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Postpartum Human Immunodeficiency Virus Care Among Women Diagnosed During Pregnancy

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Abstract

OBJECTIVE—To identify factors associated with continuity of care and human immunodeficiency virus (HIV) virologic suppression among postpartum women diagnosed with HIV during pregnancy in New York State.

METHODS—This retrospective cohort study was conducted among 228 HIV-infected women diagnosed during pregnancy between 2008 and 2010. Initial receipt of HIV-related medical care (first CD4 or viral load test after diagnosis) was evaluated at 30 days after diagnosis and before delivery. Retention in care (2 or more CD4 or viral load tests, 90 days or greater apart) and virologic suppression (viral load 200 copies/mL or less) were evaluated in the 12 months after hospital discharge.

RESULTS—Most women had their initial HIV-related care encounter within 30 days of diagnosis (74%) and before delivery (87%). Of these women, 70% were retained in the first year postpartum. Women waiting more than 30 days for their initial HIV-related care encounter were more likely diagnosed in the first (29%) compared with the third (11%) trimester and were of younger (younger than 25 years, 32%) compared with older (35 years or older, 13%) age. Loss to follow-up within the first year was significantly greater among women diagnosed in the third compared with the first trimester (adjusted relative risk 2.21, 95% confidence interval [CI] 1.41–3.45) and among women who had a cesarean compared with vaginal delivery (adjusted relative risk 1.76, 95% CI 1.07– 2.91). Of the 178 women with one or more HIV viral load test in the first year postpartum, 58% had an unsuppressed viral load.

CONCLUSION—Despite the high proportion retained in care, many women had poor postpartum virologic control. Robust strategies are needed to increase virologic suppression among newly diagnosed postpartum HIV-infected women.

An estimated 200,000 women in the United States are infected with human immunodeficiency virus (HIV),[1] of whom a small fraction deliver a neonate each year.[2]

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Considerable public health resources have been used to raise awareness among women at high risk for HIV infection as well as provide information for those already infected about ways to reduce transmission to the neonate. As a result, mother-to-child transmission of HIV in the United States is uncommon.[3] In New York state, nearly all pregnant women are aware of their HIV status before delivery and prophylaxis is provided to exposed neonates identified through maternal or newborn testing.[4,5] The result has been the near elimination of mother-to-child transmission in New York state; only two cases of perinatally acquired HIV were reported in 2013. However, approximately 400 HIV-positive women deliver every year and are in need of postpartum HIV care.

Human immunodeficiency virus–positive women are more likely to adhere to treatment during pregnancy than after.[6] Prior studies report that only approximately one third of women engage in postpartum HIV-related care,[7–9] increasing the likelihood of poor virologic control postpartum.[9] Few studies have evaluated HIV care and outcomes during the postpartum period among women in the United States; none has specifically focused on women diagnosed during pregnancy. The HIV care outcomes for this group may differ from women diagnosed before pregnancy. The primary objective of this study was to describe initial receipt of HIV-related care and postpartum retention in HIV-related care among women diagnosed with HIV during pregnancy. We also evaluated HIV viral suppression in the first year postpartum.

MATERIALS AND METHODS

This retrospective cohort study was conducted among newly diagnosed HIV-infected women with a live birth, who were eligible for inclusion in the study if they: 1) gave birth to a live neonate from 2008 to 2010, 2) were diagnosed with HIV infection while pregnant, 3) were reported to the New York State HIV Surveillance Registry, 4) resided in New York state at HIV diagnosis, 5) had a residence at diagnosis that could be geo-located, and 6) had a recorded discharge date.

The New York State Department of Health's Surveillance Registry receives name-based reports for all HIV-related laboratory test results (eg, CD4 counts and percent, viral load tests, nucleotide sequences from genotype resistance testing) for individuals who reside or receive HIV-related care in the state.[10] The Surveillance Registry routinely undergoes quality control and verification in conformity with the Centers for Disease Control and Prevention's HIV Surveillance Guidelines.[11] Human immunodeficiency virus medical visits were approximated using recorded CD4 and viral load laboratory tests[12] assessed for the 12 months after hospital discharge. Laboratory data from January 2008 to December 2011 were used to equalize the observation period for all study participants. This study was approved by the New York State Department of Health institutional review board. Because the study used data reported to the HIV Surveillance Registry and there was no contact with infected persons, informed consent was not required.

