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MATERNAL POSTTRAUMATIC STRESS DISORDER, DEPRESSION AND ALCOHOL DEPENDENCE AND CHILD BEHAVIOUR OUTCOMES IN HIV INFECTED MOTHER-CHILD DYADS: A LONGITUDINAL STUDY

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ABSTRACT

Objectives: HIV and psychiatric disorders are prevalent and often concurrent. Child-bearing women are at an increased risk for both HIV and psychiatric disorders, specifically depression and posttraumatic stress disorder (PTSD). Poor mental health in the peripartum period has adverse effects on infant development and behaviour. Few studies have investigated the relationship between maternal PTSD and child behaviour outcomes in an HIV vertically infected sample. The aim of this study was to investigate if maternal postpartum trauma exposure and PTSD were risk factors for child behaviour problems. Additionally, maternal depression, alcohol abuse and functional disability were explored as co-factors.

Setting: The study was conducted in Cape Town, South Africa.

Participants: Seventy mother-child dyads infected with HIV were selected from a group of participants recruited from Community Health Centers.

Design: The study followed a longitudinal design. Five measures were used to assess maternal trauma exposure, PTSD, depression, alcohol abuse and functional disability at 12 months postpartum: Life Events Checklist (LEC), Harvard Trauma Scale (HTS), Alcohol Use Disorders Identification Test (Audit), Center for Epidemiological Studies Depression Scale (CESD) and the Sheehan Disability Scale (SDS). Child behaviour was assessed at 42 months with the Child Behaviour Checklist (CBCL).

Results: The rate of maternal disorder was high with 50% scoring above the cut-off for depression, 22.9% for PTSD, and 7% for alcohol abuse. Half of children scored within the clinical range for problematic behaviour. Children of mothers with depression were significantly more likely to display total behaviour problems than children of mothers without depression. Maternal PTSD had the greatest explanatory power for child behaviour problems although it did not significantly predict child outcomes.

Conclusion: This study highlights the importance of identifying and managing maternal PTSD and depression in mothers of children infected with HIV. The relationship between maternal PTSD and child behaviour warrants further investigation.

ARTICLE SUMMARY

Article focus

- This study investigated maternal mental health (PTSD, trauma exposure, depression and alcohol abuse) at one year postpartum as a predictor of child behaviour problems at three and a half years of age in HIV infected, mother-child dyads.

- Self-reports were used to determine the prevalence of maternal psychiatric disorders and child behaviour problems in the dyads.

Key Messages

- Maternal depression is associated with child behaviour problems in the general population as well as in this HIV infected sample.

- Prevalence of maternal depression and PTSD is high among mothers infected with HIV and prevalence of child behaviour problems is high among their infected children.

- The influence of maternal PTSD on child behaviour warrants further investigation.

Strengths and limitations of the study

- This study is, to our knowledge, the first to investigate PTSD as a predictor of child behaviour in vertically transmitted, HIV infected, mother-child-dyads.

- The study employed a longitudinal design with the child participants being relatively healthy as indicated by immunological status.

- The sample size of the study may have reduced statistical power and poor maternal mental health may have biased caregiver perceptions of child behaviour.

INTRODUCTION

South Africa has a high HIV prevalence rate of 11%. [1] The prevalence of psychiatric disorders in the general South African population is also relatively high compared to other countries, with an estimated lifetime and 12-month prevalence rates of 30.3% and 16.5% respectively. [2] There is an increased risk of common psychiatric disorders addociated with HIV infection [3-6] with depression nearly twice as common in infected individuals. [4] One study documented a 19% prevalence of common psychiatric disorders among HIV infected South Africans, with 14% meeting criteria for depression, 5% for posttraumatic stress disorder (PTSD) and 7% for alcohol dependence or abuse. [6] Individuals newly diagnosed with HIV are at an even higher risk for a common psychiatric disorder. [5] In addition, women are disproportionately and dually burdened by HIV and mood and anxiety disorders. Female gender is considered a risk factor for mood and anxiety disorders and for increased severity of these disorders [2] and women, especially child-bearing women, are disproportionally affected by HIV. [1]

Poor maternal mental health is associated with adverse long-term effects in child development and behaviour. [7-13] Depression, including postpartum depression, is linked to various forms of child and infant internalising and externalising behaviour problems, such as: insecure attachment and less optimal mother-child interaction; [8,10,14] higher levels of tension and lower levels of emotional development; [7] low social competence and adaptive functioning [9]; poorer cognitive development; [7] lower competencies and general behaviour problems in boys; [8] and attention-deficit hyperactivity disorder. [12] These problems can persist into adolescence. For example, infant negative emotional reactivity and shyness has been associated with inhibition and withdrawal in early childhood and with anxiety symptoms in middle childhood and adolescence. [15] Negative reactivity, low persistence, aggression and school difficulties in childhood have also been associated with substance abuse in adolescence. [16]

Furthermore, children of mothers with comorbid PTSD and depression are significantly more likely to display internalising and externalizing behaviour problems compared to children of mothers with depression only. [13] These children are more likely to display somatic symptoms and are more likely to be emotionally reactive, anxious/depressed and aggressive. [13] South Africa has a high rate of exposure to violence and traumatic events which increases risk for PTSD. [17]

Prevalence of PTSD and trauma exposure is high among individuals infected with HIV, with female gender being a significant risk factor in this group. [3-6,18,19] Women infected with HIV are therefore at high risk of PTSD and their children are consequently at risk of behavioural and developmental problems.

Maternal stress and anxiety is also linked to child behaviour problems. Various studies have investigated the negative effect of antenatal maternal stress on child development. [20] Fewer studies have focussed on postpartum maternal stress and anxiety and child behaviour outcomes. However, maternal stress and anxiety is negatively associated with parenting skills, and infant and child behaviour problems. [21-23] Maternal anxiety is a significant predictor of child attention and aggression problems [24] and maternal stress is significantly associated with child anxious and depressive symptoms. [25]

In addition to anxiety, PTSD and depression, maternal postpartum alcohol abuse/dependence has been associated with child and infant behaviour problems and developmental risk. [26-29] Alcohol abuse is one of the major contributors to disease burden in South Africa and antenatal alcohol abuse in associated with high rates of fetal alcohol spectrum disorders. [30-34] Child behaviour problems associated with parental postpartum alcohol abuse/dependence include: poor inhibitory control, attention shifting, distractibility, defiance, aggression, delinquency, emotional reactivity and withdrawal. [27,35]

To date, few studies have investigated the relationship between maternal postpartum trauma exposure, PTSD and child behaviour outcomes. None, to our knowledge, have examined this relationship in HIV-infected individuals, despite evidence of high prevalence of PTSD in this group and its public health implications. This is of significant public health concern particularly in the South African context. The primary aim of this study was to investigate the impact of maternal trauma exposure and PTSD at a specific time point (12 months postpartum) and the long-term effect thereof on child behaviour (at three and a half years of age) in mother-child dyads, infected with HIV, while controlling for the effects of depression. A secondary aim of the study was to investigate the relationship between maternal alcohol dependence/abuse, functional disability and child behaviour outcomes.

METHODS

Participants

Seventy mother-child dyads infected with HIV participated in the study from 2005 onwards. In eight cases, the maternal caregiver was not the child's biological mother. Maternal/mother within the context of this study therefore refers to either the biological mothers or primary caregiver of the child. The mother-child dyads were selected, based on the completeness of their data, as a sub-group from the Children with HIV Early Antiretroviral Therapy (CHER) trial. HIV-infected infants entered the study at a mean of seven weeks of age and were randomised to early antiretroviral therapy for either 40 weeks or 96 weeks followed by planned treatment interruption or deferred therapy until meeting treatment guideline thresholds at that time; a CD4 below 20% (25% in first year of life) or progression of HIV disease. This study commenced in 2005 and ended in 2011. [36] The study was conducted in two South African sites, the Perinatal HIV Research Unit in Soweto and the Children's Infectious Diseases Clinical Research Unit (KID-CRU), in Tygerberg Children's Hospital, Cape Town. Participants were identified and recruited from local community health centres through HIV vertical transmission prevention programs. A neurodevelomental sub-study was conducted in KID-CRU, and the data collected at this site was used in the current study.

Study Design

The neurodevelopmental sub-study reported herein was conducted over five years, and included all infants with birth weight >2000g and normal neurological examination before 12 weeks of age and excluded infants with CNS insults other than due to HIV. Maternal assessments were completed at 10-12 months and infant assessments at 42 months of age. The Committee for Health Research at Stellenbosch University, Cape Town, South Africa, approved the study.

Procedures

Informed consent was obtained from all mothers of infants infected with HIV, in their preferred language (English, Afrikaans or isiXhosa). Maternal participants completed a series of questionnaires including a demographic questionnaire, the Life Events Checklist (LEC), the Harvard Trauma Scale (HTS), the Alcohol Use Disorder Identification Test (Audit), the Center for Epidemiologic Studies Depression Scale

(CESD), and the Sheehan Disability Scale (SDS). The same battery of questionnaires was completed at five different time points over the course of five years. These self-report measures were verbally administered in Afrikaans and English by a trained research psychologist. A trained research assistant was used for Xhosa-speaking mothers.

Child behaviour was assessed at 42 months postpartum using the Child Behaviour Checklist (CBCL) which the mothers or caregivers, who were living with the children for the previous six months and took responsibility for caring for the child, completed on their own. The CBCL was administered by a research assistant if the mothers were illiterate or had difficulty completing the assessment. Immunodeficiency in children was measured using CD4 percentages and absolute scores. Immunodeficiency was determined in according to the World Health Organisation's guidelines on the classification of HIV associated immunodeficiency in children. [37] The CD4 counts and percentages of children were determined on a regular basis, but viral loads were only determined if there were concerns about treatment failure. Maternal CD4 counts and viral loads were not assessed as mothers were not receiving treatment at the same facility as the children.

Measures

Demographic Questionnaire

Biographical information regarding maternal age, ethnicity, language, marital status, education, annual household income, employment status and gender of the child was determined through a demographic questionnaire. The relationship of the caregiver to the child was also obtained.

Life Events Checklist

Traumatic life events were measured using the Life Events Checklist (LEC) The Life Events Checklist is a 16-item self-report questionnaire assessing the incidence of 16 different categories of traumatic events including physical assault, life threatening illness, natural disasters, sexual assault, and sudden unexpected death of a loved one. Participants had three optional responses to each item; direct 'happened to me', indirect 'witnessed it', and removed 'heard about it'. A score was then tallied for the total number of direct Life Events. Respondents who reported directly experienced trauma were asked to complete the Harvard Trauma Scale.

Harvard Trauma Scale

The Harvard Trauma Scale (HTS) is a 30-item, self-report questionnaire designed to screen for the presence of PTSD in cross-cultural populations. [38] Examples of items include 'feeling as though the event is happening again' and 'nightmares about the event that keep coming back'. Symptoms are reported on a four point Likert scale ranging from "not at all" to "extremely", with a total score range of 30 to 120. The cut-off score indicative of PTSD is 75 or higher. The HTS is regarded a valid and reliable measure to screen for a diagnosis of PTSD where cross-cultural sensitivity is necessary. [39]

Alcohol Use Disorders Identification Test

Alcohol dependence and abuse were measured using the Alcohol Use Disorders Identification Test (Audit). The 10-item questionnaire assesses alcohol dependence and abuse and is scored on a five point Likert scale from "never" to "daily or almost daily". The cut-off score is set at eight for alcohol abuse and 13 or more for alcohol dependence. The Audit is a reliable measure developed by the World Health Organisation and has been implemented and tested internationally. [40] It has been applied in a variety of settings and cultures [41-43] including Mexico, [44] Venezuala, [45] Hong Kong, [46] Zimbabwe [47] and in South Africa with HIV-infected patients. [48,49] In each of these studies the Audit outperformed other self-report measures in the identification of alcohol abuse and dependence.

Center for Epidemiological Studies Depression Scale

The Center for Epidemiological Studies Depression Scale (CESD) is a self-report measure to screen for depression. The CESD is a 20-item scale that assesses current levels of depression as per DSM-IV criteria. Responses are measured on a four point Likert scale ranging from "rarely or none of the time" to "most or all of the time". A score of 16 or more is considered indicative of depression. The CESD has been validated for clinic and community settings to detect depressive symptoms [50-52] and in many cross-cultural samples [53-55] and across ethnic groups. [56,57] The CESD has been used to measure depression in several clinic samples of individuals infected with HIV. [58,59,60,61]

The Sheehan Disability Scale

The Sheehan Disability Scale (SDS) is a self-report measure used to evaluate patients' functional impairment in relation to self-reported symptoms. [62] Functional disability is assessed across three core areas, namely, work/school, social life, and at home/family responsibilities. Functioning is reported on a visual analogue scale ranging from zero to ten. Higher scores indicate greater impairment and disability. The SDS is frequently used in clinical trials in psychiatry and is a valid, reliable measure of functional disability, responsive to change over time. [63]

The Child Behaviour Checklist

Child behaviour problems were assessed using the preschool version of the Child Behaviour Checklist (CBCL). [64] The CBCL is a 100 item self-report questionnaire, usually completed by a parent or caregiver. The items are scored on a three point Likert scale ranging from "not true" to "very true or often true". Behavioural problems are measured in eight domains, namely, emotionally reactive, anxious/depressed, somatic complaints, withdrawn behaviour, sleep problems, common/non-specific problems, attention problems and aggressive behaviour. The first four domains are viewed as internalising behaviour problems, the last two domains are viewed as externalising behaviour problems and all of the domains combined are viewed as total behaviour problems. The CBCL is a widely used behavioural checklist with good reliability and validity in a variety of cultural and language settings. [65,66,67]

Data analysis

All analyses were performed using Statistical Analysis Software (SAS) and SPSS version 20. Descriptive statistics were computed for the demographic characteristics of the sample as well as the prevalence rates of maternal mental health problems and child behavioural problems. Differences in behaviour problems between children of mothers with and without PTSD, depression and alcohol abuse were analysed by means of t-tests. Linear regression analysis was preformed to determine if maternal mental status was a significant predictor of child behaviour outcomes. Of particular interest was the influence of trauma exposure and PTSD on child behaviour outcomes. Depression was controlled for due to previous studies reporting a relationship between depression and child behaviour problems.

