# Prevalence and risk factors for child mental disorders in a population-based cohort of HIV-exposed and unexposed African children aged 7-11 years

European Child & Adolescent Psychiatry
https://doi.org/10.1007/s00787-018-1146-8

ORIGINAL CONTRIBUTION

# Prevalence and risk factors for child mental disorders in a population-based cohort of HIV-exposed and unexposed African children aged 7–11 years

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Received: 21 May 2017 / Accepted: 14 March 2018


**Abstract**
Despite being home to a large population of vulnerable children there is a dearth of population-based evidence on childhood mental disorders in sub-Saharan Africa. Parent and child mental health are rarely measured concurrently, despite potential for confounding with other risk factors, including parental HIV. Using the parent-report Child Behaviour Checklist (CBCL) we assessed children's mental health in a population-based cohort of 1536 HIV-negative children (31% HIV-exposed, 18% HIV-affected, 51% HIV-unexposed) aged 7–11 years. CBCL was scored using CBCL Rating-to-Score software. A binary indicator was determined using the clinical threshold ≥ 65. We modelled mental disorders using logistic regression, including covariates associated with the mother, child, household, and parenting. Structural equation modelling techniques also derived continuous latent variables representing the underlying mental health and parent-relationship constructs. Prevalence of conduct disorders (11.8%) was high, regardless of HIV exposure, while HIV-affected children had increased odds of affective disorders. Maternal depression increased odds of externalising disorders; maternal anxiety was associated with affective and anxiety disorders. Mother–child relationship dysfunction increased odds of all disorders, including: affective [aOR = 5.1 (2.6–9.9)]; oppositional [aOR = 7.9 (4.0–15.5)]; conduct [aOR = 4.3 (2.6–7.2)] disorders. Food insecurity and male gender increased odds of somatic disorders; breastfeeding halved odds of conduct disorders. In the latent model, associations were substantially stronger for the mother–child relationship and externalising disorders (Oppositional 0.464 $p < 0.001$; Conduct 0.474 $p = <0.001$). Conduct disorders were high for all children regardless of HIV exposure. The mother–child relationship was strongly related to all child disorders, suggesting potential for concurrent interventions targeting child behaviours and the parent–child or mother–child relationship.

**Keywords** Mental disorders · Parenting stress · HIV · Africa · Child

## Introduction

A recent meta-analysis [1] reporting on the worldwide prevalence of child mental disorders, using only diagnostic measures, included 41 studies from 27 countries across every region of the world. The worldwide pooled prevalence of mental disorders was 13.4% (CI 95% 11.3–15.9). The prevalence of any anxiety disorder was 6.5% (CI 95% 4.7–9.1), any depressive disorder was 2.6% (CI 95% 1.7–3.9), attention-deficit hyperactivity disorder was 3.4% (CI 95% 2.6–4.5), and any disruptive disorder was 5.7% (CI 95% 4.0–8.1). It is striking that this meta-analysis included only two studies from the African continent, published in 1999 and 2001, reflecting an absolute dearth of recent diagnostic data on children from this region, which is concerning given that Africa is home to the youngest population of any region globally. Updated estimates are also important given some evidence from high income countries that mental health disorders in children may be increasing [2]; and evidence from low and middle income contexts is very limited.

A systematic review of children's mental health problems in sub-Saharan Africa [3] which included both diagnostic

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**Electronic supplementary material** The online version of this article (https://doi.org/10.1007/s00787-018-1146-8) contains supplementary material, which is available to authorized users.

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Published online: 21 April 2018

and screening studies, found only 10 studies ($n = 9713$ children aged 0–16 years) from six countries, reporting 14.3% prevalence of any psychopathology. Studies using screening methodologies reported a higher prevalence than those using diagnostic measures (19.8 versus 9.5%). With the exception of one, all 10 of these studies were published prior to 2005, with the largest sample size being less than 600. In South Africa [4], a large, school-based assessment of children aged 10–12 years reported prevalence of 14% on self-reported measures, and 40% on teacher-report measures. A large population-based study [5] of pre-schoolers ($n = 3539$ aged 1.5–5.5 years) in rural Kenya found an overall prevalence of 13% (CI 95% 12–14) with high rates of both internalising (22%) and externalising (10%) problems. Risk factors included consumption of cassava, perinatal complications, and child illness (seizure disorders, burn injuries, and respiratory problems). However, a limitation of that research is that it did not examine the role of parental mental health or other non-biological contextual factors. To our knowledge no African population-based studies to date have examined the prevalence of child mental disorders in children 7–11 years taking into account HIV exposure (which is common in sub-Saharan Africa) and/or parental mental health.

Merikangas and colleagues [6] highlight several challenges in the global literature on child and adolescent mental disorders, which are relevant to Africa. These include that: preadolescent children are often excluded from surveys thus limiting our understanding of prevalence across the life course and developmental trajectories; in the examination of risk factor literature parents and children seldom have concurrent mental health data measured; most studies report limited data on contextual and confounding variables in the familial and caregiving context. Together this limits our understanding of how parent and child mental disorders may be related, and what shared risk factors may inform interventions.

Investigating the relationship between parental and child mental health in an African context is important given systematic reviews suggesting a strong intergenerational association, and global literature suggesting that an estimated 12–40% of children are raised by a mother or father with a mental illness [7]. Compared to children of parents without a mental health problem, these children have an increased risk of developing emotional, social, cognitive, and physical problems [8]. The existing literature, mostly from high income countries (HIC), postulates these risks are conferred through a complex combination of genetics, neurobiological, and psychosocial risk factors in the parent and the child [9]. The parental factors could be directly linked to the parent's behaviour, cognition and emotions, or indirectly through a variety of familial and contextual stressors associated with parental psychological difficulties, including marital conflict, isolation, and poverty. Furthermore in Africa, the burden of parental HIV is an additional concern, given that adults with HIV are known to have elevated mental health risks and that HIV-exposed or affected children have higher rates of socio-emotional and behavioural problems. In sub-Saharan Africa between 30 and 40% of children [10] are raised by an HIV-infected parent (most frequently their mother) with potential impacts on the child's mental health through several environmental, familial and biological mechanisms [11, 12]. Yet there is little understanding of child mental health in the context of maternal HIV or maternal mental health. This is particularly concerning in high risk–low resource settings where targeted interventions could have enormous potential to improve both parent and child mental health concurrently.

In this analysis, we examine the prevalence of mother-reported child mental health disorders in a large, population-based cohort of HIV-exposed and unexposed HIV-negative children aged 7–11 years in rural South Africa. We investigate household, maternal and child factors associated with mental disorders, and examine the inter-relationship between maternal and child mental disorders.

## Method

We use data from the Siyakhula Cohort [13], which includes HIV-negative children (aged 7–11 years), enrolled from the Africa Health Research Institute, previously the Africa Centre for Population Health (Africa Centre) (http://www.africacentre.com). The institute hosts a longitudinal Demographic Surveillance System (DSS) [14], with annual surveillance of households and individuals, collecting data including vital events (births, deaths), HIV status, and household socio-economic data.

