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Mental Health of HIV-Seropositive Women During Pregnancy and Postpartum Period: A Comprehensive Literature Review

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Abstract

With growing numbers of HIV-seropositive (HIV+) women of child-bearing age and increased access to effective clinical protocols for preventing mother-to-child transmission (MTCT) of HIV, mental health-related factors have become increasingly relevant due to their potential to affect the women's quality of life, obstetric outcomes and risk of MTCT. This review synthesizes evidence from 53 peer-reviewed publications examining mental health-related variables in pregnant and postpartum HIV+ women. The presentation of results is organized by the level of socioeconomic resources in the countries where studies were conducted (i.e., high-, middle-, and low-income countries). It is concluded that psychiatric symptoms, particularly depression, and mental health vulnerabilities (e.g., inadequate coping skills) are widespread among pregnant HIV+ women globally and have a potential to affect psychological well-being, quality of life and salient clinical outcomes. The current body of evidence provides rationale for developing and evaluating clinical and structural interventions aimed at improving mental health outcomes and their clinical correlates in pregnant HIV+ women.

Keywords

HIV; Pregnancy; Mental health; Perinatal depression; Women

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Introduction

HIV-seropositive (HIV+) women of child-bearing age are the fastest growing HIV+ population in the world and 1.49 million infants every year are born to HIV+ women [1]. Effective antiretroviral therapy (ART)-based protocols for preventing mother-to-child HIV transmission (MTCT) are becoming increasingly accessible worldwide [2]. However, mental health-related factors could potentially undermine its effective delivery and affect the women's quality of life and psychological well-being. For example, depression is a highly prevalent co-morbidity among HIV+ individuals in general [3], and has been associated with poor HIV viral suppression [4], increased mortality, accelerated disease progression [5] and increased risk of ART non-adherence [6]. Depression among HIV+ individuals has also been correlated with lower scores in the psychological, social, and environmental domains of quality of life [7]. In the case of pregnant HIV+ women, such findings give rise to additional concerns, some of which are discussed below.

First, there is the concern that adverse mental health outcomes could affect obstetric and neonatal outcomes, HIV disease management during pregnancy or postpartum and related risk of MTCT. Indeed, a recent meta-analysis reported optimal ART adherence in only 76 % pregnant and 53 % postpartum HIV+ women worldwide and identified emotional stress, depression and substance abuse as barriers to adherence. [8] The meta-analysis highlighted the need for more research and development of appropriate interventions targeting mental health factors among HIV+ pregnant women. [8] However, to our knowledge, the literature addressing mental health outcomes specifically in pregnant HIV+ women has not been synthesized in a manner that would inform development of such interventions. Treatment guidelines for managing depression during pregnancy jointly developed by the American Psychiatric Association and the American College of Obstetricians and Gynecologists [9] provide extensive overview of relevant literature along with consensus-based treatment and diagnostic algorithms, but do not address HIV-related or HIV-specific clinical factors among pregnant women. Next, there is the concern that pregnancy might be a time of heightened mental health vulnerability for HIV+ women due to adversary contextual factors, which commonly co-occur with HIV infection among women. For example, three recent literature reviews [10–12] highlighted the high co-occurrence rates of intimate partner violence (IPV) and HIV infection among women. One of these three reviews indicated a need to examine the relationship between IPV, post-traumatic stress disorder and substance abuse in HIV+ women [12]. Yet, these reviews did not focus on IPV in the context of pregnancy or the postpartum period. Further, a recent comprehensive literature review provided strong evidence of the negative impact of HIV-related stigma on women's participation in MTCT prevention programs in low-income countries and outlined a theoretical model that includes women's mental health as a variable that might interact with both stigma and MTCT. However, the review did not discuss the specific mental health-related findings of the included studies [13].

Ideally, mental health outcomes of pregnant HIV+ women would be evaluated in relation to salient clinical variables, such as HIV disease severity indicators, ART adherence or MTCT risk, as well as to frequently co-occurring contextual factors, such as HIV stigma; or IPV, which is strongly associated with adverse mental health outcomes in women [14]. Clearly,

the absence of publications presenting current state of the evidence regarding mental health of HIV+ women during pregnancy remains a gap in the field. In order to address this gap, we conducted a comprehensive review of the global literature examining mental health of pregnant HIV+ women. The main objective of the review was to describe and synthesize the current evidence on the nature, extent and correlates of mental health outcomes among pregnant HIV+ women, and identify clinical and research implications of the reviewed evidence. The results of our review are presented in this article. To reflect the reality that not all HIV+ women across the globe have the same opportunities and access to key resources necessary for effective HIV care and MTCT, the presentation of results is organized by the level of socioeconomic resources available in the countries where the studies were conducted (i.e., high-, middle- and low-income countries [15]). Key methodological features, specific findings and other pertinent details of included studies are summarized in Table 1.

Methods

Two research assistants (D.N., N.T.) with Bachelor of Science degrees independently searched databases: Pub-Med, PsycINFO, PsycARTICLES, ERIC, Web of Science (Thomas Reuters), and Medline (Thomas Reuters). The search was originally completed in December 2012, and then updated in September and December 2013.

Article Eligibility Criteria

Only original articles reporting on mental health outcomes in pregnant HIV+ women were included. There were no restrictions based on a publication date. Articles reporting on studies using quantitative, qualitative and mixed methods were included. Book chapters, letters to editors and replies, literature reviews, case studies, reports, brief summaries of studies, newspaper and newsletter articles, opinions and recommendations, non-peer reviewed articles and dissertations that were not original research were excluded.

Articles that did not evaluate mental health outcomes of women who are pregnant and have HIV were excluded; For example, articles that focused on HIV risk behaviors of pregnant women, HIV knowledge of pregnant women at risk for HIV or the development of children with vertically acquired HIV were excluded. Articles focusing on HIV testing were included only if they reported on mental health outcomes of pregnant women who tested HIV+ in the study. Articles that focused on the legal perspectives of HIV and pregnancy were also excluded. Articles dealing with MTCT, infant feeding, HIV diagnostic disclosure, treatment adherence or stigma among HIV-infected pregnant women were excluded unless they evaluated mental health outcomes as variables of interest in relation to MTCT, disclosure, adherence or stigma. Articles focusing on validation of mental health screening tools were also excluded.

Literature Search Procedure

We used the following three search terms: (1) “HIV” or “AIDS”; (2) “pregnancy”; and (3) “mental health”, “mental illness”, “psychiatric disorder”, “depression”, “adherence”, “PTSD”, “anxiety”, “disclosure”, “trauma” or “substance abuse”. Each individual search

consisted of a combination of the three search terms connected by “AND”. All searches were limited to the English language. Searches in PsycINFO, PsycARTICLES and ERIC were limited to peer-reviewed journal articles and dissertations. Each individual search within a database was then combined using “OR” to account for duplication. After merging the final lists from individual database searches, duplicates were removed using Endnote and Refworks.

To determine the eligibility of articles identified by the search, the two research assistants reviewed article titles. If the eligibility was not clear from a title alone, the whole abstract was read. If, upon reading the abstract, article eligibility still remained unclear, the article was set aside for the next stage of eligibility assessment procedure. Discrepancies in results between the two independent searches were resolved by consensus between the two research assistants and, if necessary, arbitrated by the senior authors (P.D.B. and S.K.). After excluding articles that did not qualify for inclusion, based on the title and preliminary abstract review, the remaining abstracts were evaluated by all four authors. If the eligibility was not clear from reading an abstract alone, the whole manuscript was reviewed by the senior authors until the eligibility was determined. After excluding articles that were not eligible based on the abstract review, the remaining articles were read in full by the senior authors. Reference lists of the included articles were searched for additional potentially eligible articles.

Results

Of the 2,395 unduplicated articles, 2,229 were excluded based on title (or review of abstract if title was unclear) or publication type. Additional 108 articles were excluded after abstract reviews. After the remaining 58 articles were read in full, 7 were excluded. Two articles were added by searching reference lists of the remaining 51 articles, resulting in a final inclusion of 53 articles. The presentation of the 53 included articles is organized by the level of socio-economic resources of countries where the studies were conducted. There were 30 articles from high-income, 5 from middle-income and 18 from low-income countries (see Fig. 1).