Three models were run with the following continuous outcome variables as measured by the CBCL: total child behavioural problems (internalising, externalising and sleep problems), child internalising behaviour problems and child externalising behaviour problems. The same continuous predictor variables were used in all three regression models. The predictor variables were: exposure to traumatic life events (LE), PTSD symptomatology (HTS), alcohol abuse/dependence (Audit), depression (CESD) and functional disability (SDS).

RESULTS

Sample demographics

The sample included 70 mother-child dyads, each being HIV-infected. The mean age of the mothers/caregivers at 12 months postpartum was 28.8 (range: 16-64) years. The mother-child dyads were mainly black (88.6%) and Xhosa speaking (65.7%). The mothers were mostly single (64.3%) and unemployed (80.9%). The majority of mothers had some secondary schooling (58.6%) with an annual income below R10 000 (US$1038). Thirthy-six children (51%) were female. The majority of caregivers at 10 to 12 months (94.3%) and 42 months (91.4%) were the biological mothers of the children, however there were eight changes in caregiver from 12 months postpartum to 42 months postpartum. Reasons for change in caregiver included: mother passed away (n = 3), mother was unavailable on the day of assessment (n = 2), and the person attending lived with the child and was closely involved in caring for the child (n = 3).

At 42 months, the majority of the children did not have CD4 percentages (91.4%, range: 16.3%-53.6%) or absolute scores (100%, range: 468-3267) indicative of immunodeficiency. The prevalence of infant immunodeficiency was higher at 10 to 12 months postpartum with 47.1% (range: 15.4%-54.5%) and 40% (range: 574-3777) showing mild to severe immunodeficiency based on CD4 percentages and absolute scores respectively. The demographic and biological information of participants are presented in Table 1.

Table 1

Demographic layout of the sample

	N	%	M
Relationship of carer to child at 12 months postpartum[1]	70		
Mother	66	94.3	
Grandmother	2	2.9	
Aunt	1	1.4	
Guardian	1	1.4	
Relationship of carer to child at 42 months postpartum[2]	70		
Mother	64	91.4	
Grandmother	5	7.1	
Aunt	1	1.4	
Age of mother/caregiver[1]	70		28.8
Gender of child[1]	70		
Male	34	48.6	
Female	36	51.4	
Language[1]	70		
Afrikaans	9	12.9	
English	15	21.4	
Xhosa	46	65.7	
Ethnicity[1]	70		
Black	62	88.6	
Coloured	3	4.3	
White	4	5.7	
Asian	1	1.4	
Marital Status[1]	70		
Single	45	64.3	
Married/living with a partner	23	32.9	
Divorced/separated	2	2.9	
Annual Income[1]	70		
< R10 000	51	72.9	
R 10 000 – R20 000	11	15.7	
R 20 000 – R 40 000	2	2.9	
R 40 000 – R 60 000	0	0	
R 60 000 – R 100 000	1	1.4	
> R 100 000	0	0	

	N	%	M
Level of Education[1]	70		
No schooling	0	0	
Some primary schooling	7	10	
Completed primary school	3	4.3	
Some secondary schooling	41	58.6	
Grade 12 completed	18	25.7	
Higher education completed	1	1.4	
Employment Status[1]	68		
Employed	13	19.1	
Unemployed	55	80.9	
Immunodeficiency (CD4 percentage) of child[1]	70		36.1
Not significant (>30%)	37	52.9	
Mild (25-30%)	15	21.4	
Advanced (20-24%)	12	17.1	
Severe (<20%)	6	8.6	
Immunodeficiency (CD4 absolute score) of child[1]	70		1862.6
Not significant	42	60	
Significant (<750)	28	40	
Immunodeficiency (CD4 percentage) of child[2]			34.3
Not significant (>25%)	64	91.4	
Mild (20-25%)	4	5.7	
Advanced (15-19%)	2	2.9	
Severe (<15%)	0	0	
Immunodeficiency (CD4 absolute score) of child[2]			1374.2
Not significant	70	100	
Significant (<350)	0	0	

[1]Data recorded at 12 months postpartum
[2]Data recorded at 42 months postpartum

Prevalence of maternal psychiatric disorders and child behaviour problems

The prevalence rate for all maternal psychiatric disorders was 27.6%. Depression was the most prevalent disorder at 50% (n = 35), followed by PTSD with 22.9% (n = 16), alcohol abuse with 7.1% (n = 5) and alcohol dependence with 2.9% (n = 2). A large proportion of children scored within the clinical range for problematic behaviour with a prevalence rate of 44.3% (n = 31) for total behaviour problems. Internalising behaviour problems were most prevalent with 50% of children scoring above cut-off. The most common internalising behaviour problems were somatic complaints (n =

28), followed by withdrawn behaviour (n = 20), emotional reactivity (n = 15) and anxious/depressed behaviour (n = 10). Externalising behavioural problems were less prevalent with 30% (n = 21) of children scoring within the clinical range. Aggressive behaviour (n = 12) was the most common externalising behaviour problem followed by attention problems (n = 8). Sleeping problems (n = 3) was the least common behaviour problem (see Table 2).

Table 2
Descriptive statistics for maternal mental health and child behaviour problems

	M	SD	Above cut-off N	Above cut-off %
Directly experienced life events (LE)[1]	2.36	2.13		
Substance abuse (Audit)[1]	1.30	3.45		
Hazardous drinking			5	7.1
Alcohol dependence			2	2.9
Depression (CESD)[1]	17.40	14.05	35	50
Posttraumatic Stress Disorder (HTS)[1]	59.67	21.36	16	22.9
Functional disability (SDS)[1]	7.11	6.75		
Total behaviour problems (CBCL)[2][3]	46.41	29.30	31	44.3
Sleep	3.16	2.67	3	4.3
Internalising behaviour problems (CBCL)[2]	14.67	11.07	35	50.0
Emotional reactive	3.20	3.39	15	21.4
Anxious/depressed	3.73	2.85	10	14.3
Somatic	4.61	3.57	28	40.0
Withdrawn	3.13	3.02	20	28.6
Externalising behaviour problems (CBCL)[2]	14.59	9.07	21	30.0
Attention	2.74	1.97	8	11.4
Aggression	11.84	7.77	12	17.1

[1]Maternal measures
[2]Child measures
[3]Total behaviour problems comprise of internalising behaviour problems, externalising behaviour problems and sleeping problems.

Maternal mental health as a predictor of child behaviour outcomes

The children of mothers with depression (*M* = 53.74, *SE* = 28.53) were significantly more likely to display behaviour problems *t*(68) = 2.15, *p* = .035, compared to the children of mothers without depression (*M* = 39.09, *SE* = 28.59). The children of mothers meeting criteria for PTSD (*M* = 54.06, *SE* = 18.97) were more likely to display behaviour problems compared to the children of mothers who did not meet criteria for PTSD (*M* = 44.25, *SE* = 30.76), but this was not a significant effect *t*(58) = 1.19, *p* = .238. The children of mothers who abused alcohol (*M* = 52.60, *SE* = 24.52) were also more likely to display behaviour problems, compared to the children of mothers who did not abuse alcohol (*M* = 45.94, *SE* = 29.74), but this effect was also was not significant *t*(68) = .49, *p* = .628 (see table 3).

Table 3
Comparison of CBCL scores for child behaviour problems based on maternal mental status

	M	SD	Df	t	p
Maternal depression (CESD)			68	2.15	.035
Children of mothers with depression	53.74	28.53			
Children of mothers without depression	39.09	28.59			
Maternal PTSD (HTS)			58	1.19	.238
Children of mothers with PTSD	54.06	18.97			
Children of mothers without PTSD	44.25	30.76			
Maternal alcohol abuse (Audit)			68	.49	.628
Children of mother who abuse alcohol	52.60	24.52			
Children of mothers who do not abuse alcohol	45.94	29.74			

Table 4 presents the results of the regression analyses with predictor variables, their standardized coefficients and significance levels for the outcome variables: child total behaviour problems (Model 1), child internalising behaviour problems (Model 2) and child externalising behaviour problems (Model 3). Table 5 presents the summary statistics for the regression analysis.

Table 4

Parameters for the variables predicting child behaviour outcomes (N=59)

Model		β	Std. error	Standardised Beta coefficients	t	Sig.	95% Confidence Interval Lower limit	Upper limit
		Unstandardised					95% Confidence Interval	
1	Total problems (Constant)	26.02	11.49		2.27	.028	4.33	47.71
	Traumatic life events (LE)	-1.79	1.91	-.13	-.94	.352	-5.40	1.81
	Alcohol dependance/abuse (Audit)	-.14	1.07	-.02	-.13	.894	-2.16	1.87
	Depression (CESD)	.20	.33	.10	.61	.546	-.42	.82
	Functional disability (SDS)	.24	.60	.06	.40	.688	-.89	1.38
	PTSD (HTS)	.35	.26	.27	1.38	.173	-.13	0.83
2	Internalising problems (Constant)	8.14	4.30		1.89	.064	.02	16.27
	Traumatic life events (LE)	-1.18	.72	-.23	-1.64	.106	-2.53	.18
	Alcohol dependance/abuse (Audit)	-.39	.40	-.13	-.99	.328	-1.15	.36
	Depression (CESD)	.14	.12	.19	1.12	.268	-.09	.37
	Functional disability (SDS)	.06	.22	.04	.28	.781	-.36	.49
	PTSD (HTS)	.12	.10	.24	1.29	.203	-.06	.30
3	Externalising problems (Constant)	6.05	3.62		1.67	.100	-.78	12.88
	Traumatic life events (LE)	-.15	.60	-.03	-.25	.807	-1.28	.99
	Alcohol dependance/abuse (Audit)	.37	.34	.15	1.12	.270	-.26	1.01
	Depression (CESD)	.01	.10	.02	.11	.909	-.18	.21
	Functional disability (SDS)	.02	.19	.01	.08	.936	-.34	.37
	PTSD (HTS)	.14	.08	.34	1.79	.079	-.01	.30

1. Outcome: total child behaviour problems (CBCL)
2. Outcome: internalising child behaviour problems (CBCL)
3. Outcome: externalising child behaviour problems (CBCL)

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Table 5
Model summary predicting child behaviour problems

Model	R²	ΔR²	F	df1	df2	p
1	.119	.036	1.44	5	53	.227
2	.150	.070	1.88	5	53	.114
3	.147	.067	1.83	5	53	.123

1. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (Audit), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: total child behaviour problems (CBCL)
2. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (Audit), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: internalising child behaviour problems (CBCL)
3. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (Audit), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: externalising child behaviour problems (CBCL)

The linear combination of maternal variables, namely, traumatic life events, PTSD, depression, alcohol dependence/abuse and functional disability explained 3.63% of the variance in total child behaviour problems in model 1. The amount of variance explained was not significant $F_{(5,53)} = 1.44$, $p = .226$. None of the predictor variables significantly contributed to predicting child behaviour problems within this model. Maternal PTSD $\beta = .35$, $t(59) = 1.38$, $p = .173$ made the largest contribution to explaining child total behaviour problems, based on standardised beta coefficients and significance levels, followed by traumatic life events $\beta = -1.79$, $t(59) = -.94$, $p = .352$, depression $\beta = .20$, $t(59) = .61$, $p = .546$, disability in functioning $\beta = .24$, $t(59) = .40$, $p = .688$ and alcohol dependence/abuse $\beta = -.14$, $t(59) = -.13$, $p = .894$.

The linear combination of the maternal variables in model 2 explained 7.02% of the variance in child internalising behaviour problems. The amount of variance explained in this model was also not significant $F_{(5,53)} = 1.44$, $p = .226$. None of the predictor variables significantly contributed to predicting child internalising behaviour problems. Maternal PTSD $\beta = .12$, $t(59) = 1.29$, $p = .203$ made the largest contribution to explaining child internalising behaviour problems, based on standardised Beta coefficients, followed by traumatic life events $\beta = -1.18$, $t(59) = -1.64$, $p = .106$, depression $\beta = .14$, $t(59) = 1.12$, $p = .268$, alcohol dependence/abuse $\beta = -.39$, $t(59) = -.99$, $p = .328$ and functional disability $\beta = .06$, $t(59) = .28$, $p = .781$.

