Title Page

Child and adolescent suicide attempts, suicidal behavior and Adverse Childhood Experiences in South Africa: a prospective study.

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LC and MB had responsibility for the overall study design and management. LC, MB and MO conducted the analyses for the paper. LC, MO, MB and LS had responsibility for conceptualizing and writing the paper. All authors reviewed and approved the final version. No authors have any conflicts of interest. Dr Lucie Cluver has full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

ABSTRACT (249 words)

Child and adolescent suicide attempts, suicidal behavior and Adverse Childhood Experiences in South Africa: a prospective study.

Purpose: This is the first known prospective study of child suicidal behavior in sub-Saharan Africa. Aims were to determine whether 1) cumulative exposure to adverse childhood experiences predicts later suicidality, and 2) heightened risks are mediated by mental health disorder and drug/alcohol misuse.

Methods: Longitudinal repeated interviews one year apart (97% retention) with 3515 adolescents aged 10-18 in South Africa (56% female, <2.5% refusal). Random selection of census enumeration areas from urban/rural sites within two provinces, and door-to-door sampling included all homes with a resident child. Measures included past-month suicide attempts, planning and ideation, mental health disorders, drug/alcohol use and adverse childhood experiences (ACE) e.g. parental death by AIDS or homicide, abuse, and exposure to community violence. Analyses included multivariate logistic regression and multiple mediation tests.

Results: Past-month suicidality rates were 3.2% of adolescents attempting, 5.8% planning and 7.2% reporting ideation. After controlling for baseline suicidality and socio-demographics, a strong, graded relationship was shown between cumulative ACE and all suicide behaviors one year later. Suicide attempts rose from 1.9% among adolescents with no ACE to 6.3% among adolescents with >5 ACE (cumulative OR 2.46 CI 1.00–6.05). For suicide planning, 2.4% to 12.5%, (cumulative OR 4.40 CI 2.08-9.29) and for suicide ideation 4.2% to 15.6% (cumulative OR 2.99 CI 1.68-5.53).

Baseline mental health, but not drug/alcohol misuse mediated relationships between ACE and subsequent suicidality.

Conclusions: Preventing and mitigating childhood adversities has the potential to reduce adolescent suicidality. Amongst children already exposed to adversities, effective mental health services may buffer against future suicidality.

Implications and contribution: Sub-Saharan Africa has high rates of childhood exposure to adversities such as parental death, abuse and violence. This is the first prospective study to test linkages to suicide behavior. It shows that childhood adversities increase mental health disorder, and though this increase suicide attempts threefold and suicide planning fivefold.

Child and adolescent suicide attempts, suicidal behavior and Adverse Childhood Experiences in South Africa: a prospective study.

Global suicide rates have risen by 60% in recent decades, although reliable data is lacking from sub-Saharan Africa.[1] In South Africa, suicide is responsible for around 9.5% of non-natural deaths amongst young people, with school-based studies reporting ideation rates ranging from 4-47%.[2] Suicidal ideation is often recurrent and is associated with subsequent risk of suicide attempts; around one-third of fatal suicides have made a prior suicide attempt.[3] All suicidal behaviours are burdensome and deserving of support and attention.

Adolescents' suicidal behaviour has been linked to an interplay between genetic, psychological, cognitive, and social factors, with particular risks related to childhood adversities.[4] In the 1990s, the ground breaking 'Adverse Childhood Experiences' (ACE) study in the United States showed strong and graded relationships between retrospective reports of exposure to childhood ACE and suicide attempts during adolescence and adulthood.[5] Findings identified depression and substance misuse as possible mediators of this relationship.

Within sub-Saharan Africa, large numbers of youth are exposed to adverse childhood experiences. These include experiences identified in developed world studies, such as abuse and domestic violence, and others more common to the region, such as parental AIDS-illness and death. Evidence suggests that many of these are closely and causally related to each other, and if left unchecked, can result in accumulated exposure to multiple adversities.[6] Although many children show remarkable resilience,[7] cumulative exposure to stressors may wear down their coping capacity.