Low-Income Countries

Eighteen publications from studies conducted in Zimbabwe [16, 17], Angola [18], Zambia [19], South Africa [20–28], Tanzania [29–31], Kenya [32] and Nigeria [33] met the review eligibility criteria. Fifteen of these 18 publications reported on depressive symptoms or other mental health-related outcomes such as distress, anxiety or coping mechanisms [16–22, 25–32], two studies focused on IPV and pregnant HIV+ women [23, 33] and one study examined substance abuse in pregnant HIV+ women [24]. Four of these studies were clinical trials which evaluated interventions designed to improve mental health outcomes in pregnant HIV+ women. [25, 26, 30, 31]

Depression and Other Psychiatric Symptoms

Results from studies conducted on the African continent suggest substantial rates of depressive symptoms and emotional distress among HIV+ pregnant women in the region.

This included two case-control [16, 20], two cross-sectional [18, 19] and one longitudinal study [22] which used various screening and survey tools to quantify mixed psychiatric and psychosocial outcomes in populations of HIV+ pregnant women; one qualitative study [21]; as well as three large studies, two of which were cross-sectional [17, 28] and one longitudinal [29], examining specifically depression or depressive symptoms and their correlates.

For instance, 85 % of pregnant HIV+ women from a Zambian urban cohort ($N = 45$) reported depressive symptoms of “loss of interest in life, ideas of guilt and worthlessness, poor concentration and lethargy”; and recurring thoughts of suicide [19]. Also, HIV+ status was associated with increased risk of antenatal depression in a South African urban cohort ($N = 387$) [28], added risk and severity of emotional distress in an Angolan cohort ($N = 157$) [18] and higher odds of increased anxiety, but not depression, in a South African cohort [20] of pregnant women ($N = 60$). In a large Tanzanian cohort of HIV+ women ($N = 996$), a positive depression screen on the Hopkins Symptom Checklist-25 (HSCL-25) during the perinatal period predicted a more than 60 % increased risk of subsequent disease progression and mortality [29]. Among women receiving perinatal care at two Zimbabwean urban clinics ($N = 210$), the risk of positive depression screen on the Edinburgh Postnatal Depression Scale (EPDS) 6 weeks postpartum was associated with adverse life events, unemployment and multiparity, but not with maternal HIV status [17].

Knowledge and timing of the HIV diagnosis appeared to moderate psychiatric outcomes. For example, pregnant women from the Zambian urban cohort who knew they were HIV+ before becoming pregnant were less likely to develop depressive symptoms compared to those diagnosed with HIV during pregnancy [19]. In a Zimbabwean study of pregnant women ($N = 437$) screened before undergoing HIV counseling and testing, psychiatric co-morbidity was detected in 73 (17 %) women, and the rates of psychiatric co-morbidity did not differ by HIV status [16]. In a qualitative study conducted in South Africa, pregnant HIV+ women ($N = 28$) were interviewed before and after finding out their newborn’s HIV status. The women’s narratives suggest that the period before getting the results of HIV testing was emotionally stressful for all mothers. However, the mothers of HIV-negative babies were relieved after finding out the babies’ HIV status, while mothers of HIV+ babies remained distressed. Both groups of mothers expressed feeling responsible and guilty for exposing their child to HIV [20]. Reported correlates of psychiatric co-morbidity in African populations of pregnant HIV+ women also included having a husband over the age of 35 years [16], single marital status [18, 28] and unplanned pregnancy [28].

Results from the longitudinal cohort study conducted in Kenya suggest that postpartum depression may be among independent predictors of perceived HIV-related stigma. This large cohort study ($N = 1777$) examined factors associated with anticipating or experiencing HIV-related stigma among pregnant women receiving antenatal care and HIV testing in clinics in rural Kenya. In a subset of HIV+ women ($N = 147$) who were re-interviewed at 4–8 weeks postpartum, more than half reported having experienced stigma; EPDS scores of 10 or higher were among independent predictors of experiencing stigma [32] (Table 1).

The Role of Coping

In a 2-year longitudinal study of 224 South African women who had been diagnosed with HIV during pregnancy, mental health outcomes were evaluated in relation to the women's coping styles, where coping was categorized as either active or avoidant. Active coping styles were defined as "behavioral and cognitive attempts to deal with a stressful situation and change it", such as problem-solving, cognitive re-framing or information-seeking. Avoidant coping styles were defined as "behavioral and cognitive attempts to avoid dealing with a stressful situation" (e.g., through disengagement, denial or distraction). Active (vs. avoidant) coping styles were associated with less internalized stigma (i.e., the extent to which the woman perceives or anticipates being stigmatized because of her HIV) and depression [22, 27]. Additionally, active coping was also associated with knowing someone living with HIV, being physically healthy and living above the poverty line. In contrast, avoidant coping was associated with lower HIV-knowledge and less formal education [22].

Substance Abuse

In the South African cohort of pregnant HIV+ women ($N = 201$), 18 % women reported alcohol consumption during pregnancy, and 67 % reported binge drinking (defined as 3+ drinks in one sitting). In this cross-sectional study, a higher risk of drinking during pregnancy was associated with not being married and poorer mental health; the average severity of drinking was higher among urban and peri-urban women relative to rural women. Women who had poorer mental health outcomes were more likely to use tobacco, engage in sexual risk-taking or drinking alcohol [24].

Intimate Partner Violence

Two studies conducted in Africa which examined IPV in large urban cohorts of pregnant HIV+ women met the eligibility criteria for this review [23, 33]. Both studies used operational definitions of IPV that spanned a broad spectrum of types of violence, including physical, sexual and psychological violence perpetrated by a woman's current or former intimate partner.

In a cross-sectional study ($N = 652$) conducted in Nigeria, 65.8 % HIV+ pregnant women reported lifetime history of IPV. Seventy-four percent of women with positive history of IPV reported that IPV started after they had been diagnosed with HIV [33]. In a South African prospective cohort ($N = 1492$), approximately 25 % of women reported experiencing some type of IPV during the current pregnancy, with psychological violence being its most prevalent form. The odds of women experiencing emotional distress increased significantly with each additional episode of psychological or sexual violence during pregnancy, but were only marginally associated with physical violence [23].

Interventions Designed to Improve Mental Health Outcomes

Of the four clinical trials included in this review, two were randomized controlled trials (RCTs) conducted in Tanzania [30, 31] and two were quasi-experimental clinical trials conducted in South Africa [25, 26]. Three of these trials evaluated psychosocial interventions, and one evaluated efficacy of nutritional supplements in improving mental

health and psychosocial outcomes of pregnant HIV+ women. In an RCT conducted in Tanzania, a 6-week structured nurse-midwife facilitated psychosocial support group, using a problem-solving therapy approach, was compared to usual care with the objective to reduce depressive symptoms (measured by HSCL-25 scores) and increase prenatal disclosure rates of HIV status among HIV+ pregnant women. Attrition rates were comparably high (>30 %) in both arms. Among 188 women who completed the study, the intervention was marginally better at reducing depression; 60 % of women who had been assigned to the intervention group had a HSCL-25 score above 1.06 (score compatible with a Major Depressive Disorder) versus 73 % in the control group ($p = 0.066$). HIV disclosure rates did not differ across the two study arms. However, among those women who disclosed, those who participated in the active treatment arm were significantly more likely to be personally satisfied with the response of family and friends to their disclosure (88 %) compared women in the control group (62 %) ($p = 0.004$) [31].

A structured 10-session psychosocial support group intervention, designed to improve a range of mental health and psychosocial outcomes in newly HIV-diagnosed pregnant women (i.e., to increase HIV disclosure, self-esteem, active coping and positive social support, and decrease depression, avoidant coping, and negative social support), was evaluated using a quasi-experimental design in a study conducted in South Africa [26]. At two months post-intervention, the women in the intervention group demonstrated significantly higher overall rates of disclosure ($p < 0.001$), higher average scores on measures of active coping ($p < 0.05$), lower average scores on measures of avoidant coping ($p < 0.05$), and improved self-esteem ($p < 0.05$) compared to the control group of women who did not take part in the intervention. The disclosure rates remained significantly higher in the intervention group than in the comparison group at 8-month post-intervention assessment ($p < 0.001$). The improved coping outcomes were maintained at the 8-month follow-up in the intervention group, but the corresponding scores had reached similar levels in the comparison group, suggesting that the participation in structured support group may accelerate the process of women's adjusting to her new HIV diagnosis during pregnancy, birth and early motherhood, but may not have sustainable benefits over time. There were no significant differences between the two groups in depressive symptoms (as measured by the Center for Epidemiological Studies Depression Scale [CES-D]) and support [26].