Human immunodeficiency virus–infected women who delivered a live neonate were identified by linking case records from the New York State HIV Perinatal Database to the statewide HIV Surveillance Registry. All neonates born in New York state are screened for

HIV antibodies. Neonates are identified in the Perinatal Database based on a positive HIV antibody result. Additional case data are obtained from diagnostic laboratory testing of exposed neonates and abstraction from the prenatal, labor and delivery, newborn, and pediatric medical records. Only mothers with an existing case record in the Statewide HIV Registry could be studied. New York state laws prohibit the creation of a case record for mothers who have not themselves consented to be tested for HIV; only one occurrence was recorded between 2008 and 2010.

Women were categorized as diagnosed with HIV during pregnancy based on reports to the Perinatal Database. Timing of diagnosis was validated by estimating the start of pregnancy (ie, the neonate's birth date minus gestational age at delivery) and then comparing this date with the date of diagnosis reported to the HIV Surveillance Registry. Women diagnosed between admission for delivery and up to 14 days after delivery were categorized as diagnosed at delivery. Demographic data and clinical outcomes were obtained from the New York State HIV Surveillance Registry. Pregnancy-related variables such as type of delivery, neonate's birth date, and gestational age at delivery were obtained from the Perinatal Database.

The three HIV care-related outcomes evaluated in this study were: 1) initial receipt of HIV-related care, 2) retention in care in the first year postpartum, and 3) virologic suppression in the first year postpartum. Initial receipt of HIV-related care was assessed as occurring within 30 days after diagnosis or longer based on the time between the date of diagnosis and the date of the first laboratory test (ie, CD4 or HIV viral load test) reported to the Surveillance Registry. Initial receipt of HIV-related care also was assessed as occurring before or after delivery. Retention in HIV care was defined as two or more laboratory tests (ie, CD4 or viral load tests) in the 12 months after delivery hospital discharge separated by at least 90 days.[13] Human immunodeficiency virus virologic suppression was defined as a quantitative viral load test 200 copies/mL or less. Women were categorized as virologically suppressed if all reported viral loads were 200 copies/mL or less during the first postpartum year.

Bivariate analyses using unadjusted relative risks (RRs) with 95% confidence intervals (CIs) were conducted to test associations between categorical study variables and outcomes. Stratified analyses were used to evaluate the interaction of study variables with each other and the study outcomes. Women who met the study inclusion criteria were included in the analysis of initial receipt of HIV-related care and postpartum HIV viral suppression, but only those women whose initial care encounter occurred before delivery were evaluated in the analysis of retention in care.

Missing values were imputed for number of previous live births (18%), last viral load before delivery (15%), low birth weight, and percent residing in a high-poverty area (less than 1% each) using Sequential Regression Multivariate Imputation[14] implemented using IVEware.[15] Separate models were fitted for retention and virologic suppression using Poisson regression[16,17] solved using generalized estimating equations.[18] Only covariates that best predicted ($P<.05$) each outcome were retained in the final models. Multivariable associations were reported as adjusted RRs with 95% CIs. Because the standard analysis approach is to model the less frequent outcome, the RRs of not initiating HIV care, and not being retained

in care (ie, lost to follow-up in the first year postpartum) are presented. Data analyses were conducted using SAS 9.3 and IVEware.[15]

RESULTS

Between 2008 and 2010, 254 women with a live birth in New York state were identified as having been diagnosed with HIV during pregnancy. Women were excluded if they: 1) had a missing maternal discharge date (n=15), 2) resided outside of New York state at HIV diagnosis (n=4), or 3) had insufficient address information to geo-locate residence at delivery (n=7). An additional 30 women who did not receive HIV-related care before delivery were excluded from the analysis of retention in care.

Of the 30 women whose initial receipt of HIV-related care occurred after delivery, two, five, and seven women were diagnosed in the first, second, and third trimesters, respectively; 16 were diagnosed at delivery. Women whose initial receipt of HIV-related care occurred after delivery were predominately black (60%) or Hispanic (27%) and aged younger than 25 years (40%). Seven had no reported viral load test in the 12 months after delivery and the remaining women (n=23) had an unsuppressed viral load at the first test in the 12-month postpartum follow-up period.

Women in the study were predominately black (61%) (Table 1). The median age at HIV diagnosis was 27.5 years (range 15.0–45.0 years). Almost two thirds (64%) resided in census tracts where more than 20% lived below the federal poverty level. Most women were diagnosed with HIV in the first (46%) or second (30%) trimesters of pregnancy. The majority (94%) had documentation in the medical chart of at least one prenatal care visit. The date of prenatal care initiation was available for most women (77%); the majority of women had their HIV infection diagnosed in the trimester during which they initiated prenatal care (52% in the first trimester, 71% second, and 75% third). Five instances of mother-to-child transmission occurred, one each among women diagnosed in the first, second, and third trimesters and two among women diagnosed at delivery.

