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Prevalence of prenatal and postpartum depression and associated factors among HIV-infected women in public primary care in rural South Africa: a longitudinal study

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Abstract

This study aimed to assess the longitudinal prevalence of prenatal and postnatal depression and associated factors among HIV-infected women in rural South Africa. In a longitudinal, cluster-randomized, prevention of mother to child transmission (PMTCT) intervention trial, 681 HIV-infected prenatal women in 12 community health centres in Mpumalanga province, South Africa, were recruited in 2015 by consecutive sampling at 8–24 weeks pregnancy and followed up at 32 weeks prenatally, and 6 and 12 months postpartum (retention rate = 59.2%). Results indicate that at baseline, 48.7% of the women screened positive for depression (scores of ≥13 on the "Edinburgh Postnatal Depression Scale 10"), while postnatally (at 12 months) the prevalence was 35.6%. Mothers who did not have depression before or after were 205 (50.1%), those who had depression before and after were 58 (14.4%), those who had depression only before were 81 (20.1%), and those who had depression only after were 59 (14.6%). In multinominal logistic regression analyses, less education and physical and psychological intimate partner violence were associated with sustained perinatal depression. Participation in the PMTCT intervention was associated with remitting depression while alcohol use was associated with the onset of postnatal depression. Using generalized linear mixed models in longitudinal analyses, psychological partner violence, lack of male involvement during pregnancy and non-adherence to antiretroviral treatment were associated with depression. In conclusion, a high pre- and postnatal prevalence of depression was found highlighting the utility of interventions to address prevention and treatment of perinatal depression.

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Disclosure statement

No potential conflict of interest was reported by the authors.

Keywords

Antenatal care; postnatal care; HIV; depression; longitudinal study; South Africa

Introduction

Globally, the prevalence of perinatal depression has been estimated to be 11.9% (Woody, Ferrari, Siskind, White-ford, & Harris, 2017). Among HIV-infected women in Africa, a review of antenatal depression found a weighted mean prevalence of 23.4% (and suspected antenatal depression of 43.5%) and of 22.5% with postnatal depression (suspected postnatal depression of 31.1%), though no reported incidence rates of depression (Sowa, Cholera, Pence, & Gaynes, 2015). A global review of longitudinal studies of depression found an average rate of antenatal depression of 17% and of postnatal depression of 13% (Underwood, Waldie, D'Souza, Peterson, & Morton, 2016). On average, 39% with antenatal depression reported postnatal depression, and 47% with postnatal depression reported previous antenatal depression, suggesting that postnatal depression may be a continuation of antenatal depression (Underwood et al., 2016). Untreated antenatal depression is associated with poor pregnancy outcomes and untreated postnatal depression may lead to severe health consequences to both the infant and the mother (Sowa et al., 2015).

Risk factors for perinatal depression in HIV-infected women in South Africa, as reviewed in Peltzer, Rodriguez, and Jones (2016), may include sociodemographic factors (younger age, single marital status, financial insecurity, and low socioeconomic status), health-related risk factors (poorer physical health, having had a previous depressive episode), and psychosocial variables (low self-esteem, perceived stress, social isolation, lack of social support, lack of partner support, unplanned pregnancy, and experience of emotional and physical intimate partner violence). In addition, poor antiretroviral (ARV) medication adherence, decreased time on ART and poor treatment outcomes have been associated with depressive symptoms (Peltzer & Shikwane, 2011).

Little is known regarding factors associated with the potential resolution of antenatal depression or the development of postnatal depression in women in rural South Africa. The present study aimed to address the longitudinal prevalence of prenatal and postnatal depressive symptoms and associated factors in perinatal HIV-infected women in community health care centre facilities in Mpumalanga province, South Africa.

Method

Study design

This study was drawn from an ongoing longitudinal PMTCT clinic-randomized controlled trial with two assessments occurring prenatally (8–24 and 32 weeks pregnant) and two assessments postnatally (6 and 12 months). The trial was designed to enhance uptake of the prevention of mother to child transmission (PMTCT) protocol, and was conducted in 12 community health centres in Gert Sibande and Nkangala districts in Mpumalanga province, South Africa. The intervention condition received a six session structured behavioural risk-

reduction programme targeting the prevention of vertical transmission, adherence to PMTCT and medication use, HIV testing of family members, prevention of HIV transmission and stigma, serostatus disclosure, partner communication, intimate partner violence (IPV) reduction, safe infant feeding, safer conception, family planning and dual method sexual barrier use (see Jones et al., 2014, for protocol details).

