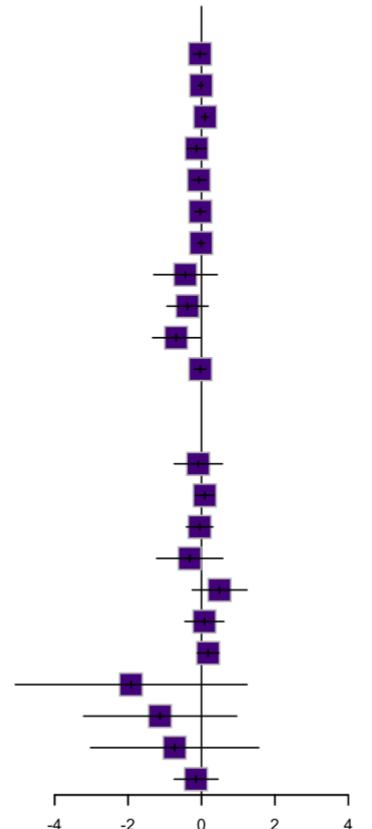
Beta coefficient [95%-CI] SE p

Witnessing Community Violence

Cognitive flexibility	-0.04 [-0.22; 0.13]	0.090	0.643
Dominant motor	-0.01 [-0.08; 0.05]	0.030	0.726
Expressive language	0.10 [0.00; 0.19]	0.050	0.049
Inhibition	-0.13 [-0.39; 0.13]	0.130	0.316
Learning	-0.07 [-0.26; 0.13]	0.100	0.509
Memory	-0.03 [-0.17; 0.11]	0.070	0.662
Nondominant motor	-0.01 [-0.09; 0.07]	0.040	0.815
Nonverbal Intelligence	-0.44 [-1.30; 0.43]	0.440	0.322
Receptive language	-0.38 [-0.94; 0.18]	0.280	0.185
Selective attention	-0.69 [-1.33; -0.04]	0.330	0.037
Working memory	-0.03 [-0.19; 0.12]	0.080	0.680

Community Victimization

Cognitive flexibility	-0.09 [-0.74; 0.57]	0.330	0.797
Dominant motor	0.09 [-0.16; 0.34]	0.130	0.483
Expressive language	-0.05 [-0.41; 0.31]	0.180	0.789
Inhibition	-0.32 [-1.22; 0.58]	0.460	0.483
Learning	0.49 [-0.25; 1.24]	0.380	0.196
Memory	0.08 [-0.45; 0.61]	0.270	0.768
Nondominant motor	0.18 [-0.11; 0.47]	0.150	0.230
Nonverbal Intelligence	-1.92 [-5.07; 1.24]	1.600	0.233
Receptive language	-1.13 [-3.21; 0.96]	1.060	0.289
Selective attention	-0.73 [-3.02; 1.56]	1.160	0.530
Working memory	-0.15 [-0.74; 0.45]	0.300	0.628



β per one unit change in the violence subscore

Appendix Figure 22 Forest plot estimates of associations between community violence and cognitive functions in males using observed data

Violence Exposure Types and Cognitive Outcomes in Males (Ns Vary)

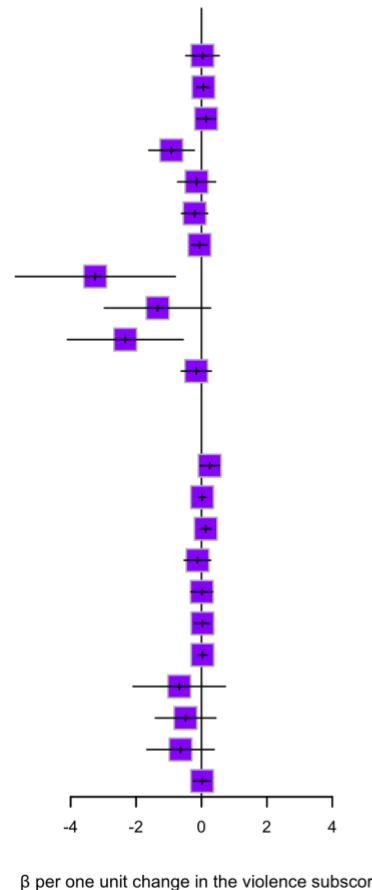
Beta coefficient [95%-CI] SE p

Witnessing Domestic Violence

Cognitive flexibility	0.03 [-0.48; 0.54]	0.260	0.905
Dominant motor	0.06 [-0.14; 0.25]	0.100	0.563
Expressive language	0.14 [-0.14; 0.43]	0.140	0.320
Inhibition	-0.92 [-1.61; -0.22]	0.350	0.010
Learning	-0.15 [-0.73; 0.43]	0.290	0.608
Memory	-0.21 [-0.61; 0.19]	0.200	0.307
Nondominant motor	-0.06 [-0.29; 0.17]	0.120	0.613
Nonverbal Intelligence	-3.25 [-5.69; -0.80]	1.240	0.009
Receptive language	-1.34 [-2.97; 0.28]	0.820	0.105
Selective attention	-2.33 [-4.10; -0.56]	0.900	0.010
Working memory	-0.16 [-0.62; 0.30]	0.230	0.497