A small number of studies in sub-Saharan Africa have examined relationships between ACE and suicidality. Two used adult samples and tested associations between retrospective recall of abuse and of childhood traumas: in rural South Africa, women (n=2782) reporting childhood emotional neglect had increased likelihood of suicidal thoughts,[8] and in Nigeria, childhood separation from biological parents, household conflict and physical abuse were risk factors for lifetime suicide attempts (n=6752).[9] Very few studies focus on youth suicide ideation (none assessing actual suicide attempts): children aged 13-15 in schools in five African countries showed strong cross-sectional associations between exposure to physical and sexual violence and suicidal ideation,[10] and in South Africa increased suicidal ideation was found amongst children orphaned by AIDS or with AIDS-unwell parents.[11]

To date, no known studies in sub-Saharan Africa have tested whether, as found in the US, *cumulative* exposure to ACE is linked to child suicidality. Nor has any research in the region examined if heightened child suicide risks may be mediated, as suggested in the US study, through mental health and substance misuse. Finally, to date all known studies either used cross-sectional data or adults' retrospective report of childhood adversities: unlike initiatives in Europe and elsewhere, no known studies in sub-Saharan Africa have examined prospective predictors of child suicidality.

For this study, the adverse experiences identified in the US were adapted to include adversities that are widespread within sub-Saharan Africa and shown to negatively effect child mental health. Thus, four ACE from the original US study were used: physical, emotional and sexual abuse and domestic violence exposure. Five additional ACE that were particularly relevant to this context were added: AIDS-orphanhood, parental AIDS-illness, parental death by homicide, community violence exposure and

food insecurity. Study aims were to i) test potential effects of cumulative ACE on subsequent child suicidal behaviour, and ii) to test potential mediation effects of mental health and substance misuse.

DESIGN

Participants and procedures: The baseline sample included 3515 children and adolescents aged 10-18 (56% female), interviewed at baseline (2009-10; refusal rate <2.5%) and followed up at one year (2011-12; retention rate 96.8%). Two urban and two rural health districts with >30% antenatal HIV-prevalence were selected within two South African provinces: Mpumalanga and the Western Cape. Within these strata, sequentially numbered census enumeration areas were sampled using random number generation. In each area, every household was visited and included in the study if it had a resident adolescent. One randomly selected adolescent per household was interviewed face-to-face for 60-70 minutes. All questionnaires, information and consent forms were translated into Xhosa, Zulu, Sotho, Swati and Shangaan (all questionnaires were checked with back-translation), and adolescents chose their language of participation.

Ethical protocols were approved by the Universities of Oxford, Cape Town and KwaZulu-Natal, and Provincial Health and Education Departments of Western Cape and Mpumalanga. All interviewers were trained in working with vulnerable youth, and voluntary informed consent was obtained from adolescents and primary caregivers. No incentives were given, apart from refreshments and certificates of participation. Confidentiality was maintained, except where participants were at risk of significant harm or requested assistance. Where participants reported recent abuse, rape, suicidal behavior or risk of significant harm, immediate referrals were made to

child protection and health services, with follow-up support including transport assistance for children to access services and identification of NGOs that could provide longer-term support. For past abuse or rape, referrals and support in accessing HIV/AIDS and counseling services were provided. Throughout the study, approximately 600 referrals were made (including for non-receipt of social welfare grants etc), but in many contexts services were under-staffed and overburdened and thus adolescents did not receive adequate long-term support.

MEASURES

Outcome: *Suicidal behavior* was measured with the MINI International Psychiatric Interview for Children and Adolescents suicidality scale,[12] measuring self-harming desire, suicidal thoughts, ideation, planning and attempts. This scale is well-validated, showing strong internal consistency and test-retest reliability[13] with an acceptable alpha of .73 in the current sample.

Predictors: Adverse childhood experiences *Parental AIDS-death and AIDS-illness* were determined using Verbal Autopsy methods,[14] validated in South Africa with sensitivity of 89% and specificity 93%.[15] In the current study, determination of HIV/AIDS required reported HIV+ status with CD4 count <350, or a conservative threshold of ≥ 3 AIDS-defining illnesses; e.g. Kaposi's sarcoma or shingles.