Sample and procedure

Eligible women were HIV-seropositive pregnant women between 8 and 24 weeks pregnant, the typical time of entry into antenatal care, and aged 18 years or older, with partners. Candidates agreeing to participate were enrolled following provision of written informed consent in 2015. There were no exclusions based on literacy as all assessments were administered using an audio computer assisted self-interview (ACASI) system.

After enrollment, all women were assessed in their preferred language (English, isiZulu, or seSotho) using ACASI to enhance disclosure, accommodate all levels of literacy and reduce interviewer bias. To familiarize participants with the computer system, assessors completed the demographic component of the questionnaire with participants prior to completion of all other assessments, and the on-site assessor was available to assist where necessary and answer any questions.

Ethical approval was granted by the Human Sciences Research Council (HSRC) Research Ethics Committee (REC), protocol approval number REC4/21/08/13. Study approval was also obtained from the Department of Health and Welfare, Mpumalanga Provincial Government, South Africa and the University of Miami Miller School of Medicine Institutional Review Board (IRB ID: 20130238), and the study was registered as a clinical trial on clinicaltrials.gov, number NCT02085356.

Measures

Depression was assessed using the “Edinburgh Postnatal Depression Scale 10” (EPDS-10; Cox, Holden, & Sagovsky, 1987), which was adapted for perinatal depression. The EDPS-10 is a 10-item instrument in which participants rate how often they have experienced depressive symptoms in the past 7 days. Scores range from 0 through 30; the validated cut-off score for South African populations is 12 (Lawrie, Hofmeyr, de Jager, & Berk, 1998). Cronbach alpha for the EDPS-10 scale ranged from 0.66 at baseline, 0.70 6 weeks, and 0.67 at 6 and 12 months postpartum.

Sociodemographic factors assessed included, age, formal education, employment status, income, partner status and alcohol use. *Reproductive issues* assessed included current number of children and planning of the current pregnancy (Jones et al., 2014). *HIV-specific issues* assessed included date of HIV diagnosis, months since ART initiation, and HIV status of children (Jones et al., 2014). *Partner-specific issues* assessed included disclosure of HIV status to partner, HIV status of partner, condom use, male involvement and intimate partner violence (Jones et al., 2014).

Intimate partner violence (IPV) was assessed using an adaptation of the Conflict Tactics Scale 18 (CTS-18; Straus, 1979), which included a 9-item partner psychological

victimization subscale (Cronbach alpha 0.76, 0.66, 0.83 and 0.83, respectively, at the two prenatal and two postnatal assessment points), and 9-item partner physical violence subscale (Cronbach alpha 0.92, 0.89, 0.94 and 0.94 at the four assessment points). In this study respondents indicated the number of times in the past month their partner has engaged in specific behaviours, ranging from 0 (Never) to 6 (More than 20 times).

Male involvement was assessed using a "Male Involvement Index" (Jones et al., 2014), comprised of 11 items related to the participant's partner's involvement in the antenatal period. Questions included "Does your male partner attend antenatal care visits with you?" And "Have you discussed antenatal HIV prevention for your baby with your male partner?" Participants responded to each item as 1 (Yes) or 0 (No), and scores ranged from 0 to 11. (Cronbach alpha 0.83, 0.82, 0.84 and 0.82, respectively, at the two prenatal and two post-natal assessment points).

Stigma was assessed using the "AIDS-Related Stigma Scale" (Kalichman et al., 2005), a 9-item scale including, e.g., "People who have AIDS should be ashamed." Response options were 0 = disagree or 1 = agree, with a scores range of 0 to 9, where higher scores indicate greater levels of stigma. The reversed coded item for this scale ("It is safe for people who have AIDS to work with children") was excluded given the scale's poor internal reliability ($\alpha = 0.58$) with its inclusion. Excluding the item, reliability was adequate ($\alpha = 0.74$).

Antiretroviral adherence was assessed by the number of self-reported antiretroviral medication doses skipped in the past week. Participants responses were dichotomized into a score of 0, no skipped medication in the past week or 1, skipped medication in the past week.