Maternal variables explained 6.66% of the variance in child externalising behaviour problems in model 3 and the variance explained was once again not significant $F(5,53) = 1.83$, $p = .123$. None of the predictor variables significantly contributed to explaining child externalising behaviour problems. Maternal PTSD $\beta = .14$, $t(59) = 1.79$, $p = .079$ made the largest contribution, based on standardised beta coefficients and significance levels, followed by alcohol dependence/abuse $\beta = .37$, $t(59) = 1.12$, $p = .270$, traumatic life events $\beta = -.15$, $t(59) = -.25$, $p = .807$, depression $\beta = .01$, $t(59) = .11$, $p = .909$ and functional disability $\beta = .02$, $t(59) = .08$, $p = .936$.

DISCUSSION

The present study examined the long term effects of maternal mental health and child behaviour outcomes in a sample of mother-child dyads infected with HIV. Firstly, we found that maternal mental disorders and child behaviour problems were common among HIV infected mothers and vertically infected children. The overall prevalence of maternal psychiatric disorders was 27.6%. Previous studies have reported prevalence rates of 19% to 56% among HIV infected samples. [3-6] Half of mothers in this study scored above the cut-off for depression, followed by 22.9% for PTSD, 7.1% for alcohol abuse and 2.9% for alcohol dependence. Previous studies similarly have reported high prevalence rates, among samples infected with HIV, for depression (14% - 36%), PTSD (5% - 14.8%) and alcohol dependence (7%). [3-6] The results of this study revealed even higher prevalence rates for depression and PTSD and lower prevalence rates for alcohol dependence. The high prevalence rate of PTSD could possibly be biased by female gender, a previously identified risk factor for PTSD in HIV infected individuals. [18] The low rate of alcohol dependence might be due to the use of prenatal alcohol exposure as an exclusion criterion for participation in the study.

A high rate of child behaviour problems (44.3% for total behaviour problems) was also found. The prevalence rate for internalising and externalising behaviour problems, which fell within the clinical range, was 50% and 30% respectively. The children in this sample are therefore at greater risk of developing psychiatric disorders, such as anxiety and substance abuse disorders, later in life. [15,16]

Second, children of mothers with depression were significantly more likely to exhibit behaviour problems than the children of mothers without depression, although this association was not significant for maternal PTSD or alcohol abuse/dependence.

Various studies have found significant links between maternal depression and internalising and externalising child behaviour problems. [7-10,12] This relationship was investigated in this study in an effort to control for the probable shared variance between depression and PTSD. Depression was not a significant predictor within the regression models of total behaviour problems, internalising or externalising behaviour problems.

Third, maternal trauma exposure, PTSD, depression, alcohol abuse/dependence and functional disability did not significantly predict child behaviour outcomes. However, PTSD made the largest contribution in predicting internalising, externalising and total behaviour problems. This relationship between PTSD and child behaviour problems warrants further investigation. Similar results have been reported, a significant association has been found between maternal stress and anxiety and child internalising and externalising problems. [24,25] The children of mothers with comorbid PTSD and depression also have an increased risk for internalising and externalising behaviour problems, compared to mothers with depression alone or no disorder. [13] While previous studies have found significant associations between parental (specifically maternal) alcohol abuse and child developmental and behaviour problems, [35,68] in the present study no significant relationship was found between alcohol dependence/abuse, functional disability and child behavioural outcomes in regression analyses.

A number of study limitations deserve mention. In eight cases, there was a change in the caregiver completing the maternal assessment at 12 months compared with the caregiver completing the child assessment at 42 months. More than one administrator was used which may have caused inconsistency in the administration of self-reports. Additionally, the maternal mental state and child behaviour outcomes were measured using self-reports and not a clinician diagnosis. The mental state of the caregivers may have contributed to biased perceptions of child behaviour being endorsed. Only 70 mother-child dyads participated in the study and 11 of the 70 were excluded from the regression analysis owing to missing data. The small sample size may have compromised statistical power for the analyses. Lastly, there was no HIV negative control or comparator group.

Nevertheless, several characteristics of the sample distinguish this study from previous research samples. This is, to our knowledge, the first study investigating the predictive effect of PTSD on child behaviour in vertically transmitted, HIV infected

children. The maternal assessments included in this study were completed at 12 months postpartum which was deemed a salient period for examining PTSD in new mothers and was intended to decrease the risk of confounding by postpartum depression, as the risk for postpartum depression is highest within the first year after giving births. The study followed a longitudinal design and investigated the long-term child outcomes of maternal mental health at a specific point in time. Biological markers (e.g. CD4 counts) indicated that the children were relatively healthy at the time of assessment thus minimizing the possibility of poor physical health being a confounding factor. All mother-child dyads had routine check ups, counseling, HIV information sessions and antiretroviral treatment available to them. The level of intervention and care provided may have contributed positively to maternal mental health and child behaviour outcomes and requires further investigation. Findings of this study highlight the need to screen for and manage maternal PTSD and depression in mothers-child dyads infected with HIV. Identifying the mechanisms by which maternal mental health variables, specifically PTSD, interact and function in relation to child development in vertically transmitted HIV also requires exploration in future larger sample longitudinal studies.

Competing Interests

None

Contributorship

Ms Jani Nöthling: data analysis and interpretation, writing of manuscript

Ms Cherie Martin: interpretation of analysis, writing of manuscript

Dr Barbara Laughton: concept design, project leader of neurodevelopmental study, oversight of child behaviour data, revision of manuscript, read and approved manuscript

Prof Mark Cotton: revision of manuscript, co-PI of study for the children with HIV Early Antiretroviral (CHER) trial for the HIV-infected infants

Prof Soraya Seedat: concept design, oversight of data analysis, revision of manuscript, read and approved manuscript

Ms Marina Basson: data collection

Ms Lungiswa Rosy Khethelo: data collection

Dr Justin Harvey: data analysis

Data sharing

No additional data are available.

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Maternal posttraumatic stress disorder, depression and alcohol dependence and child behaviour outcomes in HIV infected mother-child dyads: a longitudinal study

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MATERNAL POSTTRAUMATIC STRESS DISORDER, DEPRESSION AND

ALCOHOL DEPENDENCE AND CHILD BEHAVIOUR OUTCOMES IN HIV

INFECTED MOTHER-CHILD DYADS: A LONGITUDINAL STUDY

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ABSTRACT

Objectives: HIV and psychiatric disorders are prevalent and often concurrent. Child-bearing women are at an increased risk for both HIV and psychiatric disorders, specifically depression and posttraumatic stress disorder (PTSD). Poor mental health in the peripartum period has adverse effects on infant development and behaviour. Few studies have investigated the relationship between maternal PTSD and child behaviour outcomes in an HIV vertically infected sample. The aim of this study was to investigate if maternal postpartum trauma exposure and PTSD were risk factors for child behaviour problems. Additionally, maternal depression, alcohol abuse and functional disability were explored as co-factors.

Setting: The study was conducted in Cape Town, South Africa.

Participants: Seventy mother-child dyads infected with HIV were selected from a group of participants recruited from Community Health Centers.

Design: The study followed a longitudinal design. Five measures were used to assess maternal trauma exposure, PTSD, depression, alcohol abuse and functional disability at 12 months postpartum: Life Events Checklist (LEC), Harvard Trauma Scale (HTS), Alcohol Use Disorders Identification Test (AUDIT), Center for Epidemiological Studies Depression Scale (CESD) and the Sheehan Disability Scale (SDS). Child behaviour was assessed at 42 months with the Child Behaviour Checklist (CBCL).

Results: The rate of maternal disorder was high with 50% scoring above the cut-off for depression, 22.9% for PTSD, and 7% for alcohol abuse. Half of children scored within the clinical range for problematic behaviour. Children of mothers with depression were significantly more likely to display total behaviour problems than children of mothers without depression. Maternal PTSD had the greatest explanatory power for child behaviour problems although it did not significantly predict child outcomes.

Conclusion: This study highlights the importance of identifying and managing maternal PTSD and depression in mothers of children infected with HIV. The relationship between maternal PTSD and child behaviour warrants further investigation.

ARTICLE SUMMARY

Article focus

- This study investigated maternal mental health (PTSD, trauma exposure, depression and alcohol abuse) at one year postpartum as a predictor of child behaviour problems at three and a half years of age in HIV infected, mother-child dyads.

- Self-reports were used to determine the prevalence of maternal psychiatric disorders and child behaviour problems in the dyads.

Key Messages

- Maternal depression is associated with child behaviour problems in the general population as well as in this HIV infected sample.

- Prevalence of maternal depression and PTSD is high among mothers infected with HIV and prevalence of child behaviour problems is high among their infected children.

- The influence of maternal PTSD on child behaviour warrants further investigation.

Strengths and limitations of the study

- This study is, to our knowledge, the first to investigate PTSD as a predictor of child behaviour in vertically transmitted, HIV infected, mother-child-dyads.

- The study employed a longitudinal design with the child participants being relatively healthy as indicated by immunological status.

- The sample size of the study may have reduced statistical power. Poor maternal physical health, change in child's medical treatment and change in caregiver may have biased the results..

INTRODUCTION

The prevalence of psychiatric disorders in the general South African population is relatively high compared to other countries, with an estimated lifetime prevalence of 30.3% and 12-month prevalence of 16.5%.[1] Depression, alcohol abuse and posttraumatic stress disorder (PTSD) are commonly diagnosed disorders with a 12-month prevalence rate of 4.9%, 4.5% and 0.7% respectively. [1,2] Among South Africans, alcohol abuse has a lifetime prevalence rate of 11.4% followed by depression at 9.8% and PTSD at 2.3%. [1,2] Postpartum depression is also prevalent in South Africa. High prevalence rates of 28% and 34.7% have been reported among new mothers. [3]

In addition to high prevalence of psychiatric disorders, South Africa is overly burdened by HIV infection with a prevalence rate of 11%. [4] Common psychiatric disorders are often associated with HIV infection [5-8] with depression nearly twice as common in infected individuals. [6] One study documented a 19% prevalence of common psychiatric disorders among HIV infected South Africans, with 14% meeting criteria for depression, 5% for PTSD and 7% for alcohol dependence or abuse. [8] Individuals newly diagnosed with HIV are at an even higher risk for a common psychiatric disorder. [7] In addition, women are disproportionately and dually burdened by HIV and mood and anxiety disorders. Female gender is considered a risk factor for mood and anxiety disorders and for increased severity of these disorders. [1] Women, especially child-bearing women, are disproportionally affected by HIV. [3]

Poor maternal mental health is associated with adverse long-term effects in child development and behaviour. [9-15] Prevalence rates of 16% - 30% and 7% - 31% for externalising behaviour problems and internalising behaviour problems respectively have been identified among preschool children in low income families. [16] Internalising and externalising behaviour problems can persist into adolescence. For example, infant negative emotional reactivity and shyness have been associated with inhibition and withdrawal in early childhood and with anxiety symptoms in middle childhood and adolescence. [17] Negative reactivity, low persistence, aggression and school difficulties in childhood have also been associated with substance abuse in adolescence. [18]

Maternal depression, including postpartum depression, is linked to various forms of child and infant internalising and externalising behaviour problems, such as:

insecure attachment and less optimal mother-child interaction; [10,12,14] higher levels of tension and lower levels of emotional development; [9] low social competence and adaptive functioning [11]; poorer cognitive development; [9] lower competencies and general behaviour problems in boys; [10] and attention-deficit hyperactivity disorder. [14]

Furthermore, children of mothers with comorbid PTSD and depression are significantly more likely to display internalising and externalising behaviour problems compared to children of mothers with depression only. [15] These children are more likely to display somatic symptoms and are more likely to be emotionally reactive, anxious/depressed and aggressive. [15] South Africa has a high rate of exposure to violence and traumatic events which increases risk for PTSD. [19] Prevalence of PTSD and trauma exposure is high among individuals infected with HIV, with female gender being a significant risk factor in this group. [5-8,20,21] Women infected with HIV are therefore at high risk of PTSD and their children are consequently at risk of behavioural and developmental problems.

Maternal stress and anxiety is also linked to child behaviour problems. Various studies have investigated the negative effect of antenatal maternal stress on child development. [22] Fewer studies have focussed on postpartum maternal stress and anxiety and child behaviour outcomes. However, maternal stress and anxiety is negatively associated with parenting skills, and infant and child behaviour problems. [23-25] Maternal anxiety is a significant predictor of child attention and aggression problems [26] and maternal stress is significantly associated with child anxious and depressive symptoms. [27]

In addition to anxiety, PTSD and depression, maternal postpartum alcohol abuse/dependence has been associated with child and infant behaviour problems and developmental risk. [28-31] Alcohol abuse is one of the major contributors to disease burden in South Africa and antenatal alcohol abuse in associated with high rates of fetal alcohol spectrum disorders. [32-36] Child behaviour problems associated with parental postpartum alcohol abuse/dependence include: poor inhibitory control, attention shifting, distractibility, defiance, aggression, delinquency, emotional reactivity and withdrawal. [29,37]

To date, few studies have investigated the relationship between maternal postpartum trauma exposure, PTSD and child behaviour outcomes. None, to our knowledge, have examined this relationship in HIV-infected individuals, despite

evidence of high prevalence of PTSD in this group and its public health implications. This is of significant public health concern particularly in the South African context. The primary aim of this study was to investigate the impact of maternal trauma exposure and PTSD at a specific time point (12 months postpartum) and their association with child behaviour (at three and a half years of age) in mother-child dyads, infected with HIV, while controlling for the effects of depression. A secondary aim of the study was to investigate the relationship between maternal alcohol dependence/abuse, functional disability and child behaviour outcomes.