The majority (74%) of women had an initial HIV-related care encounter within 30 days of HIV diagnosis and 87% initiated care before delivery (Table 1). The median time to initial receipt of HIV-related care was 17 days (interquartile range 9–31 days). Although counterintuitive, for mathematical reasons, we modeled the likelihood of not having an initial HIV-related care encounter. Women who initiated HIV care more than 30 days after diagnosis appeared to have less urgent HIV treatment need. Fewer were simultaneously diagnosed with acquired immunodeficiency syndrome (4% compared with 29% of those with earlier care initiation [RR 0.14, 95% CI 0.02–0.95]). More were diagnosed in the first (29%) compared with the third (11%) trimester (RR 0.37, 95% CI 0.14–0.98). Additionally, younger (younger than 25 years) women were more likely to begin care more than 30 days after diagnosis as compared with older (35 years) women (32% compared with 13%, respectively, RR 2.54, 95% CI 1.05–6.11).

Women who did not initiate HIV-related care before delivery were more likely to have injection drug use as the HIV transmission risk compared with other women (60% compared

with 11%, respectively, RR 5.45, 95% CI 2.90–10.25) and initiated prenatal care in the third compared with first-trimester care (18% compared with 2%, respectively, RR 9.67, 95% CI 2.10–44.53).

The neonate's health was significantly associated with the mother's receipt of HIV-related care before delivery. A total of 42 neonates had a low birth weight, and five were infected with HIV. Women who did not initiate HIV-related care before delivery were more likely to have a low-birth-weight neonate than women who did obtain HIV care before delivery (33% compared with 16%, RR 2.04, 95% CI 1.12–3.71). Although not statistically significant as a result of the small number of infected neonates, women who did not initiate HIV-related care before delivery were more likely to have a neonate infected with HIV (8% [2/26]) compared with women who initiated HIV-related care before delivery (2% [3/183]). Neither the neonate's weight nor HIV infection status was associated with the mother's retention in HIV care postpartum.

Of the 198 women who initiated HIV-related care before delivery, 70% were retained in the first year postpartum (Table 2). In multivariable analysis, trimester of diagnosis, type of delivery, and race were associated with loss to follow-up with a higher risk seen among women diagnosed in the third compared with the first trimester (adjusted RR 2.21, 95% CI 1.41–3.45), cesarean delivery compared with vaginal delivery (adjusted RR 1.76, 95% CI 1.07–2.91), and white compared with black race (adjusted RR 1.91, 95% CI 1.08–3.40). Having an unsuppressed viral load at delivery (RR 1.90, 95% CI 1.25–2.91) was associated with an increased risk of loss to follow-up in bivariate but not multivariable analysis. The final model included no variables with imputed data. Trimester of HIV diagnosis appeared to modify the association between viral load at delivery and loss to follow-up in stratified analyses; however, sparse data prevented evaluation of this interaction in multivariable analysis. One woman who initiated HIV-related care before delivery died in the first year postpartum.

A total of 228 women were evaluated for HIV viral suppression. There was a median of two viral load tests in the first year postpartum (interquartile range 1–3 tests) and the median time between discharge and first viral load test was 71 days (interquartile range 40–122 days). Approximately one in five women (22% [n=50]) had no viral load test reported to the surveillance registry in the first year postpartum and 17% (n=38) had only one test. The 50 women with no viral load test were notable for the proportion with a CD4 report (40%); median cell counts ranged from 121 to 939 cells/mm^3. Among the 178 women with one or more viral load tests, 42% (n=74) were suppressed on every test in the first year postpartum (not shown). There were 144 women (77%) who initiated HIV-related care before delivery and were virally suppressed at the last test before delivery (Table 2); 16% (n=23) had no reported viral load test in the first year postpartum. Of the remaining 121 women, 52% had one or more viral load tests greater than 200 copies/mL. The majority (67%) were virally suppressed at the first viral load test in the first year postpartum and the first postpartum viral load test exceeded 1,000 copies/ mL for 24% (n=29); time between discharge and first viral load test postpartum was 66 days (interquartile range 41–101 days).