Orphanhood used UNICEF definitions of loss of one or both parents. *Parental death by homicide* used qualitative child report alongside a checklist of causes of mortality.

Abuse was measured using UNICEF scales for sub-Saharan Africa.[16] 'Severe emotional abuse' used a conservative cut-off of weekly/more frequent exposure to verbal abuse, threats of eviction, or invoking evil spirits against children. 'Severe physical abuse' used a conservative cut-off of weekly/more frequent beating with an

object or deliberate harm. *Contact sexual abuse* was rape or unwanted contact with ‘private parts’ of the adolescent or abusing adult. *Domestic violence* used past-week frequency of adults hitting each other in the home. *Community violence exposure* used the Child Exposure to Community Violence Checklist,[17] adapted to the four most common community traumas for children in South Africa,[18] coded as victimization by any of: assault, robbery, and witnessing of stabbings and shootings. *Food insecurity* was measured using items from the National Food Consumption Survey[19] and determined as insufficient food for >2 days in the past week.

Socio-demographic factors included *urban/rural location, child gender, age, province and formal/informal home*. *Household socio-economic status* was measured using an index of access to the eight highest socially-perceived childhood necessities, corroborated by >80% of the population in the nationally representative SA Social Attitudes Survey (school fees; school uniform; school books; a visit to the doctor and medicine when ill; clothes to keep warm and dry; two pairs of shoes; three meals a day; toiletries to be able to wash every day).[20]

Table 1. Sample characteristics at baseline and follow up

Potential mediators *Depression* (past 2 weeks) was measured with the Child Depression Inventory Short Form, which highly correlated with the full scale ($r=.89$).[21] Reliability in the current sample was $\alpha=.73$. *Anxiety* (past 2 weeks) used the Revised Children’s Manifest Anxiety Scale,[22] validated for use in South Africa,[23] with the 14 highest loading items identified through factor analysis in a previous study[11] (current sample: $\alpha=.84$). *Post-traumatic stress* (past month) was

measured using the Child PTSD Checklist,[24] validated in South Africa[25] (current sample $\alpha=.94$). Due to differing item numbers, scores were standardized and summed into a single scale. *Alcohol and drug misuse* were measured using 15 items adapted from the ‘National Survey of HIV and Risk Behavior amongst Young South Africans’.[26] This measured past-month regularity of alcohol use, coded as misuse if daily/several times a week, and past-year use of any drug, such as marijuana, mandrax or crystal methamphetamine. Alcohol and drug use scores were standardized and summed into a single scale.

ANALYSES

Firstly, youth lost and retained at follow-up assessment were compared on baseline sociodemographic characteristics and mental health and suicide-related variables. Secondly, frequency distributions for suicidal behavior, ACE and potential mediators were checked. Thirdly, categorical principal components analysis established that all predictors loaded onto a first component (eigenvalue = 1.8). Loadings for physical, emotional abuse and domestic violence, food insecurity and parental AIDS illness were $>.4$; sexual abuse and community violence were $>.25$; and parental death was $>.15$. This first component accounted for 19.5% of the total variance. A second component had an eigenvalue >1 (1.1, 12.5% variance), but merely served to set up a contrast between a subgroup of three variables,[27] and therefore only the first component was used for describing ACE.[28] The choice of the numerical analysis level provided equidistance between categories in the quantification.[29] A summative index with variables weighted by the component loadings correlated very closely with a simple summation of the dichotomies (Spearman's rho .95, $p<.001$), so the latter was adopted for ease of interpretation.[30] Due to low prevalence of >5