Domestic Victimization

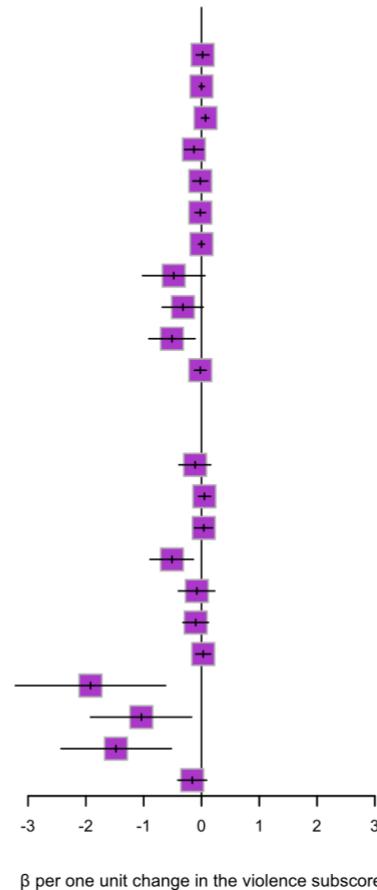
Cognitive flexibility	0.25 [-0.04; 0.54]	0.150	0.091
Dominant motor	0.02 [-0.09; 0.13]	0.060	0.663
Expressive language	0.13 [-0.03; 0.30]	0.080	0.119
Inhibition	-0.12 [-0.53; 0.28]	0.210	0.557
Learning	0.01 [-0.32; 0.34]	0.170	0.954
Memory	0.03 [-0.21; 0.26]	0.120	0.817
Nondominant motor	0.03 [-0.10; 0.16]	0.070	0.624
Nonverbal Intelligence	-0.68 [-2.09; 0.73]	0.720	0.344
Receptive language	-0.49 [-1.41; 0.44]	0.470	0.299
Selective attention	-0.64 [-1.67; 0.39]	0.520	0.221
Working memory	0.02 [-0.24; 0.28]	0.130	0.870



Appendix Figure 23 Forest plot estimates of associations between domestic violence and cognitive functions in males using observed data

Violence Exposure Types and Cognitive Outcomes in Males (Ns Vary)

	Beta coefficient [95%-CI]	SE	p
CECV total			
Cognitive flexibility	0.02 [-0.09; 0.13]	0.060	0.739
Dominant motor	0.00 [-0.04; 0.05]	0.020	0.850
Expressive language	0.07 [0.00; 0.13]	0.030	0.041
Inhibition	-0.13 [-0.29; 0.03]	0.080	0.117
Learning	-0.02 [-0.15; 0.11]	0.060	0.769
Memory	-0.02 [-0.11; 0.07]	0.050	0.713
Nondominant motor	0.00 [-0.05; 0.05]	0.030	0.895
Nonverbal Intelligence	-0.48 [-1.02; 0.06]	0.270	0.079
Receptive language	-0.32 [-0.68; 0.03]	0.180	0.075
Selective attention	-0.51 [-0.91; -0.11]	0.200	0.013
Working memory	-0.02 [-0.12; 0.08]	0.050	0.665
Polyvictimisation			
Cognitive flexibility	-0.11 [-0.39; 0.16]	0.140	0.421
Dominant motor	0.05 [-0.05; 0.16]	0.050	0.339
Expressive language	0.04 [-0.12; 0.19]	0.080	0.642
Inhibition	-0.51 [-0.89; -0.14]	0.190	0.008
Learning	-0.08 [-0.40; 0.23]	0.160	0.612
Memory	-0.10 [-0.32; 0.12]	0.110	0.369
Nondominant motor	0.03 [-0.10; 0.16]	0.060	0.645
Nonverbal Intelligence	-1.92 [-3.22; -0.62]	0.660	0.004
Receptive language	-1.04 [-1.92; -0.17]	0.440	0.020
Selective attention	-1.48 [-2.43; -0.52]	0.480	0.003
Working memory	-0.16 [-0.41; 0.09]	0.130	0.199



Appendix Figure 24 Forest plot estimates of overall violence exposure, polyvictimisation and cognitive functions in males using observed data