DISCUSSION

The majority of women diagnosed with HIV during pregnancy in the present study initiated HIV-related care before delivery (87%), and among those women, 70% were retained in care during the first year postpartum. The high frequency of initiating HIV-related care during pregnancy and postpartum retention in HIV-related care observed is likely attributable, in part, to New York's robust public health policy and infrastructure, including HIV case management, outreach for early prenatal care, and medical coverage for infected persons with medication assistance for uninsured or underinsured individuals.[4,19] However, more than half (58%) of women with a postpartum HIV viral load test did not achieve virologic suppression. Newly diagnosed women appear to merit special attention during the first year postpartum.

The observed proportion of women retained in care in New York state was nearly twice that reported by similar previous studies.[7–9] However, prior clinic-based investigations did not track patient care outside specific facilities, which may have resulted in an underestimate of retention in care. In contrast to previous work,[7] white race was associated with loss to follow-up and no association with age was observed, likely as a result of differences in patient care settings.[7]

In New York state, HIV screening has been achieved in 95% of pregnant women.[4] Diagnosis later in pregnancy was associated with a higher likelihood of loss to follow-up, a finding consistent with previous studies.[7,8] In addition to aggressive follow-up of women diagnosed later in pregnancy, there is precedent for antepartum interventions, administered as an adjunct to standard prenatal care, that promote behavior change. For example, a study of screening for diabetes mellitus among women with gestational diabetes reported a significant increase in testing in the 6 months after delivery among women who received an educational intervention.[20] Care coordination among those with HIV has resulted in better engagement in care, better HIV viral suppression, and improved immune function.[21,22] Coupling behavior change models with care coordination may be a powerful tool to improve care outcomes among postpartum women.

The management of a new HIV diagnosis among women already struggling to access and sustain health care suggests the need for intensive care coordination efforts. Although potentially resource-intensive,[22] public health programs have demonstrated success in meeting the needs of high-risk individuals.[21] Women diagnosed with HIV during pregnancy represent a small number of total deliveries each year. However, many will have additional children. Maintaining HIV virologic control can improve future pregnancy-related outcomes and decrease adverse HIV-related diseases outcomes. A partnership among obstetricians and gynecologists, internal medicine, and public health professionals could facilitate care transition and prevent declines in health status. Research is needed to understand the specific barriers to care associated with the first year postpartum and inform the development of care coordination interventions.

New York has reduced mother-to-child transmission through programs that promote virologic control before delivery[4] and through fully funding health care and medication for

at-risk and infected women who are living in poverty.[23] Although 75% of women were virally suppressed at delivery, half of those who could be followed were not suppressed in the first year postpartum and 24% rebounded to a viral load level of more than 1,000 copies/mL by the first test postpartum. Effective interventions must offset competing demands, for example, caregiver responsibilities,[24] that prevent postpartum HIV-infected women from maintaining the virologic suppression achieved during pregnancy.

This population-based study utilized HIV laboratory data from the New York State HIV Surveillance Registry with birth information from the New York State HIV Perinatal Database. Our assessment of HIV care outcomes therefore captured encounters with medical care providers even if these encounters occurred at multiple facilities, a limitation of previous clinic-based studies.[7,8] The use of CD4 count and viral load laboratory tests as proxy measures for HIV medical care may limit our ability to evaluate postpartum retention in care and HIV viral suppression because we did not capture medical visits unless a test was ordered. Alternatively, CD4 and viral load tests may overestimate care if they are conducted in the absence of a medical visit. Finally, our findings for retention in care may be conservative because some women who were not retained may be in care outside New York state.

This analysis extends previous research by evaluating initial receipt of HIV-related care, postpartum retention in care, and HIV viral suppression among women diagnosed during pregnancy, a relatively understudied area of HIV-infected U.S. women. Treatment guidelines recommend systematic monitoring of HIV-infected women in the postpartum period with adherence and retention support for women during this time.[25,26] Despite the high proportion retained, many women had poor virologic control in the first year postpartum. These findings highlight subgroups of postpartum women who are particularly susceptible to adverse HIV care outcomes and underscore the need for increased support to enhance adherence in the postpartum period for women with newly diagnosed HIV infection.