METHODS

Participants

Seventy mother-child dyads infected with HIV participated in this study. Data was collected between 2006 and 2010. In eight cases, the maternal caregiver was not the child's biological mother. 'Maternal' or 'mother' within the context of this study therefore refers to either the biological mother or primary caregiver of the child. The child had to be in the care of the caregiver for at least six months prior to the assessments to qualify as a suitable participant. The mother-child dyads were selected, based on the completeness of their data, as a sub-group from the Children with HIV Early Antiretroviral Therapy (CHER) trial. HIV-infected infants entered the CHER trial at a mean of seven weeks of age and were randomised to early antiretroviral therapy for either 40 weeks or 96 weeks followed by planned treatment interruption or deferred therapy until meeting treatment guideline thresholds at that time; a CD4 below 20% (25% in first year of life) or progression of HIV disease. The CHER study commenced in 2005 and ended in 2011. [38] The study was conducted in two South African sites, the Perinatal HIV Research Unit in Soweto and the Children's Infectious Diseases Clinical Research Unit (KID-CRU), in Tygerberg Children's Hospital, Cape Town. Participants were identified and recruited from local community health centres through HIV vertical transmission prevention programs. A neurodevelopmental sub-study was conducted in KID-CRU, and the data collected at this site was used in the current study.

Study Design

The neurodevelopmental sub-study reported herein was conducted over five years, and included all infants with birth weight >2000g and normal neurological

examination before 12 weeks of age and excluded infants with CNS insults other than due to HIV. Maternal assessments were completed at 10-12 months and infant assessments at 42 months of age. The study under investigation was approved by the Health Research Ethics Committee of Stellenbosch University in Cape Town, South Africa (N05/07/113). The ethics committee granted a waiver of parental consent for participants who were less than 18 years of age.

Procedures

Informed consent was obtained from all mothers of infants (aged 16 years and older) infected with HIV, in their preferred language (English, Afrikaans or isiXhosa). Maternal participants completed a series of questionnaires including a demographic questionnaire, the Life Events Checklist (LEC), the Harvard Trauma Scale (HTS), the Alcohol Use Disorder Identification Test (AUDIT), the Center for Epidemiologic Studies Depression Scale (CESD), and the Sheehan Disability Scale (SDS). The same battery of questionnaires was completed at five different time points over the course of five years. The assessments completed at 12 months postpartum were used in the current analysis. This was deemed a salient period for examining PTSD in new mothers and was intended to decrease the risk of confounding by postpartum depression, as the risk for postpartum depression is highest within the first year after giving birth. The self-report measures were verbally administered in Afrikaans and English by a trained research psychologist. A trained research assistant was used for Xhosa-speaking mothers.

Child behaviour was assessed at 42 months postpartum using the Child Behaviour Checklist (CBCL). This time point was selected based on completeness of data and in an effort to measure the long-term effects of maternal mental health. The mother or caregiver of the child completed the CBCL. The CBCL was administered by a research assistant if the mothers were illiterate or had difficulty completing the assessment. Immunodeficiency in children was measured using CD4 percentages and absolute scores. Immunodeficiency was determined in according to the World Health Organisation's guidelines on the classification of HIV associated immunodeficiency in children. [39] The CD4 counts and percentages of children were determined on a regular basis, but viral loads were only determined if there were concerns about treatment failure. Maternal CD4 counts and viral loads were not assessed as mothers were not receiving treatment at the same facility as the children.

Measures

Demographic Questionnaire

Biographical information regarding maternal age, ethnicity, language, marital status, education, annual household income, employment status and gender of the child was determined through a demographic questionnaire. The relationship of the caregiver to the child was also obtained.

Life Events Checklist

Traumatic life events were measured using the Life Events Checklist (LEC) The Life Events Checklist is a 16-item self-report questionnaire assessing the incidence of 16 different categories of traumatic events including physical assault, life threatening illness, natural disasters, sexual assault, and sudden unexpected death of a loved one. Participants had three optional responses to each item; direct 'happened to me', indirect 'witnessed it', and removed 'heard about it'. A score was then tallied for the total number of direct Life Events. Respondents who reported directly experienced trauma were asked to complete the Harvard Trauma Scale.

Harvard Trauma Scale

The Harvard Trauma Scale (HTS) is a 30-item, self-report questionnaire designed to screen for the presence of PTSD in cross-cultural populations. [40] Examples of items include 'feeling as though the event is happening again' and 'nightmares about the event that keep coming back'. Symptoms are reported on a four point Likert scale ranging from "not at all" to "extremely", with a total score range of 30 to 120. The cut-off score indicative of PTSD is 75 or higher. The HTS has shown strong test-retest reliability in a South African, adolescent sample. [41]

Alcohol Use Disorders Identification Test

Alcohol dependence and abuse were measured using the Alcohol Use Disorders Identification Test (AUDIT). The 10-item questionnaire assesses alcohol dependence and abuse and is scored on a five point Likert scale from "never" to "daily or almost daily". The cut-off score is set at eight for alcohol abuse and 13 or more for alcohol dependence. The AUDIT is a reliable measure developed by the World Health Organisation and has been implemented and tested internationally. [42] It has been

applied in a variety of settings and cultures [43-45-] including Mexico, [46] Venezuela, [47] Hong Kong, [48] Zimbabwe [49] and in South Africa with HIV-infected patients. [50,51] In each of these studies the AUDIT outperformed other self-report measures in the identification of alcohol abuse and dependence.

Center for Epidemiological Studies Depression Scale

The Center for Epidemiological Studies Depression Scale (CESD) is a self-report measure to screen for depression. The CESD is a 20-item scale that assesses current levels of depression as per DSM-IV criteria. Responses are measured on a four point Likert scale ranging from "rarely or none of the time" to "most or all of the time". A score of 16 or more is considered indicative of depression. The CESD has been validated for clinic and community settings to detect depressive symptoms [52-54] and in many cross-cultural samples [55-57] and across ethnic groups. [58,59] The CESD has been used to measure depression in several clinic samples of individuals infected with HIV. [60-63]

The Sheehan Disability Scale

The Sheehan Disability Scale (SDS) is a self-report measure used to evaluate patients' functional impairment in relation to self-reported symptoms. [64] Functional disability is assessed across three core areas, namely, work/school, social life, and at home/family responsibilities. Functioning is reported on a visual analogue scale ranging from zero to ten. Higher scores indicate greater impairment and disability. The SDS is frequently used in clinical trials in psychiatry and has shown good reliability in an HIV infected, South African sample. [65]

The Child Behaviour Checklist

Child behaviour problems were assessed using the preschool version of the Child Behaviour Checklist (CBCL). [66] The CBCL is a 100 item self-report questionnaire, usually completed by a parent or caregiver. The items are scored on a three point Likert scale ranging from "not true" to "very true or often true". Behavioural problems are measured in eight domains, namely, emotionally reactive, anxious/depressed, somatic complaints, withdrawn behaviour, sleep problems, common/non-specific problems, attention problems and aggressive behaviour. The first four domains are viewed as internalising behaviour problems, the last two

domains are viewed as externalising behaviour problems and all of the domains combined are viewed as total behaviour problems. The CBCL is a widely used behavioural checklist with good reliability and validity in a variety of cultural and language settings. [67-69]

Data analysis

All analyses were performed using Statistical Analysis Software (SAS) and SPSS version 20. Descriptive statistics were computed for the demographic characteristics of the sample as well as the prevalence rates of maternal mental health problems and child behavioural problems. Differences in behaviour problems between children of mothers with and without PTSD, depression and alcohol abuse were analysed by means of t-tests. Linear regression analysis was performed to determine if maternal mental status was a significant predictor of child behaviour outcomes. Of particular interest was the influence of trauma exposure and PTSD on child behaviour outcomes. Depression was controlled for due to previous studies reporting a relationship between depression and child behaviour problems.

Three models were run with the following continuous outcome variables as measured by the CBCL: total child behavioural problems (internalising, externalising and sleep problems), child internalising behaviour problems and child externalising behaviour problems. The same continuous predictor variables were used in all three regression models. The predictor variables were: exposure to traumatic life events (LE), PTSD symptomatology (HTS), alcohol abuse/dependence (AUDIT), depression (CESD) and functional disability (SDS).

RESULTS

Sample demographics

The sample included 70 mother-child dyads, each being HIV-infected. The mean age of the mothers/caregivers at 12 months postpartum was 28.8 (range: 16-64) years. The mother-child dyads were mainly black (88.6%) and Xhosa speaking (65.7%). The mothers were mostly single (64.3%) and unemployed (80.9%). The majority of mothers had some secondary schooling (58.6%) with an annual income below R10 000 (72.9%, US$1038). Thirty-six children (51%) were female. The majority of caregivers at 10 to 12 months (94.3%) and 42 months (91.4%) were the biological mothers of the children, however there were eight changes in caregiver from 12

months postpartum to 42 months postpartum. Reasons for change in caregiver included: mother passed away (n = 3), mother was unavailable on the day of assessment (n = 2), and the person attending lived with the child and was closely involved in caring for the child (n = 3).

The prevalence of infant immunodeficiency was relatively high at 10 to 12 months postpartum with 47.1% (range: 15.4%-54.5%) and 40% (range: 574-3777) showing mild to severe immunodeficiency based on CD4 percentages and absolute counts respectively. At 42 months, the majority of the children did not have CD4 percentages (91.4%, range: 16.3%-53.6%) or absolute counts (100%, range: 468-3267) indicative of immunodeficiency. The demographic and biological information of participants are presented in Table 1.

Table 1

Demographic layout of the sample

	N	%	M
Relationship of carer to child at 12 months postpartum[1]	70		
Mother	66	94.3	
Grandmother	2	2.9	
Aunt	1	1.4	
Guardian	1	1.4	
Relationship of carer to child at 42 months postpartum[2]	70		
Mother	64	91.4	
Grandmother	5	7.1	
Aunt	1	1.4	
Age of mother/caregiver[1]	70		28.8
Gender of child[1]	70		
Male	34	48.6	
Female	36	51.4	
Language[1]	70		
Afrikaans	9	12.9	
English	15	21.4	

	N	%	M
Xhosa	46	65.7	
Ethnicity[1]	70		
Black	62	88.6	
Coloured	3	4.3	
White	4	5.7	
Asian	1	1.4	
Marital Status[1]	70		
Single	45	64.3	
Married/living with a partner	23	32.9	
Divorced/separated	2	2.9	
Annual Income[1]	70		
< R10 000	51	72.9	
R 10 000 – R20 000	11	15.7	
R 20 000 – R 40 000	2	2.9	
R 40 000 – R 60 000	0	0	
R 60 000 – R 100 000	1	1.4	
> R 100 000	0	0	
Level of Education[1]	70		
No schooling	0	0	
Some primary schooling	7	10	
Completed primary school	3	4.3	

	N	%	M
Some secondary schooling	41	58.6	
Grade 12 completed	18	25.7	
Higher education completed	1	1.4	
Employment Status[1]	68		
Employed	13	19.1	
Unemployed	55	80.9	
Immunodeficiency (CD4 percentage) of child[1]	70		36.1
Not significant (>30%)	37	52.9	
Mild (25-30%)	15	21.4	
Advanced (20-24%)	12	17.1	
Severe (<20%)	6	8.6	
Immunodeficiency (CD4 absolute score) of child[1]	70		1862.6
Not significant	42	60	
Significant (<750)	28	40	
Immunodeficiency (CD4 percentage) of child[2]			34.3
Not significant (>25%)	64	91.4	
Mild (20-25%)	4	5.7	
Advanced (15-19%)	2	2.9	
Severe (<15%)	0	0	

Immunodeficiency (CD4 absolute count) of child[2]		1374.2
Not significant	70	100
Significant (<350)	0	0

[1]Data recorded at 12 months postpartum
[2]Data recorded at 42 months postpartum

Prevalence of maternal psychiatric disorders and child behaviour problems

The prevalence rate for all measured maternal psychiatric disorders (based on self-report data) was 27.6%. Depression was the most prevalent disorder at 50% (n = 35), followed by PTSD with 22.9% (n = 16), alcohol abuse with 7.1% (n = 5) and alcohol dependence with 2.9% (n = 2). A large proportion of children scored within the clinical range for problematic behaviour with a prevalence rate of 44.3% (n = 31) for total behaviour problems. Internalising behaviour problems were most prevalent with 50% of children scoring above cut-off. The most common internalising behaviour problems were somatic complaints (n = 28), followed by withdrawn behaviour (n = 20), emotional reactivity (n = 15) and anxious/depressed behaviour (n = 10). Externalising behavioural problems were less prevalent with 30% (n = 21) of children scoring within the clinical range. Aggressive behaviour (n = 12) was the most common externalising behaviour problem followed by attention problems (n = 8). Sleeping problems (n = 3) was the least common behaviour problem (see Table 2).