Eligibility criteria included that the mother and child were alive; mother's pregnancy and current HIV status, and child HIV status were known; child was resident in the study area; mother received antenatal services in the study community; the maternal-held Road-to-Health Card (RTHC) clinical record was available. If a mother did not reside with her child, or reported sleeping apart from them more than 3 days per week, she identified the person considered to be the child's primary caregiver. As the primary caregiver would be best positioned to provide a parent-report on the child's mental health and behaviour, and as their own mental health would have greatest relevance for the child's mental health, these caregivers provided consent and completed the mental health assessments.

Some mothers and children previously participated in the Vertical Transmission Study (VTS; 2001–2006), a non-randomised intervention cohort study which supported mothers to practise exclusive breastfeeding (EBF) for the first 180 days of life [15]. Others were not part of the VTS, but were born and resident in the DSS at the same time, and

benefited from the Prevention of Mother-to-Child Transmission Programme and messages about EBF in the government clinics.

Ethics permission was granted by the Biomedical Research Ethics Committee, University of KwaZulu-Natal (BF184/12). Written informed consent was obtained from mothers/primary caregivers after being contacted by phone or a home visit, and agreeing to a fieldworker visit explaining study details.

Data were collected during three visits (2012–2014). At visit one, consent was obtained. During visit two, socioeconomic and health data were collected, and mother/caregiver mental health and maternal cognitive ability assessed. At visit three child anthropometry, cognition and executive function were measured. Graduate-level research assistants with 3–5 years of child developmental assessment experience conducted the assessments.

## Outcome measures

### Child mental health measures

We used the parent-reported Child Behaviour Checklist (CBCL) [16]. The CBCL has been shown to have wide ranging utility particularly in being able to distinguish between referred and non-referred populations. It has been shown to have significant and clinically useful associations with broad-based disorders such as anxiety and affective disorders as well as specific diagnostic groups such as attention deficit hyperactivity disorder (ADHD), and conduct disorder [17]. The researchers were granted a translation license (#512-10-29-10) and the CBCL was translated, back translated and approved by the test developers. For this analysis we calculate the Internalising and Externalising scales, and the six Diagnostic and Statistical Manual (DSM) orientated scales: affective, anxious, somatic, ADHD, oppositional, and conduct. There is strong evidence for the reliability, as well as convergent and discriminative validity, of these DSM orientated scales. We normed each of the six DSM scales using multi-cultural Rating-to-Score software purchased from the test developer. For each disorder, we created a binary indicator based on the recommended clinical threshold cut-off of $\geq 65$ of the normed score.

### Caregiver mental health measures

We measured maternal depression using the Patient Health Questionnaire Depression (PHQ-9) scale and anxiety using the Generalized Anxiety Disorder 7-item (GAD-7) scale [18], creating binary indicators for depression and anxiety based on clinical algorithms. We measured parenting stress using the Parenting Stress Index Short Form [19] (PSI-36), which includes subscales related to parental distress (12 items), parent–child relationship dysfunction (12 items), and the extent to which the parent finds the child difficult (12 items). In this study our measure of parenting stress reflects only maternal report on maternal–child relationships; hence while the subscale names (parent–child) are retained when referring to this measure and its scales, in our results we refer to mother–child relationships. We created a binary indicator for each parenting stress subscale based on scores above the 90th percentile in the overall sample.

## Analysis

We modelled each of the six DSM disorders separately using complete case, multivariate logistic regression, accounting for intra-mother correlation for children with the same mother. The model was repeated for the Internalising and Externalising scales. The abbreviated models showing significant results are presented in the manuscript (significance of $< 0.050$ and Bonferroni adjusted $< 0.002$). For the interested reader the full models with all variables and the unadjusted odds ratios are presented in Tables S1 to S3. We examine prevalence, co-morbidity and correlations between DSM disorders.

### HIV exposure

The child's exposure to HIV was categorised into three groups: HIV-unexposed (mother currently HIV-negative); HIV-exposed during pregnancy (mother HIV-positive during pregnancy with child); and HIV-affected (mother HIV-negative in pregnancy but HIV-positive at current data collection round).

### Maternal, household and child covariates

For each outcome, we included the following covariates: (1) mother/caregiver age and education, mother's employment and relationship status, indicators of mother/caregiver clinical depression and anxiety; (2) number of resident adults and children in household and exposure to crime; (3) child HIV exposure, age and sex, early feeding (specifically exclusive breastfeeding), if the child ever repeated a school grade, food insecurity, and receipt of a child grant (4) whether the primary caregiver was the mother and clinical parenting stress (maternal reported) subscale indicators. We repeated the models for Internalising and Externalising disorder scales. VTS exposure is adjusted for in the final model.

### Development of the maternal mental health latent variables

To understand the association between continuous symptoms of maternal psychological problems, mother–child relationship problems and child psychological problems, we used structural equation modelling (SEM) techniques to derive continuous latent variables representing the underlying mental health and parent-relationship constructs. This is particularly helpful for complex psychological constructs which are hard to directly observe.

All items from the three maternal mental health scales (GAD-7, PHQ-9, and PSI-36) were used to derive two latent constructs. Based on a priori theoretical knowledge, we grouped the 52 items across the 3 scales into those relating to mothers' emotional symptoms and those relating to the mother–child relationship. We then loaded these items onto 2 latent factors using confirmatory factor analysis. Items related to emotional symptoms in the mother (GAD-7, PHQ-9, and the PSI parental distress scale), a total of 28 items, were loaded onto one factor, and the remaining 24 items relating to the mother–child relationship (PSI parent–child relationship dysfunction and difficult child scales) were loaded onto a separate factor. To account for scale level method variance, individual items were allowed to correlate with other items from the same original scale (i.e. GAD-7 items with other GAD-7 items). Refer to Table 1 for individual loadings. Thus a total of 52 items were reduced to 2 factors. Multiple indices were used to provide a more comprehensive evaluation of model fit, the root-mean-square error of approximations (RMSEA) [20], comparative fit index (CFI) [21]. Goodness of fit was determined in accordance with Hu et al. [21] and was indicated by CFI values of over 0.95, and RMSEA of less than 0.06. The final model showed good fit according to these indexes (CFI = 0.950 and RMSEA = 0.036 (0.034–0.036).

These factors were then regressed onto each of the CBCL DSM orientated scales—the model accounts for correlations between the two maternal latent factors (0.415, see Fig. 1) and correlations between CBCL scales (Fig. 1), and adjustment for confounding variables (maternal age, education, HIV status and child sex). Therefore, each path represents the independent association between the factor and the CBCL DSM orientated subscale.

## Results

Of 1768 eligible children in the population a total of 1592 (90%) enrolled and 10% refused. Enrolled children included 494 HIV-exposed and 1098 HIV-unexposed, of whom 1536 completed all assessments (see Fig. 2).

Of these 1536 children: 477 were HIV-exposed, 278 HIV-affected, and 779 HIV-unexposed. Two mothers had missing current HIV status, resulting in a final analytic sample of 1534 children.

Compared to HIV-exposed and affected children, HIV-unexposed children were more likely to have an older mother who was in a relationship with their biological father, living in a home with more children, with less depression or parenting stress (Supplement Table S4).