The Mamekhaya program, which involved a combination of individual support from a mentor mother and a culturally adapted 8-session cognitive-behavioral group intervention (CBI), was compared to standard services provided by midwives and counselors in a quasi-experimental clinical trial ($N = 160$) in South Africa [25]. Women at the Mamekhaya site showed significantly greater improvement in establishing social support ($p < 0.05$), reducing CES-D scores ($p < 0.01$) and increasing HIV knowledge scores ($p < 0.001$) than women at the control site [25].

Effects of vitamin supplements during the 3rd trimester of pregnancy on quality of life and the risk of elevated depressive symptoms in HIV+ women were evaluated in an RCT conducted in Tanzania [30]. The women ($N = 1013$) were randomly assigned to four study arms (vitamin A alone; multivitamins excluding vitamin A; multivitamins plus vitamin A; and placebo) and then followed at progressively longer intervals for approximately three

years on average. Multivitamin supplementation (B-complex, C and E) was efficacious in reducing risk of elevated depressive symptoms comparable to MDD (defined as 8-item HSCL-25 score above 1.06) and improving multiple dimensions of health-related quality of life, [30], possibly due to reduction in oxidative stress or due to effect of increased folate levels on increasing the levels of serotonin and its metabolites [30].

Middle-Income Countries

Five studies from the middle-income countries, all conducted in Thailand, met the eligibility criteria of this review [34–38]. Of these five studies, four were descriptive, cross-sectional studies [34–36, 38], and one was a mixed-methods study combining a clinical trial with a qualitative study [37]. All five studies used the CES-D to quantify the depressive symptoms. Overall, the women who participated in these studies tended to have a low level of formal education and high unemployment rates. Most of them were married or in a relationship.

Depression

Depression was evaluated either as an outcome of interest [34, 35, 38] or as a predictor of prenatal self-care [36] in four cross-sectional studies. One of these studies [35] was a sub-study of a larger prospective cohort. Three studies recruited the women by convenience sampling in urban antenatal [34, 36] and postpartum [38] care clinics. The sample sizes ranged from 85 [38] to 153 [36]. One study included a comparison group of pregnant women who were not HIV+ [36]. CES-D scores were evaluated either as a continuous variable (“depressive symptoms”), or as categorical variables, with the cut-offs of 16 (“mild depression”) and 23 (“severe depression”). The findings suggested a high prevalence of depression in pregnant and postpartum HIV+ Thai women, with multiple important psychosocial and clinical correlates.

Specifically, each of the three studies examining depression rates reported presence of antenatal [34] or postpartum [35, 38] depression in approximately 75 % of participating women. Higher antenatal depressive symptoms predicted lower self-esteem, less emotional support, worse financial status, more somatic symptoms [34] and worse antenatal self-care [36].

However, the findings also suggested that the negative impact of antenatal depression on antenatal self-care was not contingent on women’s HIV status. In the single study which included a comparison group, the effect of antenatal depression was moderated by the women’s learned resourcefulness (operationalized as a set of coping skills that women use to control symptoms of depression and to help their engagement in prenatal self-care) and not by HIV status [36].

Postpartum depression was associated with using venting to cope and not being in a relationship with the partner from pregnancy [35]. Post-partum depressive symptoms were inversely correlated with self-esteem, infant health status, and years of formal education [38].

HIV-Related Worry

HIV-related worry was assessed as an outcome in one study [35]. In a cohort of HIV+ women who were interviewed at 18–24 months postpartum, higher levels of HIV-related worry over the past 6 months (as measured by the modified 14-item HIV-Related Worry Scale) were associated with having an HIV+ baby, not disclosing HIV status to others and a belief that HIV brings shame to family [35].

Interventions Designed to Improve Depression Outcomes

Efficacy of a telephone support intervention in decreasing depressive symptoms in pregnant HIV+ Thai women ($N = 40$) was evaluated in one RCT. [37] The intervention, which included scheduled weekly telephone sessions of emotional and educational support provided by a registered nurse, as well as additional sessions initiated by the participants on an as-needed basis, showed greater improvement of CES-D scores from baseline to 1-month and 2-month follow-up relative to the control condition (i.e., regular prenatal care, including routinely provided standard information regarding pregnancy and HIV self-care). Additionally, in-depth interviews were conducted only with the women who had participated in the active treatment arm ($N = 20$). The narratives highlighted the following three factors as key ingredients of the intervention that helped decrease depressive symptoms: (1) putting things into perspective, (2) knowing that someone was always there and (3) practical guidance. [37]

High-Income Countries

Thirty publications from high-income countries which were eligible for this review reported data from single site-based studies conducted in the US [39–46], Italy [47, 48], Northern Ireland [49, 50] and Portugal [51]; US state Medicaid registers [52, 53] and data repositories from European [54] and US-based [55–60] prospective multi-site cohorts. HIV+ women participating in US-based studies were predominantly low-income African-American or Hispanic women receiving care in urban [39–46, 48, 52, 55, 57–65] or rural [52, 55, 57–59, 66] clinical centers. European studies generally reported less detailed demographic characteristics, but available data suggest that most participating women had low levels of formal education [54].

Women's Subjective Experiences of HIV Diagnosis and Pregnancy

Maternal uncertainty about infant HIV status was prospectively evaluated during the third trimester and five postpartum visits in a small US cohort of HIV+ women. The uncertainty scores declined over time and were correlated with multiple psychosocial variables and depression [41].

Three small qualitative studies examined salient subjective experiences that included testing HIV+ [49], pregnancy, maternity care [43, 50], and motherhood [43] following an HIV diagnosis. The women's narratives described HIV diagnosis as a disruptive, life-changing experience [43, 49], while pregnancy was viewed as an opportunity to overcome the disruption by embracing motherhood [49]. The narratives emphasized importance of

clinicians and staff being non-judgmental, non-stigmatizing, whole person-centered and sensitive to women's needs for privacy and confidentiality [43–45, 48, 49].

Studies Assessing Mixed Psychiatric Outcomes

Seven studies used psychiatric interviews [61, 62, 65], rating scales [65], psychometric tools [64] or structured socioeconomic [63] and QoL assessments [39, 50] to assess mixed psychiatric outcomes in small clinical [39, 51, 61–64] and non-clinical [65] cohorts of pregnant HIV+ women.

Early cross-sectional studies of HIV+ pregnant women reported higher depression and anxiety scores than uninfected pregnant women [63]; high rates of depressive disorders, substance-related disorders and personality disorders (as defined by the Diagnostic and Statistical Manual of Mental Disorders, 3rd Edition, Revised [67]); elevated Hamilton Rating Scale for Depression and Beck Depression Inventory scores; significant association between history of substance abuse and current psychopathology [61, 62, 65] and over-representation of unusual thought processes, hostility, suspiciousness and apathy [64]. Psychiatric disorders tended to precede the HIV diagnosis [62]. Two longitudinal studies that included comparison groups of HIV-negative women reported differential declines on measures of distress and QoL by HIV status [39, 51] and higher risk of decline in cognitive or social functioning six months postpartum in HIV+ group [39].

Depression

One prospective [60] and four cross-sectional [42–45, 57] studies evaluated rates and characteristics of depression in pregnant and/or postpartum HIV+ women. Sample sizes ranged from 51 [42] to 307 [57]. Perinatal depression (PND) was defined either as new-onset depression during pregnancy or 4 weeks postpartum [44]; or as increased depressive symptoms during pregnancy or 12 months postpartum [60].