Data analysis—Statistical analyses included descriptive statistics (such as means, standard deviations, frequencies and percentages), as well as t-tests or non-parametric tests and chi-square tests. Multinomial logistic regression was used by comparing prenatal depression prevalence with 12 months postnatal depression. The dependent variable consisted of women having no prenatal and no postnatal depression at 12 months follow-up (reference category), women with prenatal and postnatal depression at time 1 and 2, women who developed depression from time 1 to time 2, and women who changed from prenatal depression at baseline to no longer having postnatal depression at 12 months follow-up. Longitudinal analyses were conducted with depression at four assessment points from prenatal to postnatal period as dependent variable; two separate models were estimated for time-varying and time-invariant predictors of change in depression. Using a logit link function, Latent Growth Curve Model (LGCM; Wickrama, Lee, O'Neal, & Lorenz, 2016) was used to investigate the longitudinal change in depression over four timepoints. Then, to estimate unbiased longitudinal change (i.e., Rate of change) in depression, we specified a series of time invarying (Baseline characteristics) and varying covariates to the LGCM. Odds ratios were estimated as effect sizes (Allen & Le, 2008). Estimated effects are reported with 95% confidence intervals. Missing data was handled using multiple imputation technique (Asparouhov & Muthén, 2010), specifying ten imputed datasets. All data analyses were conducted using Mplus (version 7.4) (Muthén & Muthén, 2014).

Results

Sample characteristics at baseline

In all, 681 women living with HIV were enrolled during pregnancy (8–24 weeks) and completed assessments at baseline; 47.6% of the sample completed assessments at 32 weeks prenatally, 50.6% at 6 months and 59.2% at 12 months postnatally.

The mean age of the women was 28.3 (SD = 5.7) years, with a range of 18–46 years. The majority (78.3%) had 10 years or more of education, 82.5% were not employed, 54.8% had a monthly income of less than 600 South African Rand, and 40.9% were married or cohabiting. Most (79.6%) participants had one or more children, and for more than half (53.0%), the current pregnancy had not been planned.

More than half (53.9%) were diagnosed with HIV in their current pregnancy, and 59.0% reported that they had disclosed their HIV status to their partner. Among those women who had children, 5.4% knew that they had an HIV-infected child. Two-thirds (67.1%) reported they had not skipped any of their medication in past week. Almost half of the women (48.9%) had not used a condom at their last sexual intercourse, and 13.7% reported that they had drunk three or more alcoholic beverages on at least one occasion in the past month (see Table 1). As outlined in Table 1, screened depression was associated with factors associated with the ability to support a baby and relationship, e.g., Lower income, previous infant with HIV, lack of male partner involvement, unplanned pregnancy, intimate partner violence. Behavioural factors associated with screened depression included alcohol use and adherence to medication.

Attrition analyses

Attrition analyses indicated that more educated participants (odds ratio [OR] = .82, $p < .01$), and those with an HIV infected infant (OR = .64, $p < .10$) were less likely to drop out of the study; these two variables were included as covariates in the final analyses evaluating associations with unprotected sex and condom use. Participants' age, monthly income, having an HIV infected partner, disclosure of serostatus to partner, depression status, and relationship status were not associated with attrition.

Depression ante-and post-natally

Prenatally (at 8–24 weeks), the prevalence of depression was 48.7%, while at 12 months postnatal, the prevalence was 35.6%. Of those who experienced antenatal depression, 81 (20.1%) continued to have postnatal depression (at 12 months), 59 (14.6%) developed depression postnatally (incidence depression) and 106 (26.3%) who had experienced antenatal depression reported no experience of depression postnatally; 39.0% ($n = 267$) did not report depression at either time point.

In multinominal logistic regression analyses, less education and physical and psychological intimate partner violence were associated with unremitting depression. Participation in the PMTCT intervention and adherence to antiretroviral therapy were associated with remission

of depression, while alcohol use was associated with the incidence of depression (see Table 2).

Using longitudinal analyses, in Model 1, which included time-invariant predictors of depression assessed over four time periods, older age, higher education, being employed, having less income, being married or cohabiting, unplanned pregnancy, being diagnosed with HIV during the current pregnancy, time on ART, having an HIV-infected child, having an HIV-infected partner, alcohol use and having experienced AIDS stigma were associated with depression. In Model 2, which included time-varying covariates, lack of male involvement, psychological intimate partner violence and non-adherence to ART were associated with depression (see Table 3).