Table 2
Descriptive statistics for maternal mental health and child behaviour problems

			Above cut-off	
	M	SD	N	%
Directly experienced life events (LE)[1]	2.36	2.13		
Substance abuse (AUDIT)[1]	1.30	3.45		
Hazardous drinking			5	7.1
Alcohol dependence			2	2.9
Depression (CESD)[1]	17.40	14.05	35	50
Posttraumatic Stress Disorder (HTS)[1]	59.67	21.36	16	22.9
Functional disability (SDS)[1]	7.11	6.75		

Total behaviour problems (CBCL)[2] [3]	46.41	29.30	31	44.3
Sleep	3.16	2.67	3	4.3
Internalising behaviour problems (CBCL)[2]	14.67	11.07	35	50.0
Emotional reactive	3.20	3.39	15	21.4
Anxious/depressed	3.73	2.85	10	14.3
Somatic	4.61	3.57	28	40.0
Withdrawn	3.13	3.02	20	28.6
Externalising behaviour problems (CBCL)[2]	14.59	9.07	21	30.0
Attention	2.74	1.97	8	11.4
Aggression	11.84	7.77	12	17.1

[1] Maternal measures
[2] Child measures
[3] Total behaviour problems comprise of internalising behaviour problems, externalising behaviour problems and sleeping problems.

Maternal mental health as a predictor of child behaviour outcomes

The children of mothers with depression (M = 53.74, SE = 28.53) were significantly more likely to display behaviour problems $t(68)$ = 2.15, p = .035, compared to the children of mothers without depression (M = 39.09, SE = 28.59). The children of mothers meeting criteria for PTSD (M = 54.06, SE = 18.97) were more likely to display behaviour problems compared to the children of mothers who did not meet criteria for PTSD (M = 44.25, SE = 30.76), but this was not a significant effect $t(58)$ = 1.19, p = .238. The children of mothers who abused alcohol (M = 52.60, SE = 24.52) were also more likely to display behaviour problems, compared to the children of mothers who did not abuse alcohol (M = 45.94, SE = 29.74), but this effect was also was not significant $t(68)$ = .49, p = .628 (see table 3).

Table 3
Comparison of CBCL scores for child behaviour problems based on maternal mental status

	M	SD	Df	t	p
Maternal depression (CESD)			68	2.15	.035
Children of mothers with depression	53.74	28.53			
Children of mothers without depression	39.09	28.59			
Maternal PTSD (HTS)			58	1.19	.238
Children of mothers with PTSD	54.06	18.97			
Children of mothers without PTSD	44.25	30.76			

Maternal alcohol abuse (AUDIT)			68	.49	.628
Children of mother who abuse alcohol	52.60	24.52			
Children of mothers who do not abuse Alcohol	45.94	29.74			

Table 4 presents the results of the regression analyses with predictor variables, their standardized coefficients and significance levels for the outcome variables: child total behaviour problems (Model 1), child internalising behaviour problems (Model 2) and child externalising behaviour problems (Model 3). Table 5 presents the summary statistics for the regression analysis.

Table 4

Parameters for the variables predicting child behaviour outcomes (N=59)

Model		β	Std. error	Standardised Beta coefficients	t	Sig.	Lower limit	Upper limit
		Unstandardised					95% Confidence Interval	
1	Total problems (Constant)	26.02	11.49		2.27	.028	4.33	47.71
	Traumatic life events (LE)	-1.79	1.91	-.13	-.94	.352	-5.40	1.81
	Alcohol dependance/abuse (AUDIT)	-.14	1.07	-.02	-.13	.894	-2.16	1.87
	Depression (CESD)	.20	.33	.10	.61	.546	-.42	.82
	Functional disability (SDS)	.24	.60	.06	.40	.688	-.89	1.38
	PTSD (HTS)	.35	.26	.27	1.38	.173	-.13	0.83
2	Internalising problems (Constant)	8.14	4.30		1.89	.064	.02	16.27
	Traumatic life events (LE)	-1.18	.72	-.23	-1.64	.106	-2.53	.18
	Alcohol dependance/abuse (AUDIT)	-.39	.40	-.13	-.99	.328	-1.15	.36
	Depression (CESD)	.14	.12	.19	1.12	.268	-.09	.37
	Functional disability (SDS)	.06	.22	.04	.28	.781	-.36	.49
	PTSD (HTS)	.12	.10	.24	1.29	.203	-.06	.30
3	Externalising problems (Constant)	6.05	3.62		1.67	.100	-.78	12.88
	Traumatic life events (LE)	-.15	.60	-.03	-.25	.807	-1.28	.99
	Alcohol dependance/abuse (AUDIT)	.37	.34	.15	1.12	.270	-.26	1.01
	Depression (CESD)	.01	.10	.02	.11	.909	-.18	.21
	Functional disability (SDS)	.02	.19	.01	.08	.936	-.34	.37
	PTSD (HTS)	.14	.08	.34	1.79	.079	-.01	.30

1. Outcome: total child behaviour problems (CBCL)
2. Outcome: internalising child behaviour problems (CBCL)
3. Outcome: externalising child behaviour problems (CBCL)

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Table 5
Model summary predicting child behaviour problems

Model	R²	ΔR²	F	df1	df2	p
1	.119	.036	1.44	5	53	.227
2	.150	.070	1.88	5	53	.114
3	.147	.067	1.83	5	53	.123

1. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (AUDIT), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: total child behaviour problems (CBCL)
2. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (AUDIT), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: internalising child behaviour problems (CBCL)
3. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (AUDIT), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: externalising child behaviour problems (CBCL)

The linear combination of maternal variables, namely, traumatic life events, PTSD, depression, alcohol dependence/abuse and functional disability explained 3.63% of the variance in total child behaviour problems in model 1. The amount of variance explained was not significant $F_{(5,53)} = 1.44$, $p = .226$. None of the predictor variables significantly contributed to predicting child behaviour problems within this model. Maternal PTSD $\beta = .35$, $t(59) = 1.38$, $p = .173$ made the largest contribution to explaining child total behaviour problems, based on standardised beta coefficients and significance levels, followed by traumatic life events $\beta = -1.79$, $t(59) = -.94$, $p = .352$, depression $\beta = .20$, $t(59) = .61$, $p = .546$, disability in functioning $\beta = .24$, $t(59) = .40$, $p = .688$ and alcohol dependence/abuse $\beta = -.14$, $t(59) = -.13$, $p = .894$.

The linear combination of the maternal variables in model 2 explained 7.02% of the variance in child internalising behaviour problems. The amount of variance explained in this model was also not significant $F_{(5,53)} = 1.44$, $p = .226$. None of the predictor variables significantly contributed to predicting child internalising behaviour problems. Maternal PTSD $\beta = .12$, $t(59) = 1.29$, $p = .203$ made the largest contribution to explaining child internalising behaviour problems, based on standardised Beta coefficients, followed by traumatic life events $\beta = -1.18$, $t(59) = -1.64$, $p = .106$, depression $\beta = .14$, $t(59) = 1.12$, $p = .268$, alcohol dependence/abuse $\beta = -.39$, $t(59) = -.99$, $p = .328$ and functional disability $\beta = .06$, $t(59) = .28$, $p = .781$.

Maternal variables explained 6.66% of the variance in child externalising behaviour problems in model 3 and the variance explained was once again not significant $F(5,53) = 1.83$, $p = .123$. None of the predictor variables significantly contributed to explaining child externalising behaviour problems. Maternal PTSD $\beta = .14$, $t(59) = 1.79$, $p = .079$ made the largest contribution, based on standardised beta coefficients and significance levels, followed by alcohol dependence/abuse $\beta = .37$, $t(59) = 1.12$, $p = .270$, traumatic life events $\beta = -.15$, $t(59) = -.25$, $p = .807$, depression $\beta = .01$, $t(59) = .11$, $p = .909$ and functional disability $\beta = .02$, $t(59) = .08$, $p = .936$.

DISCUSSION

The present study examined the long term effects of maternal mental health and child behaviour outcomes in a sample of mother-child dyads infected with HIV. Firstly, we found that maternal mental disorders and child behaviour problems were common among HIV infected mothers and vertically infected children. The overall prevalence of maternal psychiatric disorders, based on self-report data, was 27.6%. Previous studies have reported prevalence rates of 19% to 56% among HIV infected samples. [5-8] Half of mothers in this study scored above the cut-off for depression, followed by 22.9% for PTSD, 7.1% for alcohol abuse and 2.9% for alcohol dependence. Previous studies similarly have reported high prevalence rates, among samples infected with HIV, for depression (14% - 36%), PTSD (5% - 14.8%) and alcohol dependence (7%). [5-8] The results of this study revealed even higher prevalence rates for depression and PTSD and lower prevalence rates for alcohol dependence.

The prevalence of psychiatric disorder was also considerably higher than rates documented in the general South African population [1] Previous studies have found a high prevalence (28%-34.7%) for postpartum depression in low income populations in South Africa. We found a higher prevalence rate of 50% among this sample for depression. The added emotional and physical load of HIV infection and caring for a child infected with HIV seems to contribute considerably to psychiatric disease burden. The high prevalence rate of psychiatric disorder, especially PTSD, could possibly be biased by female gender, a previously identified risk factor for PTSD in HIV infected individuals. [20] The low rate of alcohol dependence might be due to the use of prenatal alcohol exposure as an exclusion criterion for participation in the study.

A high rate of child behaviour problems (44.3% for total behaviour problems) was also found. The prevalence rate for internalising and externalising behaviour problems, which fell within the clinical range, was 50% and 30% respectively. The prevalence rate of externalising behaviour problems is considerably higher than previously reported rates of 16%-30%. The prevalence rate for internalising behaviour problems corresponds with those identified in previous studies (7%-31%). The children in this sample are therefore at greater risk of displaying externalising behaviour problems and consequently psychiatric disorders associated with externalising behaviour problems later in life. [17,16]

Second, children of mothers with depression were significantly more likely to exhibit behaviour problems than the children of mothers without depression, although this association was not significant for maternal PTSD or alcohol abuse/dependence. Various studies have found significant links between maternal depression and internalising and externalising child behaviour problems. [9-12,14] Fatigue and emotional burnout associated with depression may lead to poor mother-child interaction in early infancy and consequently to insecure infant attachment and behavioural problems [3,70]. The added burden of caring for an ill child, guilt associated with transmission of HIV to the child and stressors associated with living in poverty may further intensify depressive symptoms. [71,72] The relationship between maternal depression and child behaviour problems was investigated in this study in an effort to control for the probable shared variance between depression and PTSD. Depression was not a significant predictor within the regression models of total behaviour problems, internalising or externalising behaviour problems.

Third, maternal trauma exposure, PTSD, depression, alcohol abuse/dependence and functional disability did not significantly predict child behaviour outcomes. However, PTSD made the largest contribution in predicting internalising, externalising and total behaviour problems. This relationship between PTSD and child behaviour problems warrants further investigation. Similar results have been reported, a significant association has been found between maternal stress and anxiety and child internalising and externalising problems. [26,27] The children of mothers with comorbid PTSD and depression also have an increased risk for internalising and externalising behaviour problems, compared to mothers with depression alone or no disorder. [15] Similar to depression, maternal PTSD may lead to poor mother child interaction. Parental anxiety is associated with an overinvolved

parenting style and negative parental attitudes during interaction with children. [73]
Children may model parent's anxious behaviour; parental vigilance, intrusion and
discouragement of independent problems solving may lead to a limited sense of
competence and autonomy in the children which, in turn, can lead to anxiety within
the child. [74] Maternal antenatal anxiety may have adverse consequences on child
neurodevelopment and subsequent behavioural and emotional problems. [75] While
previous studies have found significant associations between parental (specifically
maternal) alcohol abuse and child developmental and behaviour problems, [37,76] in
the present study no significant relationship was found between alcohol
dependence/abuse, functional disability and child behavioural outcomes in regression
analyses.

A number of study limitations deserve mention. In eight cases, there was a change in
the caregiver completing the maternal assessment at 12 months compared with the
caregiver completing the child assessment at 42 months. The change in caregiver may
have, in itself, contributed to behaviour problems, Caregivers may have had a limited
sense of the child's temperament (owing to the short period of caring for the child)
leading to inaccurate representation of the child's behaviour. Several confounding
factors, apart from maternal mental health, may have influenced child behaviour
problems. Maternal physical health, child physical health, change in child's
medication (assigned treatment arm), socio-economic stressors and parenting styles
were not measured in this study and may have contributed to child behaviour
problems. Future studies should assess these factors as potential confounders.
Maternal mental health at only one time point (12 months postpartum) was included
in this analysis. Intervening maternal and/or child factors e.g. effects of HIV-related
CNS infections or encephalopathy on the developing brain between 12 and 42 months
may have contributed to child behavioural outcomes.