Among HIV+ women, the rates of depression ranged from 30.8 % of PND over 10 years [44] to 53 % positive antenatal depression screens over two years [42], but were not significantly different than in comparison groups of women at high risk for HIV infection [45, 60]. Correlates of PND included history of childhood sexual abuse [45], poor coping [57], inadequate social support [45, 57], high (perceived) stress [44, 57], past history of depression [45, 60] or other psychiatric [42, 44] or substance abuse disorder [42, 60]; antenatal substance abuse or ART adherence problems, and nadir CD4 count < 200 cells/mm³ [44]. Positive partner support predicted lower depressive symptoms [57].

Substance Abuse

Seven studies examined substance abuse in HIV+ pregnant women [40, 47, 48, 52, 54–56]. Sample sizes ranged from 114 [48] to 5,566 [54]. Four studies included a comparison group [40, 47, 48, 52]. Substances examined were cocaine/crack, opiates [40, 55, 56], alcohol, tobacco and marijuana [55].

Early longitudinal studies reported increased MTCT risk associated with antenatal use of cocaine/crack, heroin, methadone [56] and smoking [52]. Intravenous route of drug use did

not convey additional MTCT risk [54]. Antenatal HIV and opiate intake have each been associated with unfavorable effects on multiple obstetric and neonatal outcomes, including Apgar scores, gestational weight and length, rates of miscarriage or preterm labor [45, 46, 57], and maternal susceptibility to pathogens [48]. The effect of opiate intake on the latter outcome was relatively more robust [48]. Cocaine use during index pregnancy predicted an increased rate of subsequent pregnancies in both HIV+ and matched non-infected women [40].

Studies from the pre-HAART era found self-reported rates of antenatal substance abuse to be as high as 64 % [40]. A recent publication reported rate of 29 % among 480 HIV+ mothers enrolled in the Surveillance Monitoring for ART Toxicities (SMAART) protocol of the Pediatric HIV/AIDS Cohort Study (PHACS), a large longitudinal cohort of HIV-exposed but uninfected infants and their HIV+ mothers recruited from clinical centers in the US and Puerto Rico [55]. Studies comparing maternal self-reports with urine [55, 56], blood and meconium [55] toxicology assays suggested under-reporting of tobacco, marijuana, cocaine and opiate use among pregnant HIV+ women [55, 56].

Intimate Partner Violence and Other Forms of Abuse

Two publications from the Perinatal Guidance Evaluation Project (PGE), a US-based cohort which enrolled both HIV+ and HIV-negative pregnant women matched by demographics and HIV risk, suggested that vulnerability of HIV+ pregnant women to IPV may have more to do with behavioral and psychosocial factors than with the HIV diagnosis itself. The combined prevalence of IPV during pregnancy and/or postpartum was 10.6 % and did not differ by the women's HIV status [58, 59]. HIV diagnosis during current pregnancy was actually associated with reduced risk [59]. Engaging in bartered sex was the strongest predictor of IPV [59].

A retrospective medical record review conducted in a large US-based urban academic clinical center indicated a need for trauma-screening among pregnant HIV+ women, and reported high rates of psychopathology among the women who have been traumatized. [46] Among 194 HIV+ women who delivered in the clinic over a 2-year period, 45 reported a history of childhood sexual or physical abuse (66 %), abuse in adulthood by a sexual partner (25 %), or abuse during pregnancy (10 %). Ninety-one percent of the women screened positive for depressive symptoms, 71 % for anxiety, 56 % for PTSD, 50 % for HIV-related PTSD (defined as PTSD symptoms related to any HIV-associated event), and 21 % for substance abuse on a mental health screening instrument (adapted from the PRIME-MD Patient Health Questionnaire) which was routinely administered as part of antenatal care [46].

Interventions and Service Delivery

The New Jersey AIDS/HIV surveillance and paid Medicaid claims data between 1992 and 1998 suggest that the receipt of ob/gyn care increases women's chances of receiving ART and substance abuse treatment [53]. Two publications described feasible models for integrating mental health and substance abuse treatment into primary care for HIV+ pregnant women [68, 69] in the US. A program overview from Portugal proposed guidelines

for psychological assessment and a psychoeducational intervention for HIV-discordant couples transitioning to parenthood [70]. There were no published clinical trials of interventions targeting psychiatric or psychosocial outcomes among pregnant HIV+ women.

Discussion

We reviewed 53 articles examining a range of mental health-related variables in pregnant and postpartum HIV+ women. The majority of studies were conducted in the US and African countries. Findings from observational, case-control and qualitative studies indicate a high prevalence of depression, general distress and other psychiatric symptoms in cohorts of pregnant and postpartum HIV+ women. Important observational and qualitative data have been published in the areas of substance abuse, IPV and women's subjective experiences of HIV during pregnancy. All five clinical trials targeting mental health-related outcomes in pregnant HIV+ women were conducted in low-and middle-income countries.

Depression was the most studied psychiatric condition. The risk of depression during pregnancy and/or postpartum period was associated with multiple bio-psycho-social risks, indicating a need for screening protocols designed not only to identify pregnant HIV+ women struggling with depression, but also those who might be at risk for depression with the goal of closely monitoring their clinical outcomes and psychosocial needs, and providing appropriate referrals and interventions. The surveillance and claims data [52] suggest that Ob/Gyn care might be a particularly good opportunity to introduce such screening. Publications from the US [68, 69] and Portugal [70] offered feasible templates for implementing such interventions and services in high-income countries.

Besides HIV infection, pregnant HIV+ women from low and middle-income countries have to contend with many other issues that may undergird psychiatric or psychological conditions. A combination of issues includes poor socioeconomic conditions, lack of access to health care, economic or political displacement of communities, and, to a certain extent, cultural practices and gender inequalities. Future studies should aim at isolating the causes of psychiatric conditions in HIV+ women in low-income countries by attending to these contextual confounders.

The efficacy of multivitamin supplementation [30] and problem-solving group therapy [31] in Tanzanian RCTs; telephone supportive intervention in the Thailand RCT [37]; and promising results of culturally adapted psycho-educational interventions in two South African trials [25, 26] are encouraging. Future RCTs could build on this evidence and evaluate interventions aimed at not only improving mental health outcomes, but also evaluating the impact on salient clinical outcomes, such as ART adherence, HIV disease severity, obstetric outcomes or MTCT rates. The absence of published clinical trials in high-income countries highlights a critical need to develop feasible and efficacious psychosocial and/or psychopharmacological interventions for pregnant or postpartum HIV+ women. The available treatment guidelines for managing depression during pregnancy [9] do not address HIV-specific factors, but provide a useful starting point for developing interventions that do. Given that most HIV+ pregnant women in the US are low-income minority women, the

feasibility and efficacy of such interventions might be optimized by adapting them to incorporate relevant cultural, community-specific and socio-economic factors [71].

The association between maternal substance abuse during pregnancy and unfavorable clinical outcomes observed in multiple studies provides justification for developing intervention protocols designed to minimize the risk and impact of substance abuse, including smoking, among pregnant HIV+ women. The evidence suggests that these protocols will need to include urine, blood and/or meconium drug assays as assessment tools in a subset of pregnancies.

There were significant correlations of HIV-related stigma with depressive symptoms and avoidant coping in the South African [22, 27] and Kenyan cohorts [32]. The findings from these three studies complement the recent comprehensive review of literature on the role of HIV-related stigma as a barrier along the MTCT prevention cascade [13], and are consistent with the proposed theoretical framework of the review which includes poor mental health as one of its key components [13]; and provide a rationale for development of clinical interventions that would aim to minimize the negative impact of potentially modifiable mental health factors on perceived HIV-related stigma among pregnant and postpartum women.

Data from large African [23, 33] and US [58, 59] cohorts indicate that IPV against pregnant HIV+ women is widespread. A recent review stressed the need for high-quality RCTs powered to determine intervention effectiveness in preventing or reducing IPV episodes during pregnancy and impact on maternal and neonatal mortality and morbidity [72]. In the present review, the extent, patterns and correlates of IPV differed between the African and US cohorts, possibly offering some cues for designing such interventions in the context of maternal HIV infection or risk.

This review has some limitations. First, the majority of included studies were descriptive, which prevented us from making inferences about direction or causality of reported associations. Second, the heterogeneity of outcome measures and cut-offs used to quantify, define or screen for mental health outcomes in the included publications made it difficult to compare those outcomes across studies. However, the existing level of evidence allowed us to identify most studied mental health-related outcomes in populations of pregnant HIV+ women worldwide, summarize their reported clinical and socio-demographic correlates, appreciate the extent of the problem, as well as to discuss implications for clinical care and identify immediate research needs.