ACE, scores 6-9 were combined ($ACE > 5$). Fourthly, multivariate hierarchical logistic regression models were conducted to examine associations between ACE scores and subsequent suicidal behavior. Model 0 presents unadjusted coefficients. Model 1 adjusts for socio-demographic co-factors (child age, gender, province, urban/rural location, formal/informal home, socio-economic status). Model 2 additionally adjusts for baseline suicidal behavior in order to determine whether ACE score predicted suicidal behavior over and above prior suicidality. Cumulative odds ratios were calculated,[31] and cross-tabulations indicated percentage proportions in respective groups. Fifthly, to investigate potential mediating effects of mental health and substance use, a multiple mediation model was tested, using the PROCESS procedure developed by Preacher and Hayes.[32] Indirect effects and bias-corrected 95% CIs were estimated using 1000 bootstrap samples[33] (a resampling procedure with no imposed assumptions of distributional normality). Hayes argues that unstandardized coefficients are the preferred metric in causal modelling and therefore unstandardized coefficients are reported. As an additional check, significant indirect effects were also subsequently confirmed using Sobel tests. Missing data was $< 1\%$ and so imputation was not conducted.

RESULTS

At follow-up, 3% of adolescents were lost to follow-up, of which six had died (by homicide or illness, none to suicide).

Youth lost to follow-up did not differ with regard to gender [$\chi^2(1) = .07, p = .789$], suicidal ideation [$\chi^2(1) = 2.20, p = .138$], suicide planning [$\chi^2(1) = 2.01, p = .156$], or anxiety scores [$F(1, 3512) = 2.25, p = .134$] at baseline assessment. However, adolescents lost to follow-up were missing more basic necessities [$F(1, 3514) = 21.55, p < .001$], older [$F(1, 3512) = 6.44, p =$

.011], had higher depression scores [$F(1, 3512) = 8.98, p = .003$], and were more likely to have attempted suicide [$\chi^2(1) = 4.75, p = .029$] at baseline assessment. Although a follow-up rate of 96.70% after one year is extremely high, some of the most vulnerable participants were unable to be traced and results should be interpreted with this in mind. The sample was limited to youth assessed at both time points for all further analyses.

Rates of suicidality (Table 2) were 2.2% of boys and 4.1% of girls reporting past-month suicide attempts, 3.0% of boys and 6.3% of girls reporting past-month suicide planning and 5.6% of boys and 8.5% of girls reporting past-month suicide ideation. Of children reporting suicide ideation, 34% had attempted suicide in the past month, and of children reporting suicide planning, 43% had attempted suicide in the past month. Rates of baseline ACE exposure were comparable to other South African community samples. For example 13% of adolescents were orphaned by AIDS and 4.4% orphaned by homicide, 13% reported severe physical abuse and 24% went hungry for >2 days in the past week.

(Insert Table 2 approximately here)

Associations of ACE on subsequent suicide attempts

Logistic regression models (Table 3) showed that prior to any adjustments, baseline ACE score strongly predicted suicide attempts one year later (Model 0: OR 1.25; CI 1.10-1.42; $p < .001$). ACE score remained a significant predictor after controlling for socio-demographic co-factors (Model 1: OR 1.24; CI 1.08-1.44; $p = .003$). Importantly,

this relationship was maintained when additionally controlling for baseline suicide attempts (Model 2: OR 1.16; CI 1.00-1.35; $p=.047$). After controlling for baseline suicide attempts and socio-demographics, the cumulative odds ratio (i.e. comparing 0 ACE to >5 ACE) prospectively predicting suicide attempts was 2.46 (CI 1.00-6.05). Cross-tabulated observed scores showed a strongly graded relationship between baseline cumulative ACE and follow-up suicide attempts, with rates of past-month suicide attempts rising from 1.9% with none of the identified ACE, to 6.3% with more than five.

Associations of ACE on subsequent suicide planning

Logistic regression models (Table 3) showed that ACE score strongly predicted suicide planning one year later, after controlling for socio-demographic co-factors and baseline suicide planning (Model 0: OR 1.33, CI 1.20-1.47, $p<.001$; Model 1: OR 1.35, CI 1.20-1.52, $p<.001$; Model 2: OR 1.28, CI 1.13-1.45, $p<.001$). After controlling for baseline suicide planning and socio-demographics, the cumulative OR prospectively predicting suicide planning was 4.40 (CI 2.08-9.29). Cross-tabulated observed scores showed a strongly graded relationship between baseline cumulative ACE and follow-up suicide planning, with rates of past-month suicide planning rising from 2.4% among children with no identified ACE, to 12.5% among those with more than five.