Discussion

This study of perinatal depression among HIV-infected women in rural South Africa found almost half of women screened to have symptoms of prenatal depression and more than one third to have symptoms of postnatal depression at 12-months postpartum, comparable with previous studies in Africa (Sowa et al., 2015). The study provides additional evidence that rates of depression are higher during pregnancy than in the first year following childbirth, as previously found (Underwood et al., 2016), and that many women who experienced antenatal depression also experienced postnatal depression. A significant proportion of women developed depression postnatally (incidence depression), while just over a quarter of women reported remission of symptoms of depression postnatally. Importantly, participation in an enhanced PMTCT intervention that included information on stress management was associated with a reduction in the prevalence of symptoms of depression post-partum among those already depressed, while alcohol use was associated with the occurrence of new cases. Women's concerns about the health of their unborn infant may have also contributed to depression in women having an HIV-infected child (Kwalombota, 2002). Results support the development and implementation of interventions targeting stress reduction and information on healthy pregnancy among HIV-infected women in rural South African communities.

Persistent depression was associated with psychological intimate partner violence, lack of male involvement, and non-adherence to antiretroviral therapy, all of which have been previously associated, e.g., Limited partner support and maternal depression (pre- and postnatally) (Pajuloa, Savonlahtia, Sourandera, Heleniusb, & Pihaa, 2001; Ramchandani, Richter, Stein, & Norris, 2009; Stapleton et al., 2012; Tomlinson, Swartz, Cooper, & Molteno, 2004). Depression has also been previously linked with intimate partner violence (Hartley et al., 2011; Kaaya et al., 2010; Stewart, Umar, Tomenson, & Creed, 2014). Further, the association identified between unplanned pregnancy and depression has also been previously reported (Hartley et al., 2011; Manikkam & Burns, 2012). For this highly vulnerable sample, the combined stressors of poverty, violence and unplanned pregnancy may represent overwhelming and depressing burdens, reducing motivation to be adherent to ART, as noted in previous studies (Nachega et al., 2012; Sheth et al., 2015). As also seen in earlier research, the internalized AIDS-related stigma continues to be associated with depression (Ashaba et al., 2017; Peltzer & Shikwane, 2011; Wight, 2000), and may contribute to this constellation of stressors.

These findings highlight the important role that partner dynamics play in influencing the well-being of HIV-infected mothers, both in reducing stress and/or creating it. Given the potential benefits of male partner involvement, the South African PMTCT protocol recommends promoting and increasing male involvement (Van den Berg et al., 2015). However, many women in this rural sample were exposed to physical and psychological violence. Interventions targeting men's involvement during pregnancy must address the reduction of IPV and its impact on the health of the family, both mother and child. This study of the prevalence, incidence, and risk factors for the development of perinatal depression in HIV-infected women suggests that interventions for the treatment of depression in HIV-infected women may be necessary but not sufficient to reduce depression, and should include men.

Although this study did not assess HIV in infected women, previous research comparing HIV uninflected versus infected women in rural South Africa suggests that they may have similar rates of depression (Rochat, Bland, Tomlinson, & Stein, 2013). Future research should focus on identifying interventions that may be effective for both groups of women and can be administered in an antenatal setting, as this may be a cost-effective strategy. Even though the present findings support the need for healthcare interventions aimed at preventing depression with a specific focus on IPV prevention, national-level campaigns are also needed to address the normalization of IPV against women arising from its high rates in South Africa (Beyer, Wallis, & Hamberger, 2015).

Study limitations

Study follow-up rates were lower than the original target and those previously achieved in our pilot studies, and results may have been influenced by self-selection among women who were followed to 12 months postpartum. The inclusion criteria for the study participants were limited to women who had a partner, preventing generalization to women without partners. The study also relied on self-report of depression not verified by a diagnostic interview, and women may have over reported depression (Sowa et al., 2015). Finally, having an existing history of depression (Kaaya et al., 2010; Manikkam & Burns, 2012) and perceived stress (Blaney et al., 2004) were not assessed in this study but should be assessed in future studies.