In summary, this review and systematic analysis suggests that there is a high prevalence of depressive symptoms and other mental health vulnerabilities among pregnant HIV+ women globally, and that these symptoms and vulnerabilities are associated with increased risk of adverse pregnancy outcomes and decreased quality of life. The evidence presented in this review can serve as a starting point to develop and evaluate interventions designed to optimize mental health outcomes and their clinical correlates in pregnant or postpartum HIV + women.

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Fig. 1. is based on the QUOROM flow diagram [73]. It describes the number of articles retrieved, excluded, and included and the reasons and order in which articles are excluded. During the search, 2,395 articles were originally retrieved, 2,229 articles were excluded based on review of title and publication type, 108 articles were excluded based on review of abstract, 7 articles were excluded after reading the paper and 2 articles were included after searching references. 53 articles in total are included in this review

Table 1

Summary of the 53 original articles included in the review

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
Low-income countries (<i>N</i> = 18 articles)				
Antelman et al. [29]	1995–2003 Tanzania Quantitative; Longitudinal	996 (all HIV+); 76 % 5–8 years education; 58.4 % married; 72.9 % unemployed Antepartum; Postpartum years 2–8	Depression (8-item HSCL-25); Social support (FSSQ); HIV Disease Stage (WHO criteria); participation in counseling	<i>Depression associated with:</i> >60 % risk of progression to stage III/IV AIDS Two-fold mortality increase
Bernatsky et al. [18]	2005 Angola Quantitative; Cross-sectional	157 (23 HIV+; 134 HIV–); 20 % unemployed Antepartum	Emotional distress (GHQ-12); HIV-related knowledge and practices	<i>HIV+ status predicted more distress:</i> <i>Married women had less distress;</i> <i>HIV+ pregnant women:</i> 67 % had significant emotional distress 87.5 % did not know partner's HIV status 42.6 % had not disclosed HIV status to anyone 37.5 % disclosed to their current sexual partner
Chibanda et al. [17]	NR Zimbabwe Quantitative; Cross-sectional	<i>N</i> = 210 (31 HIV+; 148 HIV–; 31 unknown HIV status); 79 % married; 75 % unemployed; 74 % HS education Postpartum (6-week postnatal visit)	PPD (Shona version of EPDS, SCID); adverse life events (interview)	33 % of total cohort and 54 % HIV+ women had PPD; <i>HIV status not associated with PPD;</i> <i>Predictors of PPD:</i> 1) Adverse life events; 2) Unemployment; 3) Multiparity
Cuca et al. [32]	NR Kenya Quantitative cohort	<i>N</i> = 1,777 rural women getting antenatal HIV testing (257 HIV+); 79 % married; 80 % HS education;; 55 % unemployed; 27 % husbands had other wives Antepartum, 4–8 weeks postpartum	HIV knowledge, HIV status, disclosure, perceived stigma (PSS); anticipated stigma (ASS); experienced stigma (HASI-P); PPD (EPDS 10)	67.3 % women anticipated stigma before knowing HIV status 55.8 % HIV+ women experienced (mostly self-) stigma at postpartum; <i>Predictors of experiencing stigma among HIV+ women</i> (<i>N</i> = 147): (1) Housework major contribution to household; 2) Family knows HIV+ status; 3) Perceived community stigma; 4) PPD
Desmond et al. [24]	2008–2010 South Africa Quantitative; Cross-sectional	<i>N</i> = 1201 HIV+ women; 80 % HS education; 79 % single; 55 % unemployed; 53 % peri-urban, 24 % rural Antepartum	Alcohol use (AUDIT-C), living conditions, risky behavior, social support, home conflict; pregnancy history; mental health (GHQ-12)	18 % rate of antepartum drinking; <i>Correlates of antepartum drinking:</i> 1) STI treatment; 2) Multiple sex partners in last year; 3) (Peri-)urban living; 4) Not married; 5) More social activity; 6) Higher economic status; 7) History of mental illness
Ezechi et al. [33]	2006–2007 Nigeria Mixed Methods; Cross-sectional	<i>N</i> = 652 HIV+ women; 47.3 % HS education; 43.5 % middle class, 40.7 % upper class Antepartum	Intimate partner violence, HIV disclosure (Standardized survey)	65.8 % women reported IPV; 51.7 % verbal abuse, 21.6 % sexual deprivation, 20.8 % threat of violence Started after HIV diagnosis in 74 % cases
Futterman et al. [25]	2006–2008 South Africa Quantitative; Quasi-experimental	<i>N</i> = 160 HIV+ women; 24.4 % >10 th grade education; 31.9 % employed, 61.5 % lived in shack Antepartum; 3 mo. postpartum	Depressive symptoms (CES-D); Coping (COPE); HIV knowledge, discomfort, PMTCT adherence, (interview); Social support (MOSS)	<i>Participation in Mamekhaya program associated with:</i> Lower CES-D scores Higher social support availability Increased HIV knowledge

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
Groves et al. [23]	NR South Africa Quantitative; Cohort; Cross-sectional	N = 1402 (all HIV+); 46.4 % completed HS; 72.1 % partnered living separate Antepartum	Depression/anxiety (HSCL-25); IPV (WHO-VAW); Childhood Sexual Abuse (CSA); Perceived Relational Control (SRPS); Social Support (NSSQ); SES	24.8 % women reported IPV during pregnancy <i>Emotional distress during pregnancy:</i> Associated with childhood sexual abuse, high levels of male control within the relationship, and sexual/psychological IPV Odds higher with each episode of psychological or sexual IPV
Kaaya et al. [31]	2001–2004 Tanzania RCT	N = 188 (331 HIV+ women were randomized to two treatment arms, but analysis included only 188 who completed either arm) Antepartum	Depressive symptoms (HSCL-25); HIV disclosure (14-item scale); Social support, Fear and satisfaction with disclosure (Narrative analysis)	<i>6-week problem-solving group counseling (vs. Standard-of care):</i> Marginally greater reduction in depressive symptoms ($p = 0.066$) No difference in post-intervention disclosure ($p = 0.19$) Greater satisfaction with responses to disclosure ($p = 0.004$)
Kotze et al. [22]	NR South Africa Quantitative; Longitudinal	N = 224 (all HIV+); 76.3 % HS Education; 67.9 % single with partner; 23.2 % regular employment Antepartum; Postpartum (3, 9, 18 mos.)	Coping (COPE); HIV knowledge; Social support; Stigma; Self-esteem (RSE); Depression (CES-D); Decision-making power; Experience of violence	<i>Avoidant Coping increased at each visit:</i> Direct correlation with internalized stigma Inverse correlation with RSE, HIV knowledge scores <i>Active Coping increased at each visit:</i> Direct correlation with positive social support, inverse with internalized stigma, CES-D, RSE scores
Kotze et al. [27]	South Africa Quantitative; Longitudinal	N = 224 HIV+ women; 67.9 % single with partner; 76.3 % some form of HS; 23.2 % regular employment income Antepartum; Postpartum (3, 9, 18 mos.)	Coping strategies in the first two years after HIV diagnosis during pregnancy (BriefCOPE)	<i>Active coping used more than avoidant coping;</i> <i>Most used coping strategies:</i> acceptance, direct action, positive reframing, religion and distraction; <i>Outward-focused replaced inward-focused coping over time</i>
Kwalombota [19]	NR Zambia Mixed Methods; Cross-sectional	N = 45 (40 tested HIV+ while pregnant; other 5 aware of HIV+ status before pregnancy) Antepartum	Depression, Anxiety, Suicidal Behavior, Awareness of current affairs (non-structured interview)	85 % women reported major depressive episodes and significant thoughts of suicide
Lazarus et al. [21]	2006–2007 South Africa Qualitative; Cross-sectional	N = 38 HIV+ new mothers (20 had HIV+ babies; 18 had HIV+ babies.); 68.4 % unemployed Postpartum (4–6 weeks)	Experiences around testing and results; attitudes about future; infant feeding; family planning; stress; support; coping (PIs)	<i>Mothers of HIV+ infants:</i> relieved, determined; <i>Mothers of HIV+ infants:</i> focused on infant health care; <i>Both groups:</i> expressed guilt over exposing child to HIV, reiterated innocence of their child;
Manikkam and Burns [28]	2011 South Africa Cross-sectional	387 women attending urban antenatal clinic (104 HIV+, 201 HIV–, 73 unknown); 65 % unemployed; 52 % HS education; 70.9 % married or had a partner Antepartum	Depression (EPDS 12), demographic characteristics, pregnancy history, HIV status (standardized 12-item questionnaire)	38.5 % of total cohort suffered from depression; 38.3 % thought of harming themselves in the preceding 7 days; Correlates of depression: HIV seropositivity prior history of depression; recent thoughts of self-harm