Associations of ACE on subsequent suicide ideation

Logistic regression models (Table 3) showed that baseline ACE score strongly predicted suicide ideation one year later, after controlling for socio-demographic co-factors and additionally controlling for baseline suicide ideation (Model 0: OR 1.26,

CI 1.15-1.38, $p < .001$; Model 1: OR 1.25, CI 1.13-1.38, $p < .001$; Model 2: OR 1.20, CI 1.09-1.33, $p < .001$). After controlling for baseline suicide ideation and socio-demographics, the cumulative OR prospectively predicting suicide ideation was 2.99 (CI 1.68-5.53). Cross-tabulated observed scores showed a strongly graded relationship between baseline cumulative ACE and follow-up suicide ideation, with rates of past-month suicide ideation rising from 4.2% among children with no identified ACE, to 15.6% among those with more than five.

(Insert Table 3 approximately here)

Hypothesized mediators

(Figure 1) There was a significant indirect effect of ACE on all subsequent suicide behaviours via mental health (suicide attempts: $B = .112$, CI .052-.174, $z = 3.792$, $p < .001$; suicide planning: $B = .087$, CI .033-.139, $z = 3.580$, $p < .001$; suicide ideation: $B = .124$, CI .087-.167, $z = 5.963$, $p < .001$). There were no associations between drug/alcohol misuse and suicide behaviours, and this did not mediate the relationship between ACE and any suicide behaviours (suicide attempts: $B = .009$, CI -.009-.025; $z = 1.165$, $p < .244$; suicide planning: $B = .009$, CI -.005-.022, $z = 1.406$, $p = .16$; suicide ideation: $B = .007$, CI .003-.018, $z = 1.310$, $p = .190$). In addition, there was a direct effect of ACE on suicide planning ($B = .158$, SE=.067, $p = .019$), but not on suicide attempts ($B = .042$, SE=.081, $p = .605$) or ideation ($B = .056$, SE=.056, $p = .320$). The total effect of ACE on suicide attempts was $B = .162$, on suicide planning was $B = .254$, and on suicide ideation was $B = .187$. Cross-tabulation was used to illustrate effects: rates of any suicidal behavior for adolescents with no ACE and no mental health disorder were

4.5% (5.7% for boys and 4.1% for girls), and with >5 ACE and a mental health disorder were 25.0% (22.2% for boys and 27.3% for girls).

(Insert Figure 1 approximately here)

DISCUSSION

This is the first known large-scale, prospective study of childhood suicidal behavior in sub-Saharan Africa. Findings echo the US ACE study, where cumulative exposure to adversities predicted childhood and adult suicide attempts, but with three valuable additions: 1) prospective longitudinal design, allowing assessment of direction of association; 2) corresponding control for baseline suicidality, giving odds ratios that are adjusted downwards for a key behavioral predictor; and 3) demonstration that mental health mediates the relationship between ACE and suicidal behavior.[34] This sub-Saharan African sample suggested higher rates of suicidal behaviour than in the US ACE study: 3.2% of children reported past-month suicide attempts, compared to 3.8% reporting lifetime suicide attempts in the US sample. Both studies, as also demonstrated internationally, found higher rates of suicidality amongst females, but international evidence suggests more completed suicides amongst males, with South African hospital data showing a 3:1 female to male ratio for non-fatal suicide attempts, but a 5:1 male to female ratio for fatal suicides [2]. These suggest that, although there were very few gender differences in exposure to ACE, there are potential differences in their impacts on suicidality.