Conclusion

The study found a high prevalence of prenatal and post-natal depression and several associated factors of perinatal depression among HIV-infected women. The development of specific interventions could target partner involvement, partner violence, alcohol use, the role of depression in non-adherence and stress management. Screening for perinatal depression and access to mental health interventions should be promoted.

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Table 1

Depression by socioeconomic, reproductive, HIV, partner and mental health characteristics prenatal at baseline ($N = 681$).

Characteristic	All Mean (SD) *n*(%)	Not Depressed (*n* = 349) Mean (SD) *n*(%)	Depressed (*n* = 332) Mean (SD) *n* (%)	*p*
Socioeconomic status				
Age	28.40 (5.71)	28.42 (5.66)	28.37 (5.77)	0.12, 0.903
Education				
Grade 0–9	148 (21.7%)	68 (19.5%)	80 (24.1%)	
Grade 10–11	339 (49.8%)	162 (46.4%)	177 (53.3%)	
Grade 12 or more	194 (28.5%)	119 (34.1%)	75 (22.6%)	**11.20, 0.004**
Employed				
No	562 (82.5%)	277 (79.4%)	285 (85.8%)	
Yes	119 (17.5%)	72 (20.6%)	47 (14.2%)	**4.95, 0.026**
Monthly household income (South African Rand)				
<600 (~ $50)	373 (54.8%)	176 (50.4%)	197 (59.3%)	
≥600	306 (45.2%)	173 (49.6%)	135 (40.7%)	**5.45, 0.020**
Relationship Status				
Unmarried, living separate	403 (59.2%)	198 (56.7%)	205 (61.7%)	
Unmarried, living together	153 (22.5%)	79 (22.6%)	74 (22.3%)	
Married	125 (18.4%)	72 (20.6%)	53 (16.0%)	2.75, 0.253
Reproductive issues				
Number of children				
None	139 (20.4%)	76 (21.8%)	63 (19.0%)	
One or more	542 (79.6%)	273 (78.2%)	269 (81.0%)	0.821, 0.365
Pregnancy unplanned				
No	134 (47.0%)	186 (53.3%)	134 (40.4%)	
Yes	361 (53.0%)	163 (46.7%)	198 (59.6%)	**11.43, 0.001**
HIV issues				
Diagnosed during this pregnancy				
No	153 (46.1%)	314 (46.1%)	153 (46.1%)	
Yes	179 (53.9%)	367 (53.9%)	179 (53.9%)	0.00, 0.990
Months since ART initiation	13.27 (24.35)	13.82 (25.05)	12.69 (23.62)	0.65, 0.516[a]
HIV serostatus of children				
Negative/Do not know	513 (94.6%)	252 (92.3%)	261 (97.0%)	
Yes	29 (5.4%)	21 (7.7%)	8 (3.0%)	**5.96, 0.015**
Partner issues				
Disclosure of serostatus (to partner)				
No	279 (41.0%)	132 (37.8%)	147 (44.3%)	
Yes	402 (59.0%)	217 (62.2%)	185 (55.7%)	2.93, 0.087
HIV serostatus of spouse/partner				
Negative/Do not know	510 (74.9%)	252 (72.2%)	258 (77.7%)	

Characteristic	All Mean (SD) *n*(%)	Not Depressed (*n* = 349) Mean (SD) *n*(%)	Depressed (*n* = 332) Mean (SD) *n* (%)	*p*
Positive	171 (25.1%)	97 (27.8%)	74 (22.3%)	2.74, 0.098
Male Involvement	7.11 (3.07)	7.52 (2.88)	6.67 (3.20)	**3.65, <0.001**
Psychological Intimate Partner Violence	3.24 (5.31)	2.48 (4.85)	4.04 (5.66)	**5.62, <0.001**[a]
Physical Intimate Partner Violence	1.15 (3.68)	0.70 (2.72)	1.62 (4.34)	**4.20, <0.001**[a]
Alcohol use, stigma, adherence, and sexual risk behaviors				
Alcohol (>2 drinks last month)				
No	587 (86.2%)	310 (88.8%)	277 (834%)	
Yes	94 (13.8%)	39 (11.2%)	55 (16.6%)	**4.16, 0.041**
Stigma	1.33 (1.37)	1.18 (1.32)	1.48 (1.40)	3.55, <0.001
Adherent to ARVs				
No	224 (32.9%)	87 (24.9%)	137 (41.3%)	
Yes	457 (67.1%)	262 (75.1%)	195 (58.7%)	**20.57, <0.001**
Consistent condom use (past week)				
No	388 (57.0%)	199 (57.0%)	189 (56.9%)	
Yes	293 (43.0%)	150 (43.0%)	143 (43.1%)	0.001, 0.981
Noncondom use at last sex				
No	327 (48.9%)	146 (41.8%)	181 (54.5%)	
Yes	354 (52.0%)	203 (58.2%)	151 (45.5%)	**10.97, <0.001**
Study condition				
Standard of care	345 (50.7%)	194 (55.6%)	151 (45.5%)	
Enhanced intervention	336 (49.3%)	155 (44.4%)	181 (54.5%)	**6.95, 0.008**