The highest prevalence disorders were conduct (11.8%) and somatic (10.1%) disorders (Table 2). HIV-affected children had higher levels of all disorders, with affective and anxious being almost double the prevalence of the other groups. Accounting for co-morbidity (children only counted once even if they were above the threshold for more than one disorder) we found a pooled prevalence of any psychological morbidity above the threshold of 65 on the total CBCL to be 358 (23.4%) children.

The adjusted odds ratios in Table 3 describe changes in a child's odds of each CBCL DSM orientated disorder as a function of maternal, household, child, and mother–child relationship factors. In the adjusted model child HIV exposure and maternal depression and anxiety, increased the odds of child affective and anxiety disorders. HIV-exposed children had 60% reduced odds of oppositional disorders while HIV-affected children had threefold increased odds of affective disorders. Having a depressed mother was associated with three times the odds of oppositional, and twice the risk of conduct disorders, whilst children of mothers with anxiety had increased odds of affective, anxiety and somatic disorders.

Higher levels of parenting distress were associated with increased affective disorders in the child, while dysfunction in the mother–child relationship and reporting of a difficult child, were associated with substantially increased odds for all child disorders. These results were replicated when examining the CBCL scores by internalising and externalising subscales (Table 4). When accounting for the possible effects of multiple testing (Bonferroni adjustment) the association between dysfunction in the mother–child relationship and child mental disorders remained significant for all child mental disorders, excluding anxiety.

If the mother was in a relationship with the biological father, children had increased odds of ADHD disorders compared to children with single mothers, and children with an employed rather than unemployed mother had twice the odds of oppositional disorders. Whether the primary caregiver was the biological mother had no effect on child mental health outcomes (see Table S1).

Compared to children in households with fewer adults, those with at least four resident adults had increased odds of anxiety and somatic disorders. Conversely, children in households with at least four resident children had lowered

**Table 1** Individual loadings for maternal factors derived from 52 items (PHQ9; GAD7; PSI36)

| Factor by scale item loading (two tailed) | | Estimate | SE | Est./SE | *P* |
|---|---|---|---|---|---|
| FACTOR: maternal depression/anxiety/parental distress | | | | | |
| Patient Health Questionnaire General Anxiety Disorder Scale (GAD-7) | | | | | |
| GAD1 | Feeling nervous, anxious or on edge | 0.498 | 0.022 | 22.353 | 0.000 |
| GAD2 | Not being able to stop or control worrying | 0.574 | 0.020 | 28.096 | 0.000 |
| GAD3 | Worrying too much about different things | 0.626 | 0.019 | 33.218 | 0.000 |
| GAD4 | Trouble relaxing | 0.495 | 0.022 | 22.197 | 0.000 |
| GAD5 | Being so restless that it is hard to sit still | 0.448 | 0.023 | 19.163 | 0.000 |
| GAD6 | Becoming easily annoyed or irritable | 0.524 | 0.022 | 24.227 | 0.000 |
| GAD7 | Feeling afraid as if something awful might happen | 0.503 | 0.022 | 22.635 | 0.000 |
| Patient Health Questionnaire Depressions Scale (PHQ-9) | | | | | |
| PHQ1 | Little interest or pleasure in doing things | 0.483 | 0.024 | 19.917 | 0.000 |
| PHQ2 | Feeling down, depressed, or hopeless | 0.665 | 0.017 | 38.932 | 0.000 |
| PHQ3 | Trouble falling or staying asleep, or sleeping too much | 0.554 | 0.022 | 25.173 | 0.000 |
| PHQ4 | Feeling tired or having little energy | 0.614 | 0.021 | 29.879 | 0.000 |
| PHQ5 | Poor appetite or overeating | 0.510 | 0.023 | 22.175 | 0.000 |
| PHQ6 | Feeling bad about yourself (you are a failure, have let yourself/your family down) | 0.648 | 0.019 | 33.725 | 0.000 |
| PHQ7 | Trouble concentrating on things (reading newspaper, watching television) | 0.445 | 0.025 | 18.061 | 0.000 |
| PHQ8 | Moving or speaking so slowly (others notice) or fidgety or restless | 0.476 | 0.024 | 19.965 | 0.000 |
| PHQ9 | Thoughts that you would be better off dead or of hurting yourself in some way | 0.502 | 0.023 | 21.605 | 0.000 |
| Parenting Stress Index Short Form (PSI-36) parental distress subscale | | | | | |
| PSI1 | I often have a feeling that I cannot handle things very well | 0.417 | 17.49 | 17.498 | 0.000 |
| PSI2 | I find myself giving up more of my life to meet my child's needs than I expected | 0.309 | 0.026 | 11.931 | 0.000 |
| PSI3 | I feel trapped by my responsibilities as a parent | 0.309 | 0.026 | 11.931 | 0.000 |
| PSI4 | Since having this child, I have been unable to do new and different things | 0.341 | 13.44 | 13.449 | 0.000 |
| PSI5 | Since having this child, I am almost never able to do things that I like to do | 0.289 | 0.026 | 11.126 | 0.000 |
| PSI6 | I am unhappy with the last purchase of clothing I made for myself | 0.272 | 0.026 | 10.342 | 0.000 |
| PSI7 | There are quite a few things that bother me about my life | 0.282 | 0.026 | 10.777 | 0.000 |
| PSI8 | Having a child caused more problems than expected in relationships (partner/close friend) | 0.200 | 0.028 | 7.281 | 0.000 |
| PSI9 | I feel alone and without friends | 0.251 | 0.027 | 9.381 | 0.000 |
| PSI10 | When I go to a party, I usually expect not to enjoy myself | 0.338 | 0.026 | 13.181 | 0.000 |
| PSI11 | I am not as interested in people as I used to be | 0.318 | 0.026 | 12.086 | 0.000 |
| PSI12 | I don't enjoy things as I used to | 0.431 | 0.024 | 18.040 | 0.000 |
| FACTOR: mother–child relationship | | | | | |
| Parenting Stress Index Short Form (PSI-36) parent–child relationship dysfunction | | | | | |
| PSI13 | My child rarely does things that make me feel good | 0.622 | 0.078 | 8.026 | 0.000 |
| PSI14 | Mostly I feel that my child does not like me and does not want to be close to me | 0.359 | 0.078 | 4.622 | 0.000 |
| PSI15 | My child smiles at me much less than I expected | 0.409 | 0.078 | 5.270 | 0.000 |
| PSI16 | When I do things for my child, I get the feeling that this is not appreciated much | 0.644 | 0.085 | 7.546 | 0.000 |
| PSI17 | When playing, my child does not often giggle or laugh | 0.260 | 0.081 | 3.210 | 0.001 |
| PSI18 | My child does not seem to learn as quickly as most children | 0.473 | 0.080 | 5.920 | 0.000 |
| PSI19 | My child does not seem to smile as much as most children | 0.391 | 0.079 | 4.956 | 0.000 |
| PSI20 | My child is not able to do as much as I expected | 0.662 | 0.076 | 8.740 | 0.000 |
| PSI21 | It takes a long time and it is very hard for my child to get used to new things | 0.550 | 0.078 | 7.088 | 0.000 |
| PSI22 | I expected to have closer/warmer feelings for my child than I do, this bothers me | 0.584 | 0.051 | 11.507 | 0.000 |
| PSI23 | Sometimes my child does things that bother me just to be mean | 0.644 | 0.070 | 9.206 | 0.000 |
| PSI24 | My child seems to cry or fuss more often than most children | 0.436 | 0.029 | 15.055 | 0.000 |
| PSI25 | My child generally wakes up in a bad mood | 0.623 | 0.051 | 12.104 | 0.000 |
| Parenting Stress Index Short Form (PSI-36) difficult child | | | | | |
| PSI26 | I feel that my child is very moody and easily upset | 0.593 | 0.052 | 11.380 | 0.000 |