It is important to note that the vast majority of children in this South African sample, even those experiencing multiple concurrent adverse experiences, were not suicidal,

and no fatal suicide attempts were found over the year follow-up. However, for the minority who report suicidal behavior, it is essential to identify and interrupt pathways of risk. These findings suggest four important foci of interventions: preventing exposure to cumulative adversities; promoting resilience amongst those who have already experienced adversities; targeting interventions for children or adolescents who are experiencing mental health problems or suicidal behavior, and identifying adolescents at potential risk.

Preventing exposure to adversities: Findings show a strong, graded relationship between cumulative ACE exposure and subsequent suicidality, even when controlling for prior suicidality. This suggests that interventions that reduce or mitigate the effects of social, familial and HIV-related adversities may be protective against childhood suicide behavior. Fortunately, a strong intervention evidence-base exists for many identified ACE: for example, the effectiveness of antiretroviral treatment in reducing AIDS-related morbidity and mortality, and of regular cash transfers for reducing household food insecurity.[35] For other identified ACE, there is an emerging evidence-base in developing world contexts, for example a number of new studies are testing effectiveness of parenting support programmes to reduce abusive parenting.[36] To date, all these evidence-based interventions face major challenges in resourcing and scale-up, but the high rates of ACE such as hunger and parental AIDS-illness suggest the need for urgent intervention at scale.

Promoting resilience amongst adversity-exposed children: For those who have already experienced multiple adversities, it is essential to identify and promote modifiable predictors of resilience. Developed-world suicide research with adults

experiencing abuse, violence and HIV/AIDS-related trauma suggests protective effects of family social support and HIV-status disclosure[37]. Studies with AIDS-affected and abused children suggest resilience-promotion through parental monitoring, disclosure, social support, and family-based interventions.[38] Further research is required to identify protective factors against childhood suicidality within sub-Saharan Africa.

Mental health and suicide prevention services: Findings also showed that the relationship between ACE and later suicidal behavior was mediated by internalizing mental health problems. It is well-established that most completed suicides have experienced depression, anxiety or post-traumatic symptoms, and many have reported previous suicidal ideation or behaviour.[39] This has clear implications for mental health policy, suggesting the importance of screening for mental health problems and suicidality amongst adversity-exposed children. Furthermore, accessible and effective child and adolescent mental health and suicide prevention services may be essential components in reducing youth suicidality in sub-Saharan Africa.[2, 40].

Identifying adolescents at risk: These findings may also be of use in identifying adolescents who may be at risk of suicide attempt to practitioners in school, health and social services and non-governmental organization settings. A quarter of adolescents with >5 ACE and a mental health disorder also reported suicidal behavior. When young people present with multiple adverse home circumstances, it could be valuable to screen for possible associated internalizing mental health problems, and if these are present to ask about suicidal ideation and behavior. For those adolescents who report past suicidal attempt, the findings of this paper suggests that likelihood of

future attempts are greatly increased.

This study has a number of limitations. Firstly, the randomly-selected communities did not include any prisons, children's institutions or psychiatric hospitals, and further research should examine risk and protective factors in these high-risk settings.

Secondly, all health districts were high HIV-prevalence, and thus low-income areas in the South African context. Therefore, generalizability is not known to low HIV-prevalence or high-income population groups. However, the study benefited from within-sample variation, including urban and rural sites in two provinces, and five language groups. Additionally, door-to-door household sampling ensured inclusion of non school-attending children, who are particularly vulnerable to ACE. Thirdly, there are no validated cut-offs for psychological disorder using standardized scales in South Africa, and the use of Western norms should be interpreted with caution. Fourthly, although this is the first known sub-Saharan African study to collect prospective data on predictors of childhood suicide, the longitudinal sample is limited to one year. There would be great value in longer-term prospective studies of suicidal behavior, ideally following children and adolescents into adulthood. In addition, future research should examine particular ages when children and adolescents exposed to adversities are at highest risk of suicidal behavior, as well as potential influences of recency and chronicity of adverse experiences. Finally, further research is needed to understand the processes by which familial HIV/AIDS may cause or worsen other adverse childhood experiences, and potential differing effects of AIDS-orphanhood, living with AIDS-unwell family members, and being HIV-infected.