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
Mfusi and Mahabeer [20]	NR South Africa Mixed methods; Case-control	N = 60 (30 HIV+, 30 HIV-) rural Black women; 100 % < HS degree; 100 % married Antepartum	Anxiety (IPAT), Depression (BDI), Social Support (ISS; SSA); Adjustment to Pregnancy (IDI)	<i>single marital status; unplanned pregnancy</i> <i>HIV+ status correlated with:</i> High anxiety Small social support networks
Mundell et al. [26]	2005–2006 South Africa Quantitative; Quasi-experimental clinical trial	N = 361 HIV+ women Antepartum, Postpartum (10-session support group for pregnant women; follow-up assessments at 2 and 8 months post-intervention)	Attendance, Disclosure, Self- Esteem (RSE), Coping Styles (COPE), Positive/Negative Social Support (MSSI), Depression (CES- D)	<i>Intervention associated with:</i> Higher active coping Higher disclosure rates Lower avoidant coping Increased self-esteem
Smith Fawzi et al. [30]	1995–1997 Tanzania RCT	N = 1013 (all HIV+; 4 study arms [vitamin A; MVI excluding vitamin A; MVI+ vitamin A; placebo]); 76.2 % had 5–8 yrs. education Antepartum (12–27 weeks)	Depressive symptoms (HSCL-25), Health-related QoL (SF-36)	42 % of women had elevated depressive symptoms; MVI supplement intervention showed efficacy; Higher mean SF-36 scores Lower mean HSCL-25 scores
Stranix-Chibanda et al. [16]	2002 Zimbabwe Quantitative; Case-control	N = 437 pregnant women undergoing HIV testing; 86.5 % < 7 yrs. education; 91 % unemployed; 97 % married Antepartum (3 rd trimester)	HIV status; Demographics; Psychological morbidity (SSQ)	<i>Psychological morbidity risk:</i> Higher if husband >35 yrs. old Not associated with HIV status
Middle-income countries (N = 5 articles)				
Bennetts et al. [35]	1995–1996 Thailand Quantitative; Cross-sectional	N = 129 HIV+ women; 60 % Primary education; 77 % unemployed; 72 % in relationship Postpartum	Depression (CES-D; "mild" 16; "severe" 23); Coping (COPE); HIV-related worry (MHWS); Disclosure, Shame (closed- response questions)	43 % screened positive for mild, 29 % for severe depression; <i>Correlates of Depression:</i> 1) Venting coping strategies; 2) No longer with the partner from pregnancy; <i>Correlates of HIV-related worry:</i> 1) Having HIV+ baby; 2) HIV-related shame; 3) Not disclosing HIV diagnosis;
Boonpongmanee et al. [36]	NR Thailand Quantitative; Case-control	N = 153 (77 HIV+); ~ 90 % married; avg. yrs of education < 10 Postpartum	Depressive symptoms (CES-D); Learned resourcefulness (SCS); Prenatal self-care practices (HPCA)	<i>Depression, HIV status explained 18 % variance in HPCA scores;</i> <i>Learned resourcefulness mediated effects of depression on prenatal self-care</i>
Ross et al. [34]	2004–2006 Thailand Quantitative; Correlational; Cross-sectional	N = 127 HIV+ women; 72 % < HS education; 92 % live with partner; 45 % unemployed Antepartum	Depressive symptoms (CES-D), Self-esteem (RSE); Emotional Support (MSPSS); Physical symptoms (2 standardizes questions)	<i>Depressive Symptoms:</i> Positively correlated with physical symptoms Negatively with self-esteem, emotional support, finances 22.9 % women had CES-D scores 16–22 ("mild depression") 55.1 % had CES-D scores 23 ("severe depression")
Ross et al. [38]	2005–2007 Thailand Quantitative; Correlational; Cross-sectional	N = 85 HIV+ women; 42 % unemployed; 74.7 % < HS education; 72 % live with partner; Postpartum	Depression (CES-D; "mild" 16; "severe" 23); Self-esteem (RSE); Emotional support (MSPSS); Physical symptoms, infant health status	44.7 % screened positive for mild, 29.4 % for severe depression; <i>Predictors of Depression:</i> Lower self-esteem

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
Ross et al. [37]	2008–2009 Thailand Mixed methods (RCT and qualitative interviews)	RCT: <i>N</i> = 40 HIV+ women (2 study arms [telephone support by RN; “usual care”]; qualitative interviews: <i>N</i> = 20 women who received telephone support intervention) Antepartum	Depressive symptoms (CES-D) at 1 and 2 month from study baseline; demographic characteristics, pregnancy history and complications (standardized questionnaire)	Poor infant health status as perceived by mother Poor infant health status as perceived by mother Lower education <i>Telephone support associated with greater improvement of depressive symptoms over time;</i> <i>Most helpful elements of the intervention per interviews:</i> putting things into perspective knowing “someone was always there” practical guidance
High-income countries (<i>N</i> = 30 articles)				
Blaney et al. [57]	1996–1998 US Quantitative; Cross-sectional	<i>N</i> = 307 HIV+ women; 71 % Black; mean education = 10.95 yrs.; 21.2 % employed; mean income = \$848/mo. Antepartum	Depression severity (CES-D); no somatic items; Coping (BriefCOPE); Stressors, support (standardized interview)	<i>Depression correlates:</i> 1) Perceived stress; 2) Social isolation; 3) Disengaged coping; <i>Positive partner support inversely correlated to depression risk</i>
Bonacquisti et al. [45]	2009–2011 US Quantitative; Cross-sectional	<i>N</i> = 163 women (50 HIV+ ; 113 HIV-); 79 % Black; 63 % unmarried with partner, 48 % unemployed Antepartum	Depression (CES-D score 16); Mood disorders (SCID); Childhood sexual abuse, social support, depression history (Yes/No)	<i>36 % women screened positive for depression;</i> <i>Rates of positive depression screen, mood disorders not different by HIV status;</i> <i>Predictors of antepartum depression:</i> 1) Childhood Sexual Abuse; 2) History of depression; 3) Inadequate social support
Bucceri et al. [47]	1985–1993 Italy Quantitative Longitudinal	<i>N</i> = 315 IVDU women (151 in the early stages of HIV infection; 164 HIV-) Antepartum, 24 mo. infant follow-up	MTCT rates, pregnancy course/outcomes, HIV disease severity (clinical exam, laboratory tests)	<i>Pregnancy duration, BW, BL, HC, 1' and 5' Apgar scores not different by maternal HIV status;</i> <i>MTCT risk marginally higher in HIV+ current (vs. past) IVDUs (OR = 4.8; 95 % CI = 1.0–32.6)</i>
Dodds et al. [69]	1996 US Program overview	HIV+ women receiving primary care at Whole Life program, University of Miami Antepartum, Postpartum	N/A	<i>Demonstrates feasibility of integrating mental health care into primary care for HIV+ pregnant and non-pregnant women and its application to clinical care and research</i>
Forsyth et al. [40]	1989–1996 US Quantitative Retrospective	<i>N</i> = 360 (90 HIV+ ; 180 HIV-; 90 HIV- matched on drug use); 76.7 % African-American; Antepartum, Postpartum	SA, obstetric history, prenatal care, HIV-related factors (medical records)	<i>Cocaine use during index pregnancy associated with more subsequent pregnancies, less tubal ligations;</i> <i>HIV+ women:</i> 63 % used cocaine, 26 % used opiates during index pregnancy Had fewer subsequent pregnancies than HIV- women
James [61]	NR US Case series	<i>N</i> = 15 HIV+ women; 73.3 % Black; 26.7 % White Antepartum	Psychiatric diagnoses, SA, pregnancy outcomes, attitudes towards pregnancy (clinical interviews, medical chart review)	<i>86.7 % women had a SA disorder;</i> <i>20 % had a mood disorder;</i> <i>53.3 % had an adjustment disorder;</i> <i>73.3 % had antisocial or borderline personality disorder;</i> <i>Predominant attitudes:</i> Anxiousness, Remorse, Guilt;