**Table 1** (continued)

| Factor by scale item loading (two tailed) | | Estimate | SE | Est./SE | *P* |
|---|---|---|---|---|---|
| PSI27 | My child does a few things which bother me a great deal | 0.808 | 0.053 | 15.285 | 0.000 |
| PSI28 | My child reacts very strongly when something happens that he/she does not like | 0.634 | 0.053 | 12.022 | 0.000 |
| PSI29 | My child gets upset easily over the smallest thing | 0.569 | 0.053 | 10.784 | 0.000 |
| PSI30 | My child's sleeping or eating schedule was much harder to establish than I expected | 0.411 | 0.049 | 8.348 | 0.000 |
| PSI31 | There are some things my child does that really bother me a lot | 0.833 | 0.052 | 15.969 | 0.000 |
| PSI32 | My child turned out to be more of a problem than I had expected | 0.590 | 0.044 | 13.315 | 0.000 |
| PSI33 | My child makes more demands on me than most children | 0.652 | 0.051 | 12.728 | 0.000 |
| PSI34 | Think carefully and count the number of things which your child does that bother you | 0.384 | 0.050 | 7.738 | 0.000 |
| PSI35 | I feel I am a: not very good/having trouble/average/better than average/very good parent | 0.469 | 0.033 | 14.148 | 0.000 |
| PSI36 | Getting child to do things: harder/somewhat harder/hard/easier/much easier vs. expected | 0.619 | 0.038 | 16.228 | 0.000 |

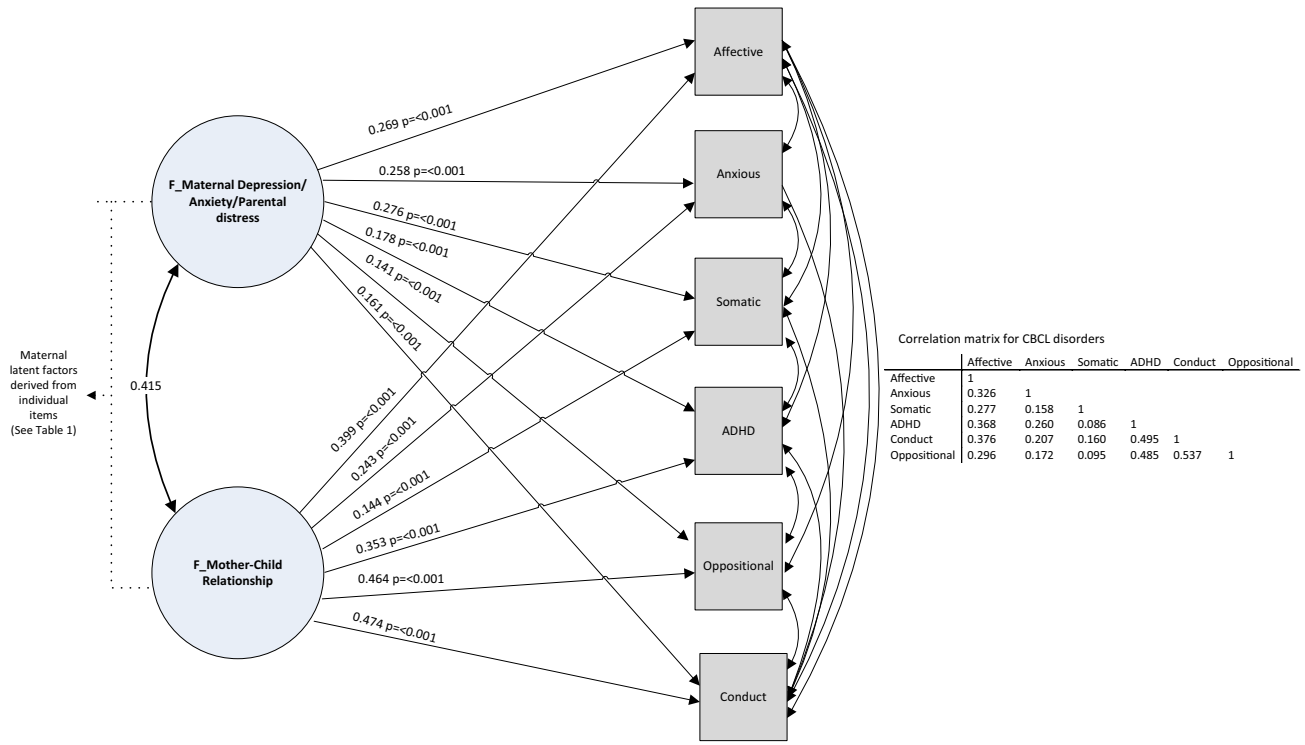


**Fig. 1** Model illustrating associations between maternal mental health factors and child CBCL subscale scores and correlation matrix for the six CBCL subscales

odds of anxiety. Exposure to crime in the past year almost doubled the odds of conduct disorders in the DSM disorders model (Table 3), but not the internalising/externalising subscale model (Table 4 and Table S2).

Boys had increased odds of anxiety and somatic disorders, and decreased odds of ADHD disorders compared to girls. Older children had 70% reduced odds of oppositional disorders relative to younger children. Given their frequent overlap and association with gender effects in the literature, Table Supplement S5 presents co-morbidity for oppositional, conduct, and somatic, anxiety and affective disorders. A higher percentage of girls had conduct disorders, but more boys were co-morbid for both oppositional and conduct disorders, while co-morbidity for affective and somatic disorders was higher in girls.

Repeating a school grade was associated with increased ADHD disorders, and food insecurity was associated with an increased risk for all disruptive disorders (ADHD, oppositional and conduct). Children who were EBF for six or more months had approximately a 50% reduction in the odds of oppositional and conduct disorders.