Despite these limitations, this study provides compelling evidence to inform suicide prevention approaches for children and adolescents in sub-Saharan Africa.

Interventions with potential to reduce child suicidality include those improving family functioning, reducing poverty, mitigating the impacts of HIV/AIDS and the provision of effective mental health services for adversity-exposed children.

1. Bertolote J, Fleischmann A. A global perspective on the magnitude of suicide mortality. In: Wasserman DWC, ed. *Oxford Textbook of Suicidology and Suicide Prevention: A Global Perspective*. Oxford: Oxford University Press; 2009:91-8.
2. Schlebusch L. Suicide prevention: a proposed national strategy for South Africa. *Afr J Psychiatry (Johannesbg)* 2012;15(6):436-40.
3. Hawton K, Bergen H, Kapur N, et al. Repetition of self-harm and suicide following self-harm in children and adolescents: findings from the Multicentre Study of Self-harm in England. *J Child Psychol Psychiatry* 2012;53(12):1212-9.
4. Miller AB, Esposito-Smythers C, Weismore JT, Renshaw KD. The relation between child maltreatment and adolescent suicidal behavior: a systematic review and critical examination of the literature. *Clin Child Fam Psychol Rev* 2013; 16(2): 146-72.
5. Dube SR, Anda RF, Felitti VJ, Chapman DP, Williamson DF, Giles WH. Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study. *JAMA* 2001; 286(24): 3089-96.

6. Cluver L, Orkin M, Boyes ME, Sherr L, Makasi D, Nikelo J. Pathways from parental AIDS to child psychological, educational and sexual risk: Developing an empirically-based interactive theoretical model. *Soc Sci Med* 2013; 87: 185-93.
7. Skovdal M, Ogutu VO, Aoro C, Campbell C. Young Carers as Social Actors: Coping Strategies of Children Caring for Ailing or Ageing Guardians in Western Kenya. *Soc Sci Med* 2010.
8. Jewkes R, Dunkle K, Nduna M, Jama P, Puren A. Associations between childhood adversity and depression, substance abuse and HIV and HSV2 incident infections in rural South African youth. *Child Abuse Negl.* 2010; 34(11): 833-41.
9. Gureje O, Kola L, Uwakwe R, Udofia O, Wakil A, Afolabi E. The profile and risks of suicidal behaviours in the Nigerian Survey of Mental Health and Well-Being. *Psychol Med* 2007; 37(6): 821-30.
10. Brown DW, Riley L, Butchart A, Meddings DR, Kann L, Harvey AP. Exposure to physical and sexual violence and adverse health behaviours in African children: results from the Global School-based Student Health Survey. *Bull World Health Organ* 2009; 87(6): 447-55.
11. Cluver L, Gardner F, Operario D. Psychological distress amongst AIDS-orphaned children in urban South Africa. *J Child Psychol and Psychiatry* 2007; 48(8): 755-63.
12. Sheehan D, Shytle D, Milo K. MINI KID: Mini International Neuropsychiatric Interview for Children and Adolescents. English Version 4.0: University of South Florida, Tampa and Hopital de la Salpetriere, Paris, 2004.
13. Lecrubier Y, Sheehan D, Weiller E, et al. The MINI International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI. *Eur Psychiatry* 1997; 12: 224-31.