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
James et al. [62]	1987–1989 US Quantitative Longitudinal	N = 55 HIV+ women in urban obstetric clinic in Georgia; sample reflected clinic demographics (~ 90 % Black, low SES; Antepartum	SA, psychiatric diagnoses (clinical interviews, medical record review)	<i>Correlates of SA:</i> Psychiatric diagnoses Major Depression Depressive Disorder NOS
Kapetanovic et al. [44]	1997–2006 US Quantitative; Retrospective	N = 273 HIV+ women; 68.9 % Hispanic, 25.6 % African American Antepartum, 4 weeks postpartum	PND, SA, psychosocial, pregnancy and HIV-related factors (chart review)	31 % women had PND (22 % antepartum; 18 % postpartum) <i>Correlates of PND:</i> 1) History of mental illness; 2) Social stress during pregnancy; 3) SA in pregnancy; 4) Adherence problems during pregnancy; 5) Nadir CD4 ⁺ cells/mm ³
Kelly et al. [49]	2008–2009 Northern Ireland Qualitative Prospective	N = 4 HIV+ women; European (n = 2), African (n = 1), Asian (n = 1) Antepartum	Pregnancy and childbirth experiences (IDIs)	<i>Major themes:</i> 1) Chaos of diagnosis; 2) Experience of stigma; 3) Threat to relationships; 4) Concern for infant; 5) Pregnancy as a savior; 6) Creating continuity out of disruption;
Kelly et al. [50]	2008–2009 Northern Ireland Qualitative Longitudinal	N = 10 HIV+ women; 6 Irish, 2 African, 1 Eastern European, 1 Asian Antepartum, Postpartum (6–8 weeks)	Pregnancy, maternity care, interactions with midwives (Serial IDIs)	<i>Major theme:</i> Desire for acceptance, normalcy; <i>Desired staff attributes:</i> 1) HIV knowledge, experience; 2) Empathy; 3) Understanding unique needs; 4) Continuity;
Koenig et al. [58]	1996–1998 US Mixed methods; Prospective; Cross-sectional	N = 634 (336 HIV+; 298 HIV– matched on demographics, HIV risk, prenatal care entry); 69.7 % Black, 19.9 % Hispanic; 53.6 % < HS, 76 % income \$1,000/mo.; Antepartum	IPV, current partnerships, HIV risk behaviors (structured interview with open-ended questions)	8.9 % women reported IPV in past 6 months; IPV, abuse rates not different by HIV status; 9.7 % HIV+ women who disclosed HIV status to partner reported physical assault, anger, depression, shock, relationship problems, or termination after disclosure;
Koenig et al. [59]	1997–1999 US Quantitative; Longitudinal	(Sample same as above) Late pregnancy, 6 mo. postpartum	IPV, SA, sexual partnerships, pregnancy and health factors (structured interview)	10.6 % women reported IPV during or after pregnancy; <i>Correlates of IPV risk:</i> 1) Bartered sex; 2) Lower income; 3) Multiple sexual partners; 4) SA
Larabee et al. [39]	1994–1995 US Quantitative; Longitudinal	N = 42 (21 HIV+; 21 HIV– matched on parity, demographics) Antepartum, Postpartum	QoL, mental health, health distress fatigue, pain, health transition, and physical, role, social, and cognitive functioning (MOS-SF) assessed at antenatal visit, 24 h and 6 months postpartum	HIV+ women had worse overall health, perceived QoL and social functioning postpartum (vs. antepartum and delivery); HIV+ (vs. HIV–) women: Higher health distress antepartum Worse perceived health transition antepartum Lower social functioning postpartum Lower cognitive functioning 6 months postpartum
Lester et al. [63]	1989–1992 US Mixed methods Cross-sectional	N = 40 (20 HIV+; 20 HIV– matched on due date, demographics, HIV risk factors); 40 % African American, 35 % White, 63 % with primary income \$500–999/mo.	Impact of positive HIV test on women's lives (standardized open-ended questions); psychological sequelae (PSS, STAI, CES-D)	Only 56 % of HIV+ and 44 % of HIV– women knew their partner's HIV status HIV+ women (vs. HIV– women): Higher mean STAI scores

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
Levine and Allen [68]	N/A US Program overview	Postpartum HIV+ women receiving care at Special Prenatal Program at Bellevue Hospital Antepartum	N/A	More likely to change their future childbearing plans Describes a feasible model of integrating antenatal, HIV and mental health clinical care for HIV+ women
Levine et al. [42]	2004–2006 US Quantitative; Cross-sectional	N = 51 (all HIV+) 80 % Black; 16 % married; 35 % employed Antepartum	Depression (BDI score >9); SA (self-report); psychosocial characteristics, pregnancy course (chart review)	53 % women screened positive for depression; Depression correlates: 1) History of psychiatric diagnosis; 2) History of SA
Mauri et al. [48]	1986–1992 Italy Quantitative; Prospective Cohort	N = 114 opiate-using women (38 HIV+; 76 HIV-) Antepartum, Postpartum	SA, obstetric parameters, perinatal outcomes (serial laboratory and clinical evaluations)	HIV+ opiate users had increased odds of: threatened premature labor; preterm labor; C-sections; unexplained fevers Regardless of maternal HIV status: Opiate addiction associated with reduced GL Methadone use associated with higher odds of SGA neonates; lower 1' and 5' Apgar scores
Pereira et al. [70]	NR Portugal Program overview	HIV-disorder couples transitioning to parenthood Antepartum	N/A	This is a step-by-step tutorial outlining key elements of a couple-focused counseling intervention for HIV-disorder couples transitioning to parenthood
Pereira and Canavarro [51]	2003–2008 Portugal Quantitative Prospective Longitudinal	N = 75 (31 HIV+, 44 HIV-); 85 % married or cohabiting Antepartum, Postpartum	QoL (WHOQOL-BREF); Emotional reactivity (EAS); Psychological symptoms (BSI)	In both groups: QoL improved in physical and psychological domains from antepartum to postpartum; HIV+ status associated with: more negative emotional reactivity, lower scores in social relationships, overall antepartum QoL; Among HIV+ women, lower antenatal anxiety predicted better psychological and overall QoL at early postpartum
Rodriguez et al. [56]	1987–NR US, Puerto Rico Natural History Cohort	N = 203 (all HIV+) Antepartum	Substance use (Self-report questionnaire, urine assay), HIV information, infant outcomes (Medical charts)	49 % of HIV+ women reported antepartum SA; SA predicted infant prematurity, smaller BW, BL and HC; Higher odds of MTCT with cocaine/crack, heroin or methadone use
Rubin et al. [60]	1994–2005 US Quantitative Prospective	244 (139 HIV+; 105 at risk for HIV); 62 % African American; 31 % Hispanic Antepartum; 12 mo. postpartum	Depressive symptoms (CES-D cut-off 16 and 23); intention of pregnancy, health behaviors, service features (clinical exam, standardized interview)	46 % women had increased CES-D scores; Rates not different by HIV status; Predictors of increased CES-D scores: 1) Pre-conception depression; 2) Use of mental health services; 3) < HS education; 4) Number of sexual partners
Sanders [43]	NR US Qualitative; Cross-sectional	N = 9 HIV+ women; Black (n = 7), White (n = 2); HS (n = 7), College/MA (n = 1); Single (n = 7), married (n = 1), divorced (n = 1) Antepartum	Reaction to HIV diagnosis, relationships with providers; pregnancy, childbearing and motherhood experiences (IDIs)	Major themes: 1) Extreme emotional distress after HIV diagnosis; 2) Feeling stigmatized; 3) Distress and ambivalence related to pregnancy and baby; 4) Experiences with healthcare providers; 5) Motherhood with HIV;