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References

1. Centers for Disease Control and Prevention. HIV surveillance report, 2012. Atlanta (GA): Centers for Disease Control and Prevention; 2014.
2. Whitmore SK, Zhang X, Taylor AW, Blair JM. Estimated number of infants born to HIV-infected women in the United States and five dependent areas, 2006. J Acquir Immune Defic Syndr. 2011; 57:218–22. [PubMed: 21372725]
3. [Retrieved March 12, 2015] HIV among pregnant women, infants, and children. Available at: http://www.cdc.gov/hiv/risk/gender/pregnantwomen/facts/
4. Birkhead GS, Klein SJ, Warren BL, Candelas AR, O'Connell DA, Scully MA, et al. Program and policy interventions for preventing mother-to-child transmission of HIV in New York State. J Public Health Manag Pract. 2010; 16:492–504. [PubMed: 20885178]

5. Birkhead GS, Pulver WP, Warren BL, Klein SJ, Parker MM, Caggana M, et al. Progress in prevention of mother-to-child transmission of HIV in New York State: 1988–2008. J Public Health Manag Pract. 2010; 16:481–91. [PubMed: 20885177]
6. Mellins CA, Chu C, Malee K, Allison S, Smith R, Harris L, et al. Adherence to antiretroviral treatment among pregnant and postpartum HIV-infected women. AIDS Care. 2008; 20:958–68. [PubMed: 18608073]
7. Siddiqui R, Bell T, Sangi-Haghpeykar H, Minard C, Levison J. Predictive factors for loss to postpartum follow-up among low income HIV-infected women in Texas. AIDS Patient Care STDS. 2014; 28:248–53. [PubMed: 24720630]
8. Rana AI, Gillani FS, Flanigan TP, Nash BT, Beckwith CG. Follow-up care among HIV-infected pregnant women in Mississippi. J Womens Health (Larchmt). 2010; 19:1863–7. [PubMed: 20831428]
9. Adams JW, Brady KA, Michael YL, Yehia BR, Momplaisir FM. Postpartum engagement in HIV care: an important predictor of long-term retention in care and viral suppression. Clin Infect Dis. 2015; 61:1880–7. [PubMed: 26265499]
10. New York State. Statutory Authority: Public Health Law. Title III (§2139).
11. New York State Department of Health. HIV/AIDS surveillance annual report, 2013. Albany (NY): New York State Department of Health; 2013.
12. Sabharwal CJ, Braunstein SL, Robbins RS, Shepard CW. Optimizing the use of surveillance data for monitoring the care status of persons recently diagnosed with HIV in NYC. J Acquir Immune Defic Syndr. 2014; 65:571–8. [PubMed: 24326601]
13. White House Office of AIDS Policy. National HIV/AIDS strategy. Washington, DC: U.S. Department of Health and Human Services; 2010.
14. Raghunathan TE, Lepkowski JM, Van Hoewyk JV, Solenberger PW. A multivariate technique for multiply imputing missing values using a sequence of regression models. Surv Methodol. 2001; 27:85–95.
15. Raghunathan, TE., Solenberger, PW., Van Hoewyk, JV. IVEware: imputation and variance estimation software user's guide. Ann Arbor (MI): Institute for Social Research, University of Michigan; 2002.
16. McNutt LA, Wu C, Xue X, Hafner JP. Estimating the relative risk in cohort studies and clinical trials of common outcomes. Am J Epidemiol. 2003; 157:940–3. [PubMed: 12746247]
17. Zou G. A modified poisson regression approach to prospective studies with binary data. Am J Epidemiol. 2004; 159:702–6. [PubMed: 15033648]
18. Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes. Biometrics. 1986; 42:121–30. [PubMed: 3719049]
19. HIV/STD/HCV prevention and related services for women. Albany (NY): New York State Department of Health; Available at: https://www.health.ny.gov/diseases/aids/general/about/prevsup.htm [Retrieved July 15, 2015]
20. Stasenko M, Liddell J, Cheng YW, Sparks TN, Killion M, Caughey AB. Patient counseling increases postpartum follow-up in women with gestational diabetes mellitus. Am J Obstet Gynecol. 2011; 204:522.e1–6. [PubMed: 21514559]
21. Irvine MK, Chamberlin SA, Robbins RS, Myers JE, Braunstein SL, Mitts BJ, et al. Improvements in HIV care engagement and viral load suppression following enrollment in a comprehensive HIV care coordination program. Clin Infect Dis. 2015; 60:298–310. [PubMed: 25301208]
22. Brennan-Ing M, Seidel L, Rodgers L, Ernst J, Wirth D, Tietz D, et al. The impact of comprehensive case management on HIV client outcomes. PLoS One. 2016; 11:1–12.
23. [Retrieved March 10, 2016] Medicaid in New York State. New York State Department of Health. 2016. Available at: https://www.health.ny.gov/health_care/medicaid/
24. Loftus H, Burnett A, Naylor S, Bates S, Greig J. HIV control in postpartum mothers: a turbulent time. Int J STD AIDS. 2015 [Epub ahead of print].
25. [Retrieved March 22, 2015] Recommendations for use of antiretroviral drugs in pregnant HIV-1-infected women for maternal health and interventions to reduce perinatal HIV transmission in the United States. 2014. Available at: http://aidsinfo.nih.gov/guidelines/html/3/perinatal-guidelines/185/postpartum-follow-up-of-hiv-infected-women