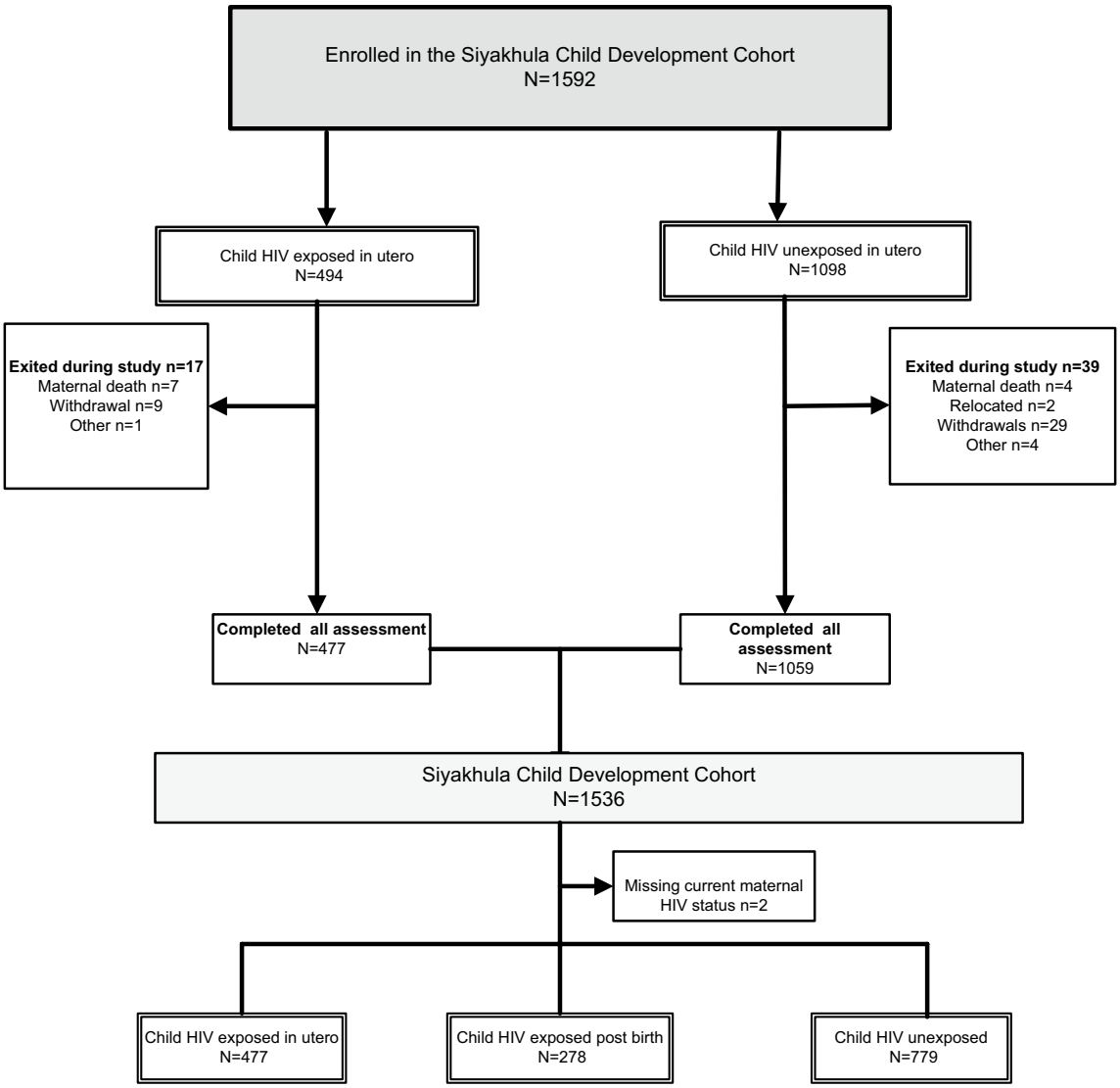


**Fig. 2** Consort diagram of children included in the study

The latent model (Fig. 1) shows that both maternal psychological problems (depression, anxiety, and parental distress) and a poor mother–child relationship were associated with CBCL subscales. For the majority of CBCL subscales, associations were substantially stronger for the poor mother–child relationship factor (with the exception of somatic symptoms). These results are consistent with the logistic regression analyses for the binary variables, but generally show stronger associations as would be expected when modelling continuous variables, and using latent constructs which minimise measurement error. Figure 1 shows that CBCL subscales were correlated to varying degrees, with externalising scales (conduct, oppositional, and ADHD) most strongly correlated with each other.

## Discussion

The prevalence of parent-reported child mental disorders was high in this population, even in those children not exposed to HIV. When compared with global prevalence estimates [1, 6] the overall prevalence of mental disorders of 23.4% was substantially higher than global rates of 13.4% [1], but within the range of previous reports for the SSA region of 14–24% [4]. Conduct disorders were substantially higher in our cohort versus global rates (11.8 vs 2.1%), while affective (5.4 vs 2.6%), ADHD (4.4 vs 3.4%) and oppositional (5.8 vs 3.6%) disorders were slightly higher, and anxiety slightly lower than global rates (5 vs 6.5%).

**Table 2** Prevalence of CBCL disorders (score ≥ 65) by child's HIV exposure status

| | HIV-unexposed[a] | HIV-exposed[a] | HIV-affected[a] | Total |
|---|---|---|---|---|
| | *N* (%) | *N* (%) | *N* (%) | *N* (%) |
| | 777 | 475 | 278 | 1530 |
| Affective | | | | |
| Absent | 748 (96.3) | 449 (94.5) | 251 (90.3) | 1448 (94.6) |
| Present | 29 (3.7) | 26 (5.5) | 27 (9.7) | 82 (5.4) |
| Anxious | | | | |
| Absent | 743 (95.6) | 455 (95.8) | 256 (92.1) | 1454 (95.0) |
| Present | 34 (4.4) | 20 (4.2) | 22 (7.9) | 76 (5.0) |
| Somatic | | | | |
| Absent | 700 (90.1) | 433 (91.2) | 242 (87.1) | 1375 (89.9) |
| Present | 77 (9.9) | 42 (8.8) | 36 (12.9) | 155 (10.1) |
| ADHD | | | | |
| Absent | 746 (96.0) | 453 (95.4) | 263 (94.6) | 1462 (95.6) |
| Present | 31 (4.0) | 22 (4.6) | 15 (5.4) | 68 (4.4) |
| Oppositional | | | | |
| Absent | 734 (94.5) | 448 (94.3) | 259 (93.2) | 1441 (94.2) |
| Present | 43 (5.5) | 27 (5.7) | 19 (6.8) | 89 (5.8) |
| Conduct | | | | |
| Absent | 692 (89.1) | 420 (88.4) | 237 (85.3) | 1349 (88.2) |
| Present | 85 (10.9) | 55 (11.6) | 41 (14.7) | 181 (11.8) |

[a]Maternal HIV status in pregnancy and at the current round of data collection was verified from the VTS/DSS databases, the RTHC, and maternal self-report

## Conduct disorders

Childhood-onset conduct disorders [22] are a concerning public health priority given their strong association with adult antisocial behaviours [23, 24]. Their aetiology is multifactorial and includes early life social disadvantage, parental psychological disorders, parenting and neurocognitive difficulties [22]. Many children with conduct disorders do not grow up to be antisocial, but one of the strongest moderators appears to be poor socio-economic status [22], and in our cohort we demonstrate a link between food insecurity and disruptive disorders [25]. This association is very relevant in South Africa [3, 4], where poverty and violence are major problems [26]. We illustrate the particular vulnerability of boy children to both internalising and externalising disorders [6], but interestingly girls and boys are at similar risk of the conduct problem component of externalising problems [27], which requires further understanding. In this, our Low and Middle Income Country (LMIC) cohort [13], we have demonstrated previously that exclusive breastfeeding halved the odds of conduct problems, similar to findings previously reported in HIC settings, signalling that early interventions may have similar and particular relevance in LMIC.