14. Lopman B, Barnabas R, Boerma T, et al. Creating and Validating an Algorithm to Measure AIDS Mortality in the Adult Population using Verbal Autopsy. *Public Library of Science Medicine* 2006; 3(8): 1273-81.
15. Kahn K, Tollman S, Garenne M, Gear J. Validation and application of verbal autopsies in a rural area of South Africa. *Tropical Medicine and International Health* 2000; 5: 824–31.
16. Snider L, Dawes A. Psychosocial Vulnerability and Resilience Measures For National-Level Monitoring of Orphans and Other Vulnerable Children: Recommendations for Revision of the UNICEF Psychological Indicator. Cape Town: UNICEF, 2006.
17. Richters J, Martinez P. The NIMH Community Violence Project: 1. Children as victims of and witnesses to violence. *Psychiatry* 1993; 56(1): 7-21.
18. SAPS Strategic Management. Annual Report of the South African Police Service 2004/2005. Johannesburg, 2005.
19. Labadarios D, Maunder E, Steyn N, et al. National food consumption survey in children aged 1-9 years: South Africa 1999. *Forum Nutr* 2003; 56: 106-9.
20. Pillay U, Roberts B, Rule S, editors. South African social attitudes: changing times, diverse voices. Cape Town: HSRC Press; 2006.
21. Kovacs M. Children's Depression Inventory. Niagra Falls, NY: Multi-health Systems; 1992.
22. Reynolds C, Paget K. National normative and reliability data for the Revised Children's Manifest Anxiety Scale. *School Psych Rev* 1983; 12(3): 324-36.
23. Boyes M, Cluver L. Performance of the Revised Children's Manifest Anxiety Scale in a Sample of Children and Adolescents from Poor Urban Communities in Cape Town. *Eur J of Psychol Assess* 2012; DOI: 10.1027/1015-5759/a000134.

24. Amaya-Jackson L. Child PTSD Checklist. North Carolina: Duke Treatment Service, 1995.
25. Boyes M, Cluver L, Gardner F. The Child PTSD Checklist in a South African sample: Reliability, convergent validity, and an examination of PTSD symptom structure. *PloS one* 2013; 7: e46905.
26. Pettifor A, Rees H, Kleinschmidt I, et al. Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey. *Aids* 2003; 19(14): 1525-34.
27. Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. *Health Policy Plan* 2006; 21(6): 459-68.
28. Howe LD, Hargreaves JR, Huttly SR. Issues in the construction of wealth indices for the measurement of socio-economic position in low-income countries. *Emerg Themes Epidemiol* 2008; 5: 3.
29. Linting M, van der Kooij A. Nonlinear principal components analysis with CATPCA: a tutorial. *J Pers Assess* 2012; 94(1): 12-25.
30. Manisera M, Van der Kooij A, Dusseldorp E. Identifying the component structure of satisfaction scales by nonlinear principal components analysis. *Quality Technology and quantitative management* 2010; 7(2): 97-115.
31. Cohen J, Cohen P, West S, Aiken L. Applied multiple regression/correlation analysis for the behavioural sciences. London: Lawrence Erlbaum Associates; 2003.
32. Hayes, A. Introduction to Mediation, Moderation and Conditional Process Analysis. New York: Guilford Press, 2012.
33. MacKinnon DP, Lockwood CM, Williams J. Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Beh Res* 2004; 39(1): 99-128.

34. Collins PY, Patel V, Joestl SS, et al. Grand challenges in global mental health. *Nature* 2011; 475(7354): 27-30.
35. Richter L, Sherr L, Adato M, et al. Strengthening families to support children affected by HIV and AIDS. *AIDS Care* 2009; 21(S1): 3-12.
36. Knerr W, Gardner F, Cluver L. Improving Positive Parenting Skills and Reducing Harsh and Abusive Parenting in Low- and Middle-Income Countries: A Systematic Review. *Prevention Sci* 2013.
37. Sherr L, Lampe F, Fisher M, et al. Suicidal ideation in UK HIV clinic attenders. *Aids* 2008; 22(13): 1651-8.
38. Eloff I, Finestone M, Makin, J D, et al. A randomized clinical trial of an intervention to promote resilience in young children of HIV-positive mothers in South Africa. *Aids*, (2014). 28, 10. doi: doi:10.1097/QAD.0000000000000335
39. Catalan J, Harding R, Sibley E, Clucas C, Croome N, Sherr L. HIV infection and mental health: suicidal behaviour--systematic review. *Psychol Health Med* 2011; 16(5): 588-611.
40. Mishara BL. Reconciling clinical experience with evidence-based knowledge in suicide prevention policy and practice. *Crisis* 2008; 29(1): 1-3.