[a]Mann-Whitney tests were used for median comparison of groups and chi-square tests for differences in proportions.

Table 2

Multinomial logistic regressions with “Stable no depression” (prenatal and 12 months postnatal) as reference group (n = 205)

	Stable Depression (n = 58)		Change to Depression (Incident epression) (n = 59)		Change to No Depression (n = 81)	
	OR [95% CI]	**AOR [95% CI]**	**OR [95% CI]**	**AOR [95% CI]**	**OR [95% CI]**	**AOR [95% CI]**
Fixed Effects						
Intervention	1.58 [0.97, 2.59]	1.55 [0.85, 2.82]	0.66 [0.38, 1.16]	0.79 [0.42, 1.50]	1.55 [0.99, 2.42]	1.77 [1.06, 2.97] *
Covariates (Baseline)						
Age	1.01 [0.97, 1.06]	–	1.02 [0.97, 1.07]	–	0.99 [0.95, 1.03]	–
Educational Attainment (ref = up to 10 years)						
10 to 11 years	0.97 [0.53, 1.77]	1.23 [0.59, 2.57]	0.80 [0.41, 1.58]	1.04 [0.46, 2.35]	1.32 [0.73, 2.37]	1.29 [0.65, 2.57]
12 years or more	0.44 [0.21, 0.92] *	0.26 [0.10, 0.66] **	0.63 [0.28, 1.38]	0.53 [0.22, 1.30]	0.96 [0.50, 1.86]	0.62 [0.29, 1.33]
Monthly Income	0.85 [0.52, 1.39]	–	1.03 [0.59, 1.79]	–	0.74 [0.47, 1.16]	
Relationship Status						
Unmarried, living together	0.87 [0.46, 1.62]	–	0.98 [0.49, 1.99]	–	1.02 [0.58, 1.79]	
Married	0.75 [0.38, 1.49]	–	1.08 [0.52, 2.25]	–	1.13 [0.63, 2.03]	
Children	0.86 [0.46, 1.59]	0.99 [0.46, 2.13]	1.73 [0.75, 3.99]	2.23 [0.76, 6.52]	1.77 [0.93, 3.39]	1.66 [0.69, 4.04]
Pregnancy Unplanned	1.12 [0.69, 1.82]	–	0.70 [0.40, 1.22]		1.40 [0.89, 2.19]	
Diagnosed during this pregnancy	0.94 [0.58, 1.53]	–	0.93 [0.54, 1.62]	–	1.19 [0.76, 1.85]	
Months Since ART Initiation	1.01 [0.99, 1.02]	–	0.99 [0.98, 1.01]	–	0.99 [0.98, 1.00]	
HIV Positive Children	0.67 [0.19, 2.34]	0.84 [0.19, 3.64]	2.30 [0.85, 6.22]	1.62 [0.57, 4.62]	0.41 [0.12, 1.42]	0.31 [0.09, 1.02]
HIV Positive Partner	1.25 [0.73, 2.12]	–	1.09 [0.59, 2.01]		0.72 [0.43, 1.21]	
Alcohol Use	1.65 [0.86, 3.17]	–	1.39 [0.66, 2.95]		1.09 [0.57, 2.07]	
Stigma	1.09 [0.92, 1.30]	–	1.21 [1.01, 1.45] *	1.35 [1.06, 6.52] *	1.06 [0.89, 1.25]	
Disclosure of HIV Status to Partner	0.86 [0.52, 1.40]	–	1.26 [0.71, 2.23]	–	0.75 [0.48, 1.18]	
Male Involvement	0.94 [0.87, 1.02]	–	0.99 [0.91, 1.08]	–	0.95 [0.89, 1.02]	
Psychologica Intimate Partner Violence	1.09 [1.05, 1.14] ***	1.16 [1.07, 1.25] ***	1.03 [0.99, 1.08]	–	0.95 [0.90, 0.99] *	1.03 [0.96, 1.10]
Physical Intimate Partner Violence	1.13 [1.04, 1.22] ***	1.04 [0.89, 1.25]	1.04 [0.97, 1.12]	–	0.91 [0.81, 1.02]	
Adherence to ARVs	0.71 [0.43, 1.17]	–	1.32 [0.71, 2.44]	–	0.57 [0.36, 0.90] *	
Sexually Active in Past Week	1.43 [0.84, 2.42]	–	1.02 [0.57, 1.82]	–	1.51 [0.93, 2.43]	
Model Fit						