       More than one administrator was used which may have caused inconsistency
in the administration of self-reports. Maternal mental state and child behaviour
outcomes were measured using self-reports and not a clinician diagnosis. The mental
state of the caregivers may have contributed to biased perceptions of child behaviour
being endorsed. Only 70 mother-child dyads participated in the study and 11 of the 70
were excluded from the regression analysis owing to missing data. The small sample
size may have compromised statistical power for the analyses. Lastly, there was no
HIV negative control or comparator group.

Nevertheless, several characteristics of the sample distinguish this study from previous research samples. This is, to our knowledge, the first study investigating the predictive effect of PTSD on child behaviour in vertically transmitted, HIV infected children. The study followed a longitudinal design and investigated the long-term child outcomes of maternal mental health at a specific point in time. Biological markers (e.g. CD4 counts) indicated that the children were relatively healthy at the time of assessment thus minimizing the possibility of poor physical health being a confounding factor. All mother-child dyads had routine checkups, counseling, HIV information sessions and antiretroviral treatment available to them. The level of intervention and care provided may have contributed positively to maternal mental health and child behaviour outcomes and requires further investigation. Findings of this study highlight the need to screen for and manage maternal PTSD and depression in mothers-child dyads infected with HIV. Identifying the mechanisms by which maternal mental health variables, specifically PTSD, interact and function in relation to child development in vertically transmitted HIV also requires exploration in future larger sample longitudinal studies.

Contributorship Statement

Ms Jani Nöthling: data analysis and interpretation, writing of manuscript

Ms Cherie Martin: interpretation of analysis, writing of manuscript

Dr Barbara Laughton: concept design, project leader of neurodevelopmental study, oversight of child behaviour data, revision of manuscript, read and approved manuscript

Prof Mark Cotton: revision of manuscript, co-PI of study for the children with HIV Early Antiretroviral (CHER) trial for the HIV-infected infants

Prof Soraya Seedat: concept design, oversight of data analysis, revision of manuscript, read and approved manuscript

Ms Marina Basson: data collection

Ms Lungiswa Rosy Khethelo: data collection

Dr Justin Harvey: data analysi

Competing Interests

None

Data Sharing Statement

No additional data

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MATERNAL POSTTRAUMATIC STRESS DISORDER, DEPRESSION AND

ALCOHOL DEPENDENCE AND CHILD BEHAVIOUR OUTCOMES IN HIV

INFECTED MOTHER-CHILD DYADS: A LONGITUDINAL STUDY

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ABSTRACT

Objectives: HIV and psychiatric disorders are prevalent and often concurrent. Child-bearing women are at an increased risk for both HIV and psychiatric disorders, specifically depression and posttraumatic stress disorder (PTSD). Poor mental health in the peripartum period has adverse effects on infant development and behaviour. Few studies have investigated the relationship between maternal PTSD and child behaviour outcomes in an HIV vertically infected sample. The aim of this study was to investigate if maternal postpartum trauma exposure and PTSD were risk factors for child behaviour problems. Additionally, maternal depression, alcohol abuse and functional disability were explored as co-factors.

Setting: The study was conducted in Cape Town, South Africa.

Participants: Seventy mother-child dyads infected with HIV were selected from a group of participants recruited from Community Health Centers.

Design: The study followed a longitudinal design. Five measures were used to assess maternal trauma exposure, PTSD, depression, alcohol abuse and functional disability at 12 months postpartum: Life Events Checklist (LEC), Harvard Trauma Scale (HTS), Alcohol Use Disorders Identification Test (AUDIT), Center for Epidemiological Studies Depression Scale (CESD) and the Sheehan Disability Scale (SDS). Child behaviour was assessed at 42 months with the Child Behaviour Checklist (CBCL).

Results: The rate of maternal disorder was high with 50% scoring above the cut-off for depression, 22.9% for PTSD, and 7% for alcohol abuse. Half of children scored within the clinical range for problematic behaviour. Children of mothers with depression were significantly more likely to display total behaviour problems than children of mothers without depression. Maternal PTSD had the greatest explanatory power for child behaviour problems although it did not significantly predict child outcomes.

Conclusion: This study highlights the importance of identifying and managing maternal PTSD and depression in mothers of children infected with HIV. The relationship between maternal PTSD and child behaviour warrants further investigation.

ARTICLE SUMMARY

Article focus

- This study investigated maternal mental health (PTSD, trauma exposure, depression and alcohol abuse) at one year postpartum as a predictor of child behaviour problems at three and a half years of age in HIV infected, mother-child dyads.

- Self-reports were used to determine the prevalence of maternal psychiatric disorders and child behaviour problems in the dyads.

Key Messages

- Maternal depression is associated with child behaviour problems in the general population as well as in this HIV infected sample.

- Prevalence of maternal depression and PTSD is high among mothers infected with HIV and prevalence of child behaviour problems is high among their infected children.

- The influence of maternal PTSD on child behaviour warrants further investigation.

Strengths and limitations of the study

- This study is, to our knowledge, the first to investigate PTSD as a predictor of child behaviour in vertically transmitted, HIV infected, mother-child-dyads.

- The study employed a longitudinal design with the child participants being relatively healthy as indicated by immunological status.

- The sample size of the study may have reduced statistical power. ~~and P~~poor maternal ~~mental~~ physical health, change in child's medical treatment and change in caregiver may have biased the results. ~~health may have biased caregiver perceptions of child behaviour~~.

INTRODUCTION

~~South Africa has a high HIV prevalence rate of 11%. [1]~~ The prevalence of psychiatric disorders in the general South African population is ~~also~~ relatively high compared to other countries, with an estimated lifetime prevalence of 30.3% and 12-month prevalence ~~rates of 30.3% and~~of 16.5% ~~respectively.~~ [1,2] Depression, alcohol abuse and posttraumatic stress disorder (PTSD) are commonly diagnosed disorders with a 12-month prevalence rate of 4.9%, 4.5% and 0.7% respectively. [1,2] Among South Africans, ~~A~~alcohol abuse has a lifetime prevalence rate of 11.4% followed by depression ~~with~~at 9.8% and PTSD ~~with~~at 2.3%. [1,2] Postpartum depression is also prevalent in South Africa. High prevalence rates of 28% and 34.7% have been reported among new mothers. [3]

In addition to high prevalence of psychiatric disorders, South Africa is overly burdened by HIV infection with a prevalence rate of 11%. [4] ~~There is an increased risk of c~~Common psychiatric disorders are often associated ~~addociated~~ with HIV infection [5-8~~3-6~~] with depression nearly twice as common in infected individuals. [6~~4~~] One study documented a 19% prevalence of common psychiatric disorders among HIV infected South Africans, with 14% meeting criteria for depression, 5% for ~~posttraumatic stress disorder (PTSD)~~PTSD and 7% for alcohol dependence or abuse. [8~~6~~] Individuals newly diagnosed with HIV are at an even higher risk for a common psychiatric disorder. [7~~5~~] In addition, women are disproportionately and dually burdened by HIV and mood and anxiety disorders. Female gender is considered a risk factor for mood and anxiety disorders and for increased severity of these disorders. [1~~2~~] ~~and w~~Women, especially child-bearing women, are disproportionally affected by HIV. [3~~1~~]

Poor maternal mental health is associated with adverse long-term effects in child development and behaviour. [~~7-13~~9-15] Prevalence rates of 16% - 30% and 7% - 31% for externalising behaviour problems and internalising behaviour problems respectively have been identified among preschool children in low income families. [16] Internalising and externalising behaviour problems can persist into adolescence. For example, infant negative emotional reactivity and shyness ha~~ve~~s been associated with inhibition and withdrawal in early childhood and with anxiety symptoms in middle childhood and adolescence. [17] Negative reactivity, low persistence, aggression and school difficulties in childhood have also been associated with substance abuse in adolescence. [18]

-Maternal Ddepression, including postpartum depression, is linked to various forms of child and infant internalising and externalising behaviour problems, such as: insecure attachment and less optimal mother-child interaction; [108,1210,14] higher levels of tension and lower levels of emotional development; [97] low social competence and adaptive functioning [119]; poorer cognitive development; [97] lower competencies and general behaviour problems in boys; [108] and attention-deficit hyperactivity disorder. [1412] These problems can persist into adolescence. For example, infant negative emotional reactivity and shyness has been associated with inhibition and withdrawal in early childhood and with anxiety symptoms in middle childhood and adolescence. [15] Negative reactivity, low persistence, aggression and school difficulties in childhood have also been associated with substance abuse in adolescence. [16]

Furthermore, children of mothers with comorbid PTSD and depression are significantly more likely to display internalising and externaliszing behaviour problems compared to children of mothers with depression only. [1513] These children are more likely to display somatic symptoms and are more likely to be emotionally reactive, anxious/depressed and aggressive. [1513] South Africa has a high rate of exposure to violence and traumatic events which increases risk for PTSD. [197] Prevalence of PTSD and trauma exposure is high among individuals infected with HIV, with female gender being a significant risk factor in this group. [5-83-6,2018,2119] Women infected with HIV are therefore at high risk of PTSD and their children are consequently at risk of behavioural and developmental problems.

Maternal stress and anxiety is also linked to child behaviour problems. Various studies have investigated the negative effect of antenatal maternal stress on child development. [2220] Fewer studies have focussed on postpartum maternal stress and anxiety and child behaviour outcomes. However, maternal stress and anxiety is negatively associated with parenting skills, and infant and child behaviour problems. [21-2323-25] Maternal anxiety is a significant predictor of child attention and aggression problems [2624] and maternal stress is significantly associated with child anxious and depressive symptoms. [2725]

In addition to anxiety, PTSD and depression, maternal postpartum alcohol abuse/dependence has been associated with child and infant behaviour problems and developmental risk. [28-3126-29] Alcohol abuse is one of the major contributors to disease burden in South Africa and antenatal alcohol abuse in associated with high

rates of fetal alcohol spectrum disorders. [32-3630-34] Child behaviour problems associated with parental postpartum alcohol abuse/dependence include: poor inhibitory control, attention shifting, distractibility, defiance, aggression, delinquency, emotional reactivity and withdrawal. [2927,3735]

To date, few studies have investigated the relationship between maternal postpartum trauma exposure, PTSD and child behaviour outcomes. None, to our knowledge, have examined this relationship in HIV-infected individuals, despite evidence of high prevalence of PTSD in this group and its public health implications. This is of significant public health concern particularly in the South African context. The primary aim of this study was to investigate the impact of maternal trauma exposure and PTSD at a specific time point (12 months postpartum) and the irlong-term effect association thereof on with child behaviour (at three and a half years of age) in mother-child dyads, infected with HIV, while controlling for the effects of depression. A secondary aim of the study was to investigate the relationship between maternal alcohol dependence/abuse, functional disability and child behaviour outcomes.

METHODS

Participants

Seventy mother-child dyads infected with HIV participated in thise study. Data was collected from between 2006 andtill 2010. from 2005 onwards. In eight cases, the maternal caregiver was not the child's biological mother. 'Maternal' or/ 'mother' within the context of this study therefore refers to either the biological mothers or primary caregiver of the child. The child had to be in the care of the caregiver for at least six months prior to the assessments to qualify as a suitable participant. The mother-child dyads were selected, based on the completeness of their data, as a sub-group from the Children with HIV Early Antiretroviral Therapy (CHER) trial. HIV-infected infants entered the study CHER trial at a mean of seven weeks of age and were randomised to early antiretroviral therapy for either 40 weeks or 96 weeks followed by planned treatment interruption or deferred therapy until meeting treatment guideline thresholds at that time; a CD4 below 20% (25% in first year of life) or progression of HIV disease. The CHERhis study commenced in 2005 and ended in 2011. [386] The study was conducted in two South African sites, the Perinatal HIV Research Unit in Soweto and the Children's Infectious Diseases

Clinical Research Unit (KID-CRU), in Tygerberg Children's Hospital, Cape Town. Participants were identified and recruited from local community health centres through HIV vertical transmission prevention programs. A neurodevelomentaldevelopmental sub-study was conducted in KID-CRU, and the data collected at this site was used in the current study.

Study Design

The neurodevelopmental sub-study reported herein was conducted over five years, and included all infants with birth weight >2000g and normal neurological examination before 12 weeks of age and excluded infants with CNS insults other than due to HIV. Maternal assessments were completed at 10-12 months and infant assessments at 42 months of age. -Thee study under investigation was approved by the Health Research Ethics Committee of Stellenbosch University in Cape Town, South Africa (N05/07/113). The ethics committee granted a waiver of parental consent for participants who were less than 18 years of age. Committee for Health Research at Stellenbosch University, Cape Town, South Africa, approved the study.