However, this association also partially represents the contribution that more difficult children may make to the mother or parent–child relationship (i.e. a heavier bidirectional component inflating the overall estimate). It is likely that having a child with conduct problems evokes more conflict in mother or parent–child relationship and increases parental stress, thus mother or parent-based training focusing exclusively on shifting maternal or parental behaviours may not suffice in these instances. There is also a need for increased repeated measures research to better elucidate the direction of effects within the mother or parent–child relationship.

## Somatic and other internalising disorders

Rates of somatisation (internalising disorders) were also high. In HIC [28] (and some LMIC) somatisation in childhood has been strongly linked to other psychological disorders, most commonly depression and anxiety, and to adult mental health problems. In this cohort we see some evidence of such co-morbidity with depression and anxiety amongst children with somatic scores above the threshold. Somatisation in middle childhood has also been shown to predict later depression and anxiety in both adolescence and adulthood [29]. In line with the literature [25, 28, 30], we found that children who are male, have greater food insecurity, a mother with anxiety, reside in a larger household, and have difficulties in the mother–child relationship have increased odds of somatisation. Growing evidence suggests that parental anxiety (during pregnancy or later in the child's life) may be linked to child somatisation [31] and that there may be overlap between children's anxiety and reporting of somatic symptoms. That ADHD was associated with educational failure is unsurprising, given the current literature [32].

## Role of HIV context

Children born into families in Southern Africa, where HIV rates are very high [10], face many proximal and distal risk factors associated with parental HIV related morbidity and mortality often compounded by stigma and family instability [33]. While evidence suggests that children are disadvantaged by their parents' HIV, findings are far from consistent [34], and very few studies report concurrent child and maternal or parent mental health data [11]. Therefore risk is often assumed to stem from parental HIV, while plausibly other confounding factors (including maternal or parental mental health or caregiving capacity), or shared risks with HIV (including poverty), may contribute to children's psychological morbidity. A better understanding of these pathways and relationships could elucidate modifiable factors to inform interventions in both low-resource and high-resource settings.

**Table 3** Multivariate logistic regressions of CBCL disorders on maternal, household, child, and parent–child relationship factors showing significant variables only ($n = 1455$)

| | Affective | Anxiety | Somatic | ADHD | Oppositional | Conduct |
|---|---|---|---|---|---|---|
| | aOR [CI] $p$ value | aOR [CI] $p$ value | aOR [CI] $p$ value | aOR [CI] $p$ value | aOR [CI] $p$ value | aOR [CI] $p$ value |
| Maternal factors | | | | | | |
| Mother's relationship status | | | | | | |
| Single | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| With biological father | 1.4 [0.6, 3.2] 0.425 | 1.4 [0.7, 2.9] 0.399 | 1.1 [0.7, 1.9] 0.654 | 3.0 [1.2, 7.0] 0.014 | 1.3 [0.6, 2.8] 0.469 | 1.4 [0.8, 2.4] 0.285 |
| New partner | 0.7 [0.3, 1.6] 0.458 | 1.1 [0.5, 2.5] 0.730 | 1.1 [0.6, 2.0] 0.698 | 1.3 [0.5, 3.2] 0.616 | 1.4 [0.6, 2.9] 0.413 | 1.2 [0.7, 2.1] 0.530 |
| Mother/caregiver employed | | | | | | |
| No | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Yes | 1.3 [0.6, 2.6] 0.460 | 1.2 [0.6, 2.3] 0.586 | 1.4 [0.9, 2.1] 0.109 | 1.0 [0.5, 2.2] 0.929 | 1.9 [1.1, 3.3] 0.027 | 1.1 [0.8, 1.7] 0.559 |
| Clinical depression[a] | | | | | | |
| Absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Present | 1.7 [0.7, 4.1] 0.271 | 2.2 [0.9, 5.3] 0.073 | 1.7 [0.9, 3.3] 0.108 | 1.2 [0.5, 2.9] 0.653 | 3.1 [1.4, 7.2] 0.007 | 2.5 [1.2, 5.0] 0.010 |
| Clinical anxiety[b] | | | | | | |
| Absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Present | 4.3 [1.4, 13.3] 0.011 | 3.1 [1.1, 8.4] 0.027 | 4.7 [2.4, 9.4] < 0.001[h] | 1.9 [0.6, 5.9] 0.249 | 2.0 [0.6, 6.4] 0.231 | 1.5 [0.6, 4.2] 0.416 |
| Household factors | | | | | | |
| Number of resident adults | | | | | | |
| 0–3 | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| 4+ | 0.8 [0.4, 1.5] 0.496 | 1.8 [1.0, 3.1] 0.035 | 1.6 [1.1, 2.3] 0.017 | 1.2 [0.7, 2.1] 0.576 | 0.8 [0.5, 1.4] 0.472 | 0.8 [0.6, 1.2] 0.353 |
| Number of resident children | | | | | | |
| 0–3 | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| 4+ | 1.0 [0.6, 1.8] 0.970 | 0.6 [0.3, 1.0] 0.046 | 0.7 [0.5, 1.1] 0.113 | 1.0 [0.6, 1.7] 0.964 | 0.9 [0.5, 1.5] 0.723 | 1.4 [0.9, 2.1] 0.093 |
| Exposure to crime in last 12 months[c] | | | | | | |
| Absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Present | 1.7 [0.9, 3.5] 0.126 | 1.0 [0.5, 1.9] 0.892 | 0.8 [0.5, 1.4] 0.452 | 0.7 [0.3, 1.6] 0.370 | 1.1 [0.6, 2.1] 0.783 | 1.7 [1.0, 2.7] 0.038 |
| Child factors | | | | | | |
| Child gender | | | | | | |
| Female | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Male | 0.6 [0.3, 1.1] 0.091 | 1.8 [1.1, 3.0] 0.027 | 2.3 [1.6, 3.3] < 0.001[h] | 0.4 [0.2, 0.7] 0.001[h] | 1.3 [0.8, 2.2] 0.231 | 1.2 [0.8, 1.7] 0.339 |
| Child's HIV exposure[d] | | | | | | |
| HIV-unexposed | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| HIV-exposed | 1.3 [0.6, 2.7] 0.573 | 0.7 [0.3, 1.6] 0.432 | 0.8 [0.5, 1.3] 0.381 | 1.1 [0.5, 2.4] 0.727 | 0.4 [0.2, 0.9] 0.034 | 0.9 [0.5, 1.4] 0.531 |
| HIV-affected | 3.1 [1.6, 6.2] 0.001[h] | 1.6 [0.8, 3.2] 0.150 | 1.1 [0.7, 1.9] 0.649 | 1.9 [0.8, 4.1] 0.129 | 1.0 [0.5, 2.0] 0.974 | 1.2 [0.7, 1.9] 0.541 |
| Exclusive breastfeeding[e] | | | | | | |
| <6 months | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| 6+ months | 0.7 [0.3, 1.3] 0.241 | 0.6 [0.3, 1.1] 0.076 | 1.0 [0.6, 1.6] 0.923 | 1.0 [0.5, 2.1] 0.941 | 0.5 [0.3, 1.0] 0.049 | 0.6 [0.3, 0.9] 0.022 |
| Repeat grade[f] | | | | | | |
| Absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Present | 1.8 [1.0, 3.2] 0.040 | 1.3 [0.8, 2.2] 0.300 | 1.1 [0.8, 1.6] 0.668 | 1.8 [1.0, 3.3] 0.052 | 0.9 [0.6, 1.6] 0.797 | 1.1 [0.8, 1.7] 0.533 |
| Food insecurity[c] | | | | | | |
| No food insecurity | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| At least once in last 4 weeks | 1.2 [0.6, 2.2] 0.604 | 1.3 [0.7, 2.3] 0.361 | 2.3 [1.5, 3.4] < 0.001[h] | 1.7 [0.9, 3.2] 0.121 | 2.0 [1.2, 3.4] 0.013 | 1.5 [1.0, 2.2] 0.031 |
| Child grant[c] | | | | | | |
| Absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Present | 7.1 [1.3, 38.0] 0.021 | 2.5 [0.7, 9.4] 0.181 | 1.1 [0.5, 2.3] 0.894 | 1.2 [0.3, 4.4] 0.796 | 0.9 [0.3, 2.3] 0.760 | 2.6 [0.8, 8.5] 0.109 |
| Parent–child relationship | | | | | | |
| Clinical parenting stress[g] | | | | | | |
| Parental distress absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Parental distress present | 2.6 [1.3, 5.0] 0.005 | 1.2 [0.6, 2.4] 0.589 | 1.0 [0.5, 1.8] 0.970 | 1.9 [0.8, 4.6] 0.157 | 0.5 [0.2, 1.3] 0.155 | 1.2 [0.6, 2.2] 0.617 |
| Relationship dysfunction absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |

**Table 3** (continued)

| | Affective<br>aOR [CI] *p* value | Anxiety<br>aOR [CI] *p* value | Somatic<br>aOR [CI] *p* value | ADHD<br>aOR [CI] *p* value | Oppositional<br>aOR [CI] *p* value | Conduct<br>aOR [CI] *p* value |
|---|---|---|---|---|---|---|
| Relationship dysfunction present | 5.1 [2.6, 9.9] < 0.001[h] | 2.0 [1.1, 3.8] 0.029 | 3.0 [1.7, 5.1] < 0.001[h] | 4.8 [2.1, 10.7] < 0.001[h] | 7.9 [4.0, 15.5] < 0.001[h] | 4.3 [2.6, 7.2] < 0.001[h] |
| Difficult child absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Difficult child present | 6.2 [3.2, 11.7] < 0.001[h] | 4.6 [2.5, 8.4] < 0.001[h] | 1.8 [1.0, 3.2] 0.034 | 4.9 [2.3, 10.4] < 0.001[h] | 3.6 [1.8, 7.3] < 0.001[h] | 5.8 [3.4, 9.7] < 0.001[h] |

All measures based on current status at time of interview. Adjusted odds ratio (aOR) based on multivariate logistic regression including all covariates. All models also adjusted for intervention exposure (VTS). This is an abbreviated model showing only significant results (significance level < 0.050, and Bonferroni adjusted < 0.002). The full model including all variables tested is presented in supplementary material for the interested reader (Table S1). Maternal, child and parenting factors not presented but controlled for included: maternal/caregiver age; maternal education, child age; child in care of mother versus alternative caregiver

[a]Binary indicator for depression based on clinical algorithm using the Patient Health Questionnaire Depression (PHQ-9) scale

[b]Binary indicator for anxiety based on clinical algorithm using the Generalized Anxiety Disorder 7-item (GAD-7) scale

[c]Based on DSS questionnaire

[d]Maternal HIV status in pregnancy and at the current round of data collection was verified from the VTS/DSS databases, the RTHC, and maternal self-report

[e]Based on maternal recall. Exposure to VTS breastfeeding intervention is adjusted for

[f]Classified as having repeated a school grade or not. Schooling in South Africa begins when the child is age 5 in Grade R (reception class). Compulsory schooling extends from Grade One to the end of senior phase, with an expected age of 15 years. Repeating Grade R (reception class) not counted as some children repeat Grade R if they start school at a very young age

[g]Binary indicator for each parenting stress subscale based on scores above the 90th percentile in the overall sample. Parenting stress measured using the Parenting Stress Index Short Form (PSI-36), which includes subscales related to parental distress, parent–child relationship dysfunction, and the extent to which the parent finds the child difficult. In this research the PSI-36 was completely by mothers, hence results reflect maternal rather than paternal distress, and the mother–child relationship dysfunction rather than parent–child relationship dysfunction

[h]Significant at Bonferroni adjusted < 0.002 level

The role of parental HIV in children's mental health outcomes, and the potential for improving targeted interventions is particularly important for HIV epidemic regions such as sub-Saharan Africa, but are also increasingly important in lower prevalence regions such as Europe. While overall HIV prevalence is much lower in Europe, Eastern Europe and Asia are the only regions in the world where new HIV infections rise annually (an increase of 57% 2010–2015) [35] along with evidence of a growing epidemic in Central Europe [36]. Similarly, risks amongst vulnerable migrant and asylum seeking populations in Europe are high [37, 38], in part because a large number may originate from epidemic regions.

In this research, we demonstrate that parental mental health and parenting stress, as opposed to HIV, are most strongly associated with children's mental disorders. The measurement of concurrent parental and child mental health problems is important as mental disorders have a strong intergenerational influence.

## Strengths and limitations

We present data from one the largest cohorts of primary school-aged children in rural Southern Africa, including exposure to HIV. Parent-reporting on child psychological morbidity, at this age, using the CBCL is well validated and accepted. However, some evidence suggests that informants in highly adverse contexts (including teachers) may over report children's symptomology [4], and that parents' own mental disorders may influence reporting [39]. Therefore these results should be interpreted cautiously, until further research, including diagnostic measures, is available. However, as children's own reports of their emotions can be unstable in primary school years, the literature suggests that parent-reported data on children's mental disorders is reliable [40] but should be complemented with family and contextual data [39], which is a particular strength of this study. Finally, due to modelling each of the outcomes separately some false-positive results may have resulted from multiple tests—however, in presenting our results we focused on strength of evidence rather than any statistical significance threshold, and we provide for the reader the associations which remain significant when applying a more conservative significance threshold.