	Stable Depression (*n* = 58)		Change to Depression (Incident epression) (*n* = 59)		Change to No Depression (*n* = 81)	
	OR [95% CI]	**AOR [95% CI]**	**OR [95% CI]**	**AOR [95% CI]**	**OR [95% CI]**	**AOR [95% CI]**
−2LL (Deviance)	−261.28		−237.99		−335.99	
Number of Parameters	10		10		10	
AIC/BIC	277.28/305.06		251.99/275.62		349.99/374.99	

*** $P < 0.001$.

** $P < 0.01$.

* $P < 0.05$.

[a] Random effects indicates the estimated variances from random effects logistic regression model.

Note: AOR = Adjusted Odds Ratio.

Table 3

Depression: longitudinal outcome ($N = 681$).

Variable	AOR (95% CI)
Model 1: Baseline characteristics (time-invariant)	
Age	1.711 [2.710, 2.735]
Education	
0-Grade 9	1 (Reference)
Grade 10–11	2.654 [2.512, 2.954]
Grade 12 or more	2.032 [2.490, 2.901]
Employed	
No	1 (Reference)
Yes	2.469 [2.524, 2.977]
Income	
600 or more	1 (Reference)
<600 Rand	2.540 [2.557, 2.886]
Relationship status	
Unmarried, living separate	1 (Reference)
Unmarried, living together	2.188 [2.552, 2.858]
Married	2.445 [2.606, 2.858]
Number of children	
None	1 (Reference)
One or more	1.765 [2.637, 2.879]
Pregnancy unplanned	
No	1 (Reference)
Yes	1.327 [2.492, 2.794]
Diagnosed during this pregnancy	
No	1 (Reference)
Yes	2.059 [2.639, 2.84]
Months since ART initiation	2.699 [2.713, 2.724]
HIV positive children	
No	1 (Reference)
Yes	1.354 [2.584, 3.264]
HIV serostatus of spouse/partner	
Negative/Do not know	1 (Reference)
Positive	1.464 [2.634, 2.967]
Alcohol (>2 drinks last month)	
No	1 (Reference)
Yes	2.153 [2.519, 3.043]
Stigma	2.073 [2.678, 2.777]
Random Effects[a]	
Intercept (baseline)	1.481 [−2.264, 5.227]
Depression	0.001 [−0.002, 0.003]

Variable	AOR (95% CI)
Model 2: Variables assessed at four assessments (time-varying)	
Fixed Effects	
Intervention	
Standard of care	1 (Reference)
Enhanced intervention	0.950 [0.957, 1.004]
Disclosure of HIV Status to Partner	0.900 [0.658, 1.232]
Male Involvement	0.916 [0.871, 0.963] **
Psychological Intimate Partner Violence	1.489 [1.262, 1.756] ***
Physical Intimate Partner Violence	1.264 [0.961, 1.663]
Adherence to ARVs	0.395 [0.285, 0.549] ***
Consistent condom use (past week)	1.079 [0.833, 1.399]
Noncondom use at last sex	0.918 [0.666, 1.264]
Random Effects[a]	
Intercept (baseline)	1.428 [0.249, 0.251]
Depression	0.001 [−0.002, 0.003]

*** $P < 0.001$.

** $P < 0.01$.

* $P < 0.05$.

[a] Random effects indicates the estimated variances from random effects logistic regression model.

AOR = Adjusted Odds Ratio, CI = Confidence Interval.