Procedures

Informed consent was obtained from all mothers of infants (aged 16 years and older) infected with HIV, in their preferred language (English, Afrikaans or isiXhosa). Maternal participants completed a series of questionnaires including a demographic questionnaire, the Life Events Checklist (LEC), the Harvard Trauma Scale (HTS), the Alcohol Use Disorder Identification Test (AUDIT), the Center for Epidemiologic Studies Depression Scale (CESD), and the Sheehan Disability Scale (SDS). The same battery of questionnaires was completed at five different time points over the course of five years. The assessments completed at 12 months postpartum were used in the current analysis for this study. This was deemed a salient period for examining PTSD in new mothers and -was intended to decrease the risk of confounding by postpartum depression, as the risk for postpartum depression is highest within the first year after giving births. -These self-report measures were verbally administered in Afrikaans and English by a trained research psychologist. A trained research assistant was used for Xhosa-speaking mothers.

Child behaviour was assessed at 42 months postpartum using the Child Behaviour Checklist (CBCL). This time point was selected based on completeness of

data and in an effort to measure the long-term effects of maternal mental health. The ~~which the~~ mothers or caregivers of the child completed the CBCL. ~~, who were living with the children for the previous six months and took responsibility for caring for the child, completed on their own.~~ The CBCL was administered by a research assistant if the mothers were illiterate or had difficulty completing the assessment. Immunodeficiency in children was measured using CD4 percentages and absolute scores. Immunodeficiency was determined in according to the World Health Organisation's guidelines on the classification of HIV associated immunodeficiency in children. [39~~7~~] The CD4 counts and percentages of children were determined on a regular basis, but viral loads were only determined if there were concerns about treatment failure. Maternal CD4 counts and viral loads were not assessed as mothers were not receiving treatment at the same facility as the children.

Measures

Demographic Questionnaire

Biographical information regarding maternal age, ethnicity, language, marital status, education, annual household income, employment status and gender of the child was determined through a demographic questionnaire. The relationship of the caregiver to the child was also obtained.

Life Events Checklist

Traumatic life events were measured using the Life Events Checklist (LEC) The Life Events Checklist is a 16-item self-report questionnaire assessing the incidence of 16 different categories of traumatic events including physical assault, life threatening illness, natural disasters, sexual assault, and sudden unexpected death of a loved one. Participants had three optional responses to each item; direct 'happened to me', indirect 'witnessed it', and removed 'heard about it'. A score was then tallied for the total number of direct Life Events. Respondents who reported directly experienced trauma were asked to complete the Harvard Trauma Scale.

Harvard Trauma Scale

The Harvard Trauma Scale (HTS) is a 30-item, self-report questionnaire designed to screen for the presence of PTSD in cross-cultural populations. [40~~38~~] Examples of items include 'feeling as though the event is happening again' and 'nightmares about

the event that keep coming back'. Symptoms are reported on a four point Likert scale ranging from "not at all" to "extremely", with a total score range of 30 to 120. The cut-off score indicative of PTSD is 75 or higher. The HTS– has shown strong test-retest reliability among in a South African, adolescent sampleis regarded a valid and reliable measure to screen for a diagnosis of PTSD where cross-cultural sensitivity is necessary. [4139]

Alcohol Use Disorders Identification Test

Alcohol dependence and abuse were measured using the Alcohol Use Disorders Identification Test (AUDIT). The 10-item questionnaire assesses alcohol dependence and abuse and is scored on a five point Likert scale from "never" to "daily or almost daily". The cut-off score is set at eight for alcohol abuse and 13 or more for alcohol dependence. The AUDIT is a reliable measure developed by the World Health Organisation and has been implemented and tested internationally. [4240] It has been applied in a variety of settings and cultures [43-4541-43] including Mexico, [4644] Venezuela, [4745] Hong Kong, [4846] Zimbabwe [4947] and in South Africa with HIV-infected patients. [50,5148,49] In each of these studies the AUDIT outperformed other self-report measures in the identification of alcohol abuse and dependence.

Center for Epidemiological Studies Depression Scale

The Center for Epidemiological Studies Depression Scale (CESD) is a self-report measure to screen for depression. The CESD is a 20-item scale that assesses current levels of depression as per DSM-IV criteria. Responses are measured on a four point Likert scale ranging from "rarely or none of the time" to "most or all of the time". A score of 16 or more is considered indicative of depression. The CESD has been validated for clinic and community settings to detect depressive symptoms [52-5450-52] and in many cross-cultural samples [55-5753-55] and across ethnic groups. [56,5758,59] The CESD has been used to measure depression in several clinic samples of individuals infected with HIV. [60-6358,59,60,61]

The Sheehan Disability Scale

The Sheehan Disability Scale (SDS) is a self-report measure used to evaluate patients' functional impairment in relation to self-reported symptoms. [6462] Functional disability is assessed across three core areas, namely, work/school, social life, and at

home/family responsibilities. Functioning is reported on a visual analogue scale ranging from zero to ten. Higher scores indicate greater impairment and disability. The SDS is frequently used in clinical trials in psychiatry and has shown good reliability in an HIV infected, South African sample. and is a valid, reliable measure of functional disability, responsive to change over time. [6563]

The Child Behaviour Checklist

Child behaviour problems were assessed using the preschool version of the Child Behaviour Checklist (CBCL). [6664] The CBCL is a 100 item self-report questionnaire, usually completed by a parent or caregiver. The items are scored on a three point Likert scale ranging from "not true" to "very true or often true". Behavioural problems are measured in eight domains, namely, emotionally reactive, anxious/depressed, somatic complaints, withdrawn behaviour, sleep problems, common/non-specific problems, attention problems and aggressive behaviour. The first four domains are viewed as internalising behaviour problems, the last two domains are viewed as externalising behaviour problems and all of the domains combined are viewed as total behaviour problems. The CBCL is a widely used behavioural checklist with good reliability and validity in a variety of cultural and language settings. [67-6965,66,67]

Data analysis

All analyses were performed using Statistical Analysis Software (SAS) and SPSS version 20. Descriptive statistics were computed for the demographic characteristics of the sample as well as the prevalence rates of maternal mental health problems and child behavioural problems. Differences in behaviour problems between children of mothers with and without PTSD, depression and alcohol abuse were analysed by means of t-tests. Linear regression analysis was preformedperformed to determine if maternal mental status was a significant predictor of child behaviour outcomes. Of particular interest was the influence of trauma exposure and PTSD on child behaviour outcomes. Depression was controlled for due to previous studies reporting a relationship between depression and child behaviour problems.

Three models were run with the following continuous outcome variables as measured by the CBCL: total child behavioural problems (internalising, externalising and sleep problems), child internalising behaviour problems and child externalising

behaviour problems. The same continuous predictor variables were used in all three regression models. The predictor variables were: exposure to traumatic life events (LE), PTSD symptomatology (HTS), alcohol abuse/dependence (AUDIT), depression (CESD) and functional disability (SDS).

RESULTS

Sample demographics

The sample included 70 mother-child dyads, each being HIV-infected. The mean age of the mothers/caregivers at 12 months postpartum was 28.8 (range: 16-64) years. The mother-child dyads were mainly black (88.6%) and Xhosa speaking (65.7%). The mothers were mostly single (64.3%) and unemployed (80.9%). The majority of mothers had some secondary schooling (58.6%) with an annual income below R10 000 (72.9%, US$1038). ~~Thirthy~~Thirty-six children (51%) were female. The majority of caregivers at 10 to 12 months (94.3%) and 42 months (91.4%) were the biological mothers of the children, however there were eight changes in caregiver from 12 months postpartum to 42 months postpartum. Reasons for change in caregiver included: mother passed away (n = 3), mother was unavailable on the day of assessment (n = 2), and the person attending lived with the child and was closely involved in caring for the child (n = 3).

~~At 42 months, the majority of the children did not have CD4 percentages (91.4%, range: 16.3%-53.6%) or absolute scores (100%, range: 468-3267) indicative of immunodeficiency.~~ The prevalence of infant immunodeficiency was ~~higher~~ relatively high at 10 to 12 months postpartum with 47.1% (range: 15.4%-54.5%) and 40% (range: 574-3777) showing mild to severe immunodeficiency based on CD4 percentages and absolute ~~scores~~ counts respectively. At 42 months, the majority of the children did not have CD4 percentages (91.4%, range: 16.3%-53.6%) or absolute ~~scores~~ counts (100%, range: 468-3267) indicative of immunodeficiency. The demographic and biological information of participants are presented in Table 1.

Table 1

Demographic layout of the sample

	N	%	M
Relationship of carer to child at 12 months postpartum[1]	70		
Mother	66	94.3	
Grandmother	2	2.9	
Aunt	1	1.4	
Guardian	1	1.4	
Relationship of carer to child at 42 months postpartum[2]	70		
Mother	64	91.4	
Grandmother	5	7.1	
Aunt	1	1.4	
Age of mother/caregiver[1]	70		28.8
Gender of child[1]	70		
Male	34	48.6	
Female	36	51.4	
Language[1]	70		
Afrikaans	9	12.9	
English	15	21.4	
Xhosa	46	65.7	
Ethnicity[1]	70		
Black	62	88.6	
Coloured	3	4.3	
White	4	5.7	
Asian	1	1.4	
Marital Status[1]	70		
Single	45	64.3	
Married/living with a partner	23	32.9	
Divorced/separated	2	2.9	
Annual Income[1]	70		
< R10 000	51	72.9	
R 10 000 – R20 000	11	15.7	
R 20 000 – R 40 000	2	2.9	
R 40 000 – R 60 000	0	0	
R 60 000 – R 100 000	1	1.4	
> R 100 000	0	0	
Level of Education[1]	70		
No schooling	0	0	
Some primary schooling	7	10	
Completed primary school	3	4.3	

	N	%	M
Some secondary schooling	41	58.6	
Grade 12 completed	18	25.7	
Higher education completed	1	1.4	
Employment Status[1]	68		
Employed	13	19.1	
Unemployed	55	80.9	
Immunodeficiency (CD4 percentage) of child[1]	70		36.1
Not significant (>30%)	37	52.9	
Mild (25-30%)	15	21.4	
Advanced (20-24%)	12	17.1	
Severe (<20%)	6	8.6	
Immunodeficiency (CD4 absolute score) of child[1]	70		1862.6
Not significant	42	60	
Significant (<750)	28	40	
Immunodeficiency (CD4 percentage) of child[2]			34.3
Not significant (>25%)	64	91.4	
Mild (20-25%)	4	5.7	
Advanced (15-19%)	2	2.9	
Severe (<15%)	0	0	
Immunodeficiency (CD4 absolute ~~score~~count) of child[2]			1374.2
Not significant	70	100	
Significant (<350)	0	0	

[1]Data recorded at 12 months postpartum
[2]Data recorded at 42 months postpartum

Prevalence of maternal psychiatric disorders and child behaviour problems

The prevalence rate for all measured maternal psychiatric disorders (based on self-report ~~a~~ ~~data~~ datassessments) was 27.6%. Depression was the most prevalent disorder at 50% (n = 35), followed by PTSD with 22.9% (n = 16), alcohol abuse with 7.1% (n = 5) and alcohol dependence with 2.9% (n = 2). A large proportion of children scored within the clinical range for problematic behaviour with a prevalence rate of 44.3% (n = 31) for total behaviour problems. Internalising behaviour problems were most prevalent with 50% of children scoring above cut-off. The most common internalising behaviour problems were somatic complaints (n = 28), followed by withdrawn behaviour (n = 20), emotional reactivity (n = 15) and anxious/depressed behaviour (n = 10). Externalising behavioural problems were less prevalent with 30% (n = 21) of children scoring within the clinical range. Aggressive behaviour (n = 12) was the

most common externalising behaviour problem followed by attention problems (n =

8). Sleeping problems (n = 3) was the least common behaviour problem (see Table 2).

Table 2
Descriptive statistics for maternal mental health and child behaviour problems

	M	SD	Above cut-off N	Above cut-off %
Directly experienced life events (LE)[1]	2.36	2.13		
Substance abuse (AUDIT)[1]	1.30	3.45		
Hazardous drinking			5	7.1
Alcohol dependence			2	2.9
Depression (CESD)[1]	17.40	14.05	35	50
Posttraumatic Stress Disorder (HTS)[1]	59.67	21.36	16	22.9
Functional disability (SDS)[1]	7.11	6.75		
Total behaviour problems (CBCL)[2][3]	46.41	29.30	31	44.3
Sleep	3.16	2.67	3	4.3
Internalising behaviour problems (CBCL)[2]	14.67	11.07	35	50.0
Emotional reactive	3.20	3.39	15	21.4
Anxious/depressed	3.73	2.85	10	14.3
Somatic	4.61	3.57	28	40.0
Withdrawn	3.13	3.02	20	28.6
Externalising behaviour problems (CBCL)[2]	14.59	9.07	21	30.0
Attention	2.74	1.97	8	11.4
Aggression	11.84	7.77	12	17.1

[1]Maternal measures
[2]Child measures
[3]Total behaviour problems comprise of internalising behaviour problems,
externalising behaviour problems and sleeping problems.

Maternal mental health as a predictor of child behaviour outcomes

The children of mothers with depression (*M* = 53.74, *SE* = 28.53) were significantly

more likely to display behaviour problems $t(68) = 2.15$, $p = .035$, compared to the

children of mothers without depression (*M* = 39.09, *SE* = 28.59). The children of

mothers meeting criteria for PTSD (*M* = 54.06, *SE* = 18.97) were more likely to

display behaviour problems compared to the children of mothers who did not meet criteria for PTSD (M = 44.25, SE = 30.76), but this was not a significant effect $t(58)$ = 1.19, p = .238. The children of mothers who abused alcohol (M = 52.60, SE = 24.52) were also more likely to display behaviour problems, compared to the children of mothers who did not abuse alcohol (M = 45.94, SE = 29.74), but this effect was also was not significant $t(68)$ = .49, p = .628 (see table 3).