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
Shannon and Lee [41]	2004–2007 US Quantitative Prospective Longitudinal	N = 20 (all HIV+); 40 % Caucasian, 40 % African American Antepartum, Postpartum	Maternal uncertainty about infant HIV status (PPUS-D); Stress (PSS-10); Distress (BSD), Depression (CES-D); Social conflict, support (IPRI-SF)	<i>Maternal uncertainty:</i> Decreased over time Inversely related to social support Positively correlated with depression, distress, social conflict
Svikis et al. [64]	NR US Mixed methods Cross-sectional	N = 21 HIV+ women; 85 % African American; Mean education = 10 yrs.; 90 % unemployed; 100 % Federal Medical Assistance; 30 % live with partner/children Antepartum	Drug addiction (AST, APS, AAS, Mac-R), personality and psychopathology (MMPI-2)	75 % women had significant scores on schizophrenia, mania, and antisocial personality scales; 67 % reached clinical significance on the anxiety scale; 86 % and 90 % above cut-off on AAS and Mac-R, respectively; All scored high on the post-traumatic stress scale; Mean 2 point personality code type: Schizophrenia-paranoia;
Swartz et al. [65]	NR US Mixed methods; Longitudinal Prospective	N = 33 HIV+ women (12 pregnant; 21 not); 51 % Black; 36 % Hispanic; 82 % on Medicaid; 88 % unemployed; 40 % single Antepartum; Postpartum (avg. follow-up time 5.4 ± 3.9 mo.)	Depression (HAM-D 15, BDI 17), SA, pregnancy history, psychosocial characteristics (Semi structured interview, GAS); Sexual functioning (SFQ)	Depression rates ranged from 22 % to 30 % over time; Pregnant women (vs. non-pregnant): Less hospitalizations and drug use HAM-D, BDI, GAS scores not different at baseline Lower HAM-D, BDI, higher GAS scores at follow-up
Tassiopoulos et al. [55]	2007–2009 US Quantitative Prospective Cohort	N = 480 mother–infant pairs (all mothers HIV+; all infants HIV–; 264 meconium samples); 63.1 % Black, 28.6 % Hispanic; 37.9 % < HS education; 60.8 % < \$20,000 annual income; 26 % employed; 23.7 % married Antepartum	SA (Substance Use Inventory, meconium, urine and blood toxicology assays), Maternal characteristics (interviewer-assisted questionnaire), HIV disease progression (chart review)	29 % self-reported SA during pregnancy; Tobacco (18 %), alcohol (10 %), cannabis (7 %) most prevalent SA decreased by trimester ($Z = -3.80$, trend $p < 0.01$) <i>Meconium assays:</i> Sensitivity of self-report was 80 % for marijuana, 67 % for cocaine, 86 % for tobacco (including passive exposure) and 67 % for tobacco when passive exposure not included PPV of self-reported tobacco use was 29 % with and 75 % without included passive exposure
Thome and Newell [54]	1985–2005 Multiple European countries Quantitative Prospective Cohort	N = 2342 (all HIV+; 1,480 Ex IVDUs; 863 Current IVDUs); 39 % married; 35 % co-habiting; 96 % White Antepartum	IVDU history (Self report); ART, HIV disease information (medical records, laboratory evaluations)	<i>MTCT rates did not differ by IVDU history;</i> <i>Current (vs. past) IVDU associated with lower BW</i>
Turner et al. [52]	1988–1990 US Quantitative; Retrospective	N = 901 (all HIV+); 41 % Black, 42 % Hispanic Antepartum	Drug use, HIV disease information, prenatal care, pregnancy outcomes (New York State Medicaid data)	<i>Smoking in pregnancy associated with 45 % added MTCT risk;</i> <i>Use of cigarettes, cocaine, other illicit drugs associated with increased risk of low BW</i>

Reference	Study year(s) Country Study design	Sample size and characteristics Pregnancy stage	Variables (measures)	Key findings
Villar-Loubet et al. [46]	2011–2013 US Retrospective	N = 45 HIV+ pregnant women who reported past history of trauma; 2/3 Black (African-American or Haitian) Antepartum	Brief mental health screen (adapted PRIME-MD PHQ with depression, anxiety, PTSD, abuse, panic, psychosis and substance abuse subscales)	Positive screening rates: Depression 91.1 %; Anxiety 71.1 %; PTSD 56.8 %; PTSD-HIV 56.8 %; Substance abuse 21 %; Psychosis 7 %
Warner et al. [53]	1992–1998 US Quantitative Retrospective	N = 346 (all HIV+; 378 deliveries); 100 % Medicaid recipients; 67.3 % African American, 21.4 % Latina; Antepartum, 6 mo. postpartum	Patterns of service use, SA and treatment, ART use (Surveillance data, paid Medicaid claims)	46 % women had SA-related claims; Ob/gyn care increased odds of SA treatment next month; Probability of ART receipt highest antepartum than other months; SA treatment: Increased odds of perinatal ART receipt Greater postpartum than any other month

AAS' Addiction Admission Scale, *APS* Addiction Potential Scale, *ART* Anti-Retroviral Therapy, *ASI* Addiction Severity Index, *ASS* Anticipated Stigma Scale, *AUC* area under curve, *AUDIT-C* Alcohol Use Disorder Identification Test-Consumption, *BDI* Beck Depression Inventory, *BL* Birth Length, *BSI* Brief Symptom Inventory, *BW* Birth Weight, *CES-D* Center for Epidemiological Studies Depression Scale, *CSA* Childhood Sexual Abuse scale, *EAS* Emotional Assessment Scale, *EPDS* Edinburgh Postnatal Depression Scale, *FGD* Focus-group discussion, *FSSQ* Duke-UNC Functional Social Support Questionnaire, *GAS* Global Assessment Scale, *GHQ-12* General Health Questionnaire, *HAM-D* Hamilton Rating Scale for Depression, *HPCA* Hart Prenatal Care Actions Scale, *HASI-P* HIV/AIDS Stigma Instrument-People Living with AIDS, *HC* Head Circumference, *HS* High School, *HSCI-25* Hopkins Symptom Check List, *IDI* In-depth interview, *IPAT* IPAT Anxiety Scale Questionnaire, *IPRI-SF* Interpersonal Relationship Inventory Scale-Short Form, *IPV* intimate partner violence, *ISS* Index of Social Support, *IVDU* Intravenous Drug Use(rs), *MDD* Major Depressive Disorder, *MHWS* Modified HIV-Related Worry Scale, *Mac-R* MacAndrews Alcoholism Scale, *MMPI-2* Minnesota Multiphasic Personality Inventory-2, *MOS-SF* Medical Outcome Survey-Short form, *MOSSS* Medical Outcomes Study Social Support Survey, *MSPSS* Multidimensional Scale of Perceived Social Support, *MSSI* Multidimensional Social Support Inventory, *MVI* multivitamin, *N/A* not applicable, *NR* not reported, *PMTCT* prevention of mother-to-child transmission of HIV, *PND* perinatal depression, *PPD* Post-Partum Depression, *PPS-10* Perceived Stress Scale-10 item, *PPUS-D* Parental Perception of Uncertainty-Diagnosis, *PPQ* Patient Problem Questionnaire, *PPV* positive Predictive Value, *PSS* Perceived Stigma Scale, *PTSD* Post-Traumatic Stress Disorder, *PTSD-HIV* PTSD symptoms related to any HIV-associated event, *QoL* Quality of Life, *RCT* randomized controlled trial, *RSE* Rosenberg Self-Esteem Scale, *SA* substance abuse, *SCID* Structured Clinical Interview for DSM-IV, *SCS* Self-Control Schedule, *SES* Socioeconomic Status, *SF-36* Medical Outcomes Study Short Form, *SFQ* Sexual Function Questionnaire, *SRPS* Sexual Relationship Power Scale, *SSA* Social Support Appraisal, *SSQ* Shona Symptom Questionnaire, *STAI* State-Trait Anxiety Inventory, *WHO* World Health Organization, *WHOQOL-Bref* World Health Organization Quality of Life Scale, *WHO-VAW* World Health Organization Violence Against Women instrument