**Table 4** Multivariate logistic regressions of CBCL internalising and externalising outcomes on maternal, household, child, and parent–child relationship factors showing only significant variables ($n = 1455$)

| | Internalising<br>aOR [CI] $p$ value | Externalising<br>aOR [CI] $p$ value |
|---|---|---|
| Maternal factors | | |
| Mother/caregiver employed | | |
| No | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Yes | 1.7 [1.0, 3.0] 0.048 | 1.4 [0.9, 2.3] 0.157 |
| Clinical depression[a] | | |
| Absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Present | 2.8 [1.2, 6.2] 0.012 | 2.4 [1.2, 5.1] 0.018 |
| Clinical anxiety[b] | | |
| Absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Present | 5.5 [2.2, 13.9] < 0.001[h] | 2.2 [0.8, 6.1] 0.133 |
| Child factors | | |
| Child gender | | |
| Female | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Male | 2.3 [1.4, 3.7] 0.001[h] | 1.0 [0.6, 1.6] 0.996 |
| Child's HIV exposure[d] | | |
| HIV-unexposed | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| HIV-exposed | 1.4 [0.7, 2.6] 0.295 | 0.8 [0.4, 1.5] 0.476 |
| HIV-affected | 2.2 [1.2, 3.9] 0.012 | 1.7 [1.0, 2.9] 0.074 |
| Food insecurity[c] | | |
| No food insecurity | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| At least once in last 4 weeks | 1.9 [1.2, 3.2] 0.010 | 1.5 [0.9, 2.3] 0.115 |
| Parent–child relationship | | |
| Clinical parenting stress[g] | | |
| Parental distress absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Parental distress present | 1.1 [0.5, 2.2] 0.802 | 1.1 [0.6, 2.3] 0.762 |
| Parent–child relationship dysfunction absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Parent–child relationship dysfunction present | 4.4 [2.5, 7.9] < 0.001[h] | 4.9 [2.8, 8.8] < 0.001[h] |
| Difficult child absent | 1.0 [1.0, 1.0] | 1.0 [1.0, 1.0] |
| Difficult child present | 5.0 [2.9, 8.9] < 0.001[h] | 7.7 [4.5, 13.3] < 0.001[h] |

All measures based on current status at time of interview. Adjusted odds ratio (aOR) based on multivariate logistic regression including all covariates. All models also adjusted for intervention exposure (VTS). This is an abbreviated model showing only significant results (significance level < 0.050, and Bonferroni adjusted < 0.002). The full model including all variables tested is presented in supplementary material for the interested reader (Table S2). Maternal, household, child and parenting factors not presented but controlled for included: maternal/caregiver age; maternal education, maternal relationship status, number of resident children and adults, exposure to crime in last 12 months, child age; exclusive breastfeeding, repeated grade, child grant, child in care of mother versus alternative caregiver

[a]Binary indicator for depression based on clinical algorithm using the Patient Health Questionnaire Depression (PHQ-9) scale

[b]Binary indicator for anxiety based on clinical algorithm using the Generalized Anxiety Disorder 7-item (GAD-7) scale

[c]Based on DSS questionnaire

[d]Maternal HIV status in pregnancy and at the current round of data collection was verified from the VTS/DSS databases, the RTHC, and maternal self-report

[e]Based on maternal recall, exposure to VTS is adjusted for

[f]Classified as having repeated a school grade or not. Schooling in South Africa begins when the child is age 5 in Grade R (reception class). Compulsory schooling extends from Grade One to the end of senior phase, with an expected age of 15 years. Repeating Grade R (reception class) not counted as some children repeat Grade R if they start school at a very young age

[g]Binary indicator for each parenting stress subscale based on scores above the 90th percentile in the overall sample. Parenting stress measured using the Parenting Stress Index Short Form (PSI-36), which includes subscales related to parental distress, parent–child relationship dysfunction, and the extent to which the parent finds the child difficult. In this research the PSI-36 was completely by mothers, hence results reflect maternal rather than paternal distress, and the mother–child relationship dysfunction rather than parent–child relationship dysfunction

[h]Significant at Bonferroni adjusted < 0.002 level

## Implications

As childhood mental disorders are intertwined with developmental processes, improving our understanding of identifiable clinical risks during early development may improve our understanding of the initial stages of psychological disturbance. Children identified early in childhood may respond better to treatment, leading to reductions in illness duration and an improvement in treatment outcomes and opportunities for prevention. Maternal psychological problems (depression, anxiety, parenting stress) and HIV play an important role in increasing children's risk of having mental health problems themselves, as has been demonstrated elsewhere [6, 8].

There is an urgent need to broaden our view of adult psychopathology to include the familial burden of mental disorders, particularly in low-resource contexts where low-intensity family-centred interventions may have particular public health relevance. Directing parents with mental health issues through adult health services likely misses several opportunities for addressing the family, and in particular child level burden of mental disorders. Since most adulthood mental disorders begin in childhood and adolescence, we highlight the importance of understanding the progression of mental disorders at earlier ages, in childhood as opposed to adolescence, where opportunities for prevention and early intervention can be maximised.

The National Institute of Clinical Excellence (NICE) guidelines [23] recommend parenting and school-based interventions where prevalence of conduct disorders is high. The relatively larger effects of parental relationship versus maternal emotional factors on disruptive disorders demonstrated in our latent model, across all child mental disorders but particularly for behavioural problems, suggest that this relationship is an important factor and key intervention target. Thus the evidence reported here suggests that there is potential for interventions which concurrently target child behaviours and mental health problems, maternal mental health and the mother–child relationship amongst families with younger children. There is a greater need for intervention development which targets both parent and child behaviours and the parent–child relationship concurrently. Recent interventions have shown potential in this area [41–43]. Such interventions may, at a population level, hold relevance for all families, including those affected more directly by HIV. Importantly, it may also provide cost saving preventative opportunities given the well-established high mental health burden amongst adolescents in low and middle income countries across the globe.

**Author contributions** Tamsen Rochat contributed to securing funding, study design and implementation of the research; she participated in data analysis and interpretation, drafted and critically revised the manuscript. Brian Houle (joint first author) led data analysis and interpretation, drafted and critically revised the manuscript. Alan Stein contributed to securing funding, study design and participated in the interpretation of data and critically revised the manuscript. Rebecca Pearson participated in data analysis and interpretation and critically revised the manuscript. Ruth Bland contributed to securing funding, study design and implementation of the research; she participated in interpretation of data and critically revised the manuscript.

**Funding** The Siyakhula Cohort was funded by Grand Challenges, Canada Saving Brains (0063-03). Grand Challenges "Saving Brains" required standardisation of core metrics across all eleven funded cohorts, including socio-demographic and economic variables and data on child cognition. The funder played no other role in the design of the study. The Africa Health Research Institute, previously called Africa Centre for Population Health, University of Kwa-Zulu Natal is funded by the Wellcome Trust (Previous Africa Centre 097410/Z/11; Current AHRI 201433/Z/16/Z). The demographic surveillance is co-funded by the South Africa Department of Science and Technology through the DST/MRC South African Population Research Infrastructure Network (SAPRIN). The original Vertical Transmission Study was funded separately by Wellcome Trust (063009/Z/00/2). Tamsen Rochat receives salary support from the Newton Advanced Fellowship Scheme (AF160108). Additional support of the DST-NRF Centre of Excellence (CoE) in Human Development (ACC2018004; OPP201600035; OPP20150015) awarded to Tamsen Rochat towards manuscript development is acknowledged. Opinions expressed and conclusions arrived at are those of the authors and are not necessarily to be attributed to the funders.

## Compliance with ethical standards

**Conflict of interest** The authors have no conflicts of interest to declare.

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