Table 3
Comparison of CBCL scores for child behaviour problems based on maternal mental status

	M	SD	Df	t	p
Maternal depression (CESD)			68	2.15	.035
Children of mothers with depression	53.74	28.53			
Children of mothers without depression	39.09	28.59			
Maternal PTSD (HTS)			58	1.19	.238
Children of mothers with PTSD	54.06	18.97			
Children of mothers without PTSD	44.25	30.76			
Maternal alcohol abuse (AUDIT)			68	.49	.628
Children of mother who abuse alcohol	52.60	24.52			
Children of mothers who do not abuse Alcohol	45.94	29.74			

Table 4 presents the results of the regression analyses with predictor variables, their standardized coefficients and significance levels for the outcome variables: child total behaviour problems (Model 1), child internalising behaviour problems (Model 2) and child externalising behaviour problems (Model 3). Table 5 presents the summary statistics for the regression analysis.

Table 4

Parameters for the variables predicting child behaviour outcomes (N=59)

Model		β	Std. error	Standardised Beta coefficients	t	Sig.	95% Confidence Interval Lower limit	Upper limit
		Unstandardised						
1	Total problems (Constant)	26.02	11.49		2.27	.028	4.33	47.71
	Traumatic life events (LE)	-1.79	1.91	-.13	-.94	.352	-5.40	1.81
	Alcohol dependance/abuse (AUDIT)	-.14	1.07	-.02	-.13	.894	-2.16	1.87
	Depression (CESD)	.20	.33	.10	.61	.546	-.42	.82
	Functional disability (SDS)	.24	.60	.06	.40	.688	-.89	1.38
	PTSD (HTS)	.35	.26	.27	1.38	.173	-.13	0.83
2	Internalising problems (Constant)	8.14	4.30		1.89	.064	.02	16.27
	Traumatic life events (LE)	-1.18	.72	-.23	-1.64	.106	-2.53	.18
	Alcohol dependance/abuse (AUDIT)	-.39	.40	-.13	-.99	.328	-1.15	.36
	Depression (CESD)	.14	.12	.19	1.12	.268	-.09	.37
	Functional disability (SDS)	.06	.22	.04	.28	.781	-.36	.49
	PTSD (HTS)	.12	.10	.24	1.29	.203	-.06	.30
3	Externalising problems (Constant)	6.05	3.62		1.67	.100	-.78	12.88
	Traumatic life events (LE)	-.15	.60	-.03	-.25	.807	-1.28	.99
	Alcohol dependance/abuse (AUDIT)	.37	.34	.15	1.12	.270	-.26	1.01
	Depression (CESD)	.01	.10	.02	.11	.909	-.18	.21
	Functional disability (SDS)	.02	.19	.01	.08	.936	-.34	.37
	PTSD (HTS)	.14	.08	.34	1.79	.079	-.01	.30

1. Outcome: total child behaviour problems (CBCL)
2. Outcome: internalising child behaviour problems (CBCL)
3. Outcome: externalising child behaviour problems (CBCL)

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Table 5
Model summary predicting child behaviour problems

Model	R²	ΔR²	F	df1	df2	p
1	.119	.036	1.44	5	53	.227
2	.150	.070	1.88	5	53	.114
3	.147	.067	1.83	5	53	.123

1. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (AUDIT), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: total child behaviour problems (CBCL)
2. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (AUDIT), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: internalising child behaviour problems (CBCL)
3. Predictors: maternal traumatic life events (LE), maternal alcohol dependence/abuse (AUDIT), maternal depression (CESD), maternal functional disability (SDS), maternal PTSD (HTS). Outcome: externalising child behaviour problems (CBCL)

The linear combination of maternal variables, namely, traumatic life events, PTSD, depression, alcohol dependence/abuse and functional disability explained 3.63% of the variance in total child behaviour problems in model 1. The amount of variance explained was not significant $F(5,53) = 1.44$, $p = .226$. None of the predictor variables significantly contributed to predicting child behaviour problems within this model. Maternal PTSD $β = .35$, $t(59) = 1.38$, $p = .173$ made the largest contribution to explaining child total behaviour problems, based on standardised beta coefficients and significance levels, followed by traumatic life events $β = -1.79$, $t(59) = -.94$, $p = .352$, depression $β = .20$, $t(59) = .61$, $p = .546$, disability in functioning $β = .24$, $t(59) = .40$, $p = .688$ and alcohol dependence/abuse $β = -.14$, $t(59) = -.13$, $p = .894$.

The linear combination of the maternal variables in model 2 explained 7.02% of the variance in child internalising behaviour problems. The amount of variance explained in this model was also not significant $F(5,53) = 1.44$, $p = .226$. None of the predictor variables significantly contributed to predicting child internalising behaviour problems. Maternal PTSD $β = .12$, $t(59) = 1.29$, $p = .203$ made the largest contribution to explaining child internalising behaviour problems, based on standardised Beta coefficients, followed by traumatic life events $β = -1.18$, $t(59) = -1.64$, $p = .106$, depression $β = .14$, $t(59) = 1.12$, $p = .268$, alcohol dependence/abuse $β = -.39$, $t(59) = -.99$, $p = .328$ and functional disability $β = .06$, $t(59) = .28$, $p = .781$.

Maternal variables explained 6.66% of the variance in child externalising behaviour problems in model 3 and the variance explained was once again not significant $F(5,53) = 1.83$, $p = .123$. None of the predictor variables significantly contributed to explaining child externalising behaviour problems. Maternal PTSD $\beta = .14$, $t(59) = 1.79$, $p = .079$ made the largest contribution, based on standardised beta coefficients and significance levels, followed by alcohol dependence/abuse $\beta = .37$, $t(59) = 1.12$, $p = .270$, traumatic life events $\beta = -.15$, $t(59) = -.25$, $p = .807$, depression $\beta = .01$, $t(59) = .11$, $p = .909$ and functional disability $\beta = .02$, $t(59) = .08$, $p = .936$.

DISCUSSION

The present study examined the long term effects of maternal mental health and child behaviour outcomes in a sample of mother-child dyads infected with HIV. Firstly, we found that maternal mental disorders and child behaviour problems were common among HIV infected mothers and vertically infected children. The overall prevalence of maternal psychiatric disorders, (based on self-report assessments) data, was 27.6%. Previous studies have reported prevalence rates of 19% to 56% among HIV infected samples. [5-83-6] Half of mothers in this study scored above the cut-off for depression, followed by 22.9% for PTSD, 7.1% for alcohol abuse and 2.9% for alcohol dependence. Previous studies similarly have reported high prevalence rates, among samples infected with HIV, for depression (14% - 36%), PTSD (5% - 14.8%) and alcohol dependence (7%). [3 65-8] The results of this study revealed even higher prevalence rates for depression and PTSD and lower prevalence rates for alcohol dependence.

The prevalence rate oof psychiatric disorder was also considerablye higher than the prevalence rates documented in the general South African population with 4.9% for depression, 4.5% for alcohol abuse and 0.6% for PTSD (12 month prevalence rates). [1] Previous studies have found a high prevalence (28%-34.7%) for postpartum depression in low income populations in South Africa. We found a higher prevalence rate of 50% among this sample for depression. The added emotional and physical load of HIV infection and caring for a child infected with HIV seems to contribute considerably to psychiatric disease burden. The high prevalence rate of maternal psychiatric disorder, especially PTSD, could possibly be biased by female gender, a previously identified risk factor for PTSD in HIV infected individuals.

[2018] The low rate of alcohol dependence might be due to the use of prenatal alcohol exposure as an exclusion criterion for participation in the study.

A high rate of child behaviour problems (44.3% for total behaviour problems) was also found. The prevalence rate for internalising and externalising behaviour problems, which fell within the clinical range, was 50% and 30% respectively. The prevalence rate of externalising behaviour problems found within this study was is considerably higher than previously reported prevalence rates of 16%-30%. The prevalence rate for internalising behaviour problems correspondsed with those identified in previous studies (7%-31%). The children in this sample are therefore at greater risk of displaying externalising behaviour problems and developing psychiatricconsequently psychiatric disorders associated with externalising behaviour problems , such as anxiety and substance abuse disorders, later in life. [1517,16]

Second, children of mothers with depression were significantly more likely to exhibit behaviour problems than the children of mothers without depression, although this association was not significant for maternal PTSD or alcohol abuse/dependence. Various studies have found significant links between maternal depression and internalising and externalising child behaviour problems. [9-127 10,1412] Fatigue and emotional burnout associated with depression may lead to poor mother-child interaction in early infancy which leads and consequently to insecure infant attachment and behavioural problems [3,70]. The added burden of caring for an ill child, guilt associated with transmission of HIV to the child and stressors associated with living in poverty may further intensify depressive symptoms. [71,72] This The relationship between maternal depression and child behaviour problems was investigated in this study in an effort to control for the probable shared variance between depression and PTSD. Depression was not a significant predictor within the regression models of total behaviour problems, internalising or externalising behaviour problems.

Third, maternal trauma exposure, PTSD, depression, alcohol abuse/dependence and functional disability did not significantly predict child behaviour outcomes. However, PTSD made the largest contribution in predicting internalising, externalising and total behaviour problems. This relationship between PTSD and child behaviour problems warrants further investigation. Similar results have been reported, a significant association has been found between maternal stress and anxiety and child internalising and externalising problems. [26,2724,25] The

children of mothers with comorbid PTSD and depression also have an increased risk for internalising and externalising behaviour problems, compared to mothers with depression alone or no disorder. [1513] Similar to depression, maternal PTSD may lead to poor mother child interaction. Parental anxiety is associated with an overinvolved parenting style and anegative parental attitudes during interaction with children. [73] Children may model parent's anxious behaviour; parental vigilance, intrusion and discouragement of independent problems solving may lead to a limited sense of competence and autonomy in the children which, in turn, can leads to anxiety within the child. [74] Maternal antenatal anxiety may have adverse consequences on child neurodevelopment which may lead toand subsequent child behavioural and emotional problems. [75] -While previous studies have found significant associations between parental (specifically maternal) alcohol abuse and child developmental and behaviour problems, [3735,7668] in the present study no significant relationship was found between alcohol dependence/abuse, functional disability and child behavioural outcomes in regression analyses.

A number of study limitations deserve mention. In eight cases, there was a change in the caregiver completing the maternal assessment at 12 months compared with the caregiver completing the child assessment at 42 months. The change in caregiver may have, in itself, contributed toaused behaviour problems, and the Ccaregivers may have had a limited sense of the child's temperament (doowing to the short period of caring for the child) leading to inaccurate representation of the child's behaviour. Several confounding factors, apart from maternal mental health, may have influenced child behaviour problems. Maternal physical health, child physical health, change in child's medication (assigned treatment arm), socio-economic stressors and parenting styles were not measured in this study and may have contributed to child behaviour problems. Future studies should includeassess these factors as potential confounders. Maternal mental health at only one time point (12 months postpartum) was included in this analysis. Intervening maternal and/or child factors e.g. effects of HIV-related CNS infections or encephalopathy on the developing brain between 12 and 42 months may have contributed to child behavioural outcomes.

d and, as such,w haveed onMore than one administrator was used which may have caused inconsistency in the administration of self-reports. Additionally, the mMaternal mental state and child behaviour outcomes were measured using self-reports and not a clinician diagnosis. The mental state of the caregivers may have

contributed to biased perceptions of child behaviour being endorsed. -Only 70 mother-child dyads participated in the study and 11 of the 70 were excluded from the regression analysis owing to missing data. The small sample size may have compromised statistical power for the analyses. Lastly, there was no HIV negative control or comparator group.

Nevertheless, several characteristics of the sample distinguish this study from previous research samples. This is, to our knowledge, the first study investigating the predictive effect of PTSD on child behaviour in vertically transmitted, HIV infected children. The maternal assessments included in this study were completed at 12 months postpartum which was deemed a salient period for examining PTSD in new mothers and was intended to decrease the risk of confounding by postpartum depression, as the risk for postpartum depression is highest within the first year after giving births. The study followed a longitudinal design and investigated the long-term child outcomes of maternal mental health at a specific point in time. Biological markers (e.g. CD4 counts) indicated that the children were relatively healthy at the time of assessment thus minimizing the possibility of poor physical health being a confounding factor. All mother-child dyads had routine checkups, counseling, HIV information sessions and antiretroviral treatment available to them. The level of intervention and care provided may have contributed positively to maternal mental health and child behaviour outcomes and requires further investigation. Findings of this study highlight the need to screen for and manage maternal PTSD and depression in mothers-child dyads infected with HIV. Identifying the mechanisms by which maternal mental health variables, specifically PTSD, interact and function in relation to child development in vertically transmitted HIV also requires exploration in future larger sample longitudinal studies.

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