26. [Retrieved March 22, 2015] Package of essential services for pregnant and postpartum women and their children. 2013. Available at: http://apps.who.int/iris/bitstream/10665/91042/1/WHO_HIV_2013.59_eng.pdf

Table 1

Factors Associated With Initial Receipt of Human Immunodeficiency Virus–Related Care* Among Women With a Live Birth Who Were Diagnosed With Human Immunodeficiency Virus Infection During Pregnancy

		Initial Care Within 30 D of Diagnosis		
Characteristic	**Total (N=228)**	**Yes (n=168 [74])**	**No (n=60 [26])**	**RR (95% CI)†**
Race–ethnicity				
Black	139 (61)	99 (71)	40 (29)	Referent
White	15 (7)	13 (87)	2 (13)	0.46 (0.12–1.73)
Hispanic	59 (26)	45 (76)	14 (24)	0.82 (0.49–1.40)
Other or unknown	15 (7)	11 (73)	4 (27)	0.93 (0.38–2.23)
Age at HIV diagnosis (y)				
Younger than 25	82 (36)	56 (68)	26 (32)	2.54 (1.05–6.11)‡
25–29	61 (27)	45 (74)	16 (26)	2.10 (0.83–5.27)
30–34	45 (20)	32 (71)	13 (29)	2.31 (0.90–5.91)
35 or older	40 (18)	35 (88)	5 (13)	Referent
% below poverty§				
Less than 20	81 (36)	59 (73)	22 (27)	0.79 (0.47–1.31)
20 to less than 40	91 (40)	72 (79)	19 (21)	0.60 (0.35–1.04)
40 or greater	55 (24)	36 (65)	19 (35)	Referent
Missing or unknown	1 (—)	1 (—)	0	
HIV transmission risk				
Heterosexual	218 (96)	160 (73)	58 (27)	Referent
IDU	10 (4)	8 (80)	2 (20)	0.75 (0.21–2.65)
Concurrent HIV and AIDS diagnosis				
No	203 (89)	144 (71)	59 (29)	Referent
Yes	25 (11)	24 (96)	1 (4)	0.14 (0.02–0.95)‡
Trimester of HIV diagnosis				
1st	105 (46)	75 (71)	30 (29)	Referent
2nd	69 (30)	50 (72)	19 (28)	0.96 (0.59–1.57)
3rd	38 (17)	34 (89)	4 (11)	0.37 (0.14–0.98)‡
At delivery	16 (7)	9 (56)	7 (44)	1.53 (0.81–2.88)
Type of delivery				
Vaginal	96 (42)	70 (73)	26 (27)	Referent
Cesarean	132 (58)	98 (74)	34 (26)	0.95 (0.61–1.47)
No. of previous live births				
0	78 (42)	56 (72)	22 (28)	1.29 (0.72–2.31)
1	44 (24)	30 (68)	14 (32)	1.45 (0.77–2.74)
2 or more	64 (34)	50 (78)	14 (22)	Referent
Unknown	42 (—)	32 (—)	10 (—)	
Low-birth-weight neonate				
Yes	42 (19)	28 (67)	14 (33)	1.36 (0.83–2.24)

Characteristic	Total (N=228)	Initial Care Within 30 D of Diagnosis		
		Yes (n=168 [74])	No (n=60 [26])	RR (95% CI)†
No	184 (81)	139 (76)	45 (24)	Referent
Unknown	2 (—)	1 (—)	1 (—)	
Neonate's HIV infection status				
Infected	5 (2)	4 (80)	1 (20)	0.74 (0.13–4.34)
Uninfected	204 (98)	149 (73)	55 (27)	Referent
Unknown	19 (—)	15 (—)	4 (—)	

Initial Care Before Delivery		
Yes (n=198 [87])	No (n=30 [13])	RR (95% CI)†
121 (87)	18 (13)	Referent
12 (80)	3 (20)	1.54 (0.51–4.64)
51 (86)	8 (14)	1.05 (0.48–2.27)
14 (93)	1 (7)	0.51 (0.07–3.59)
70 (85)	12 (15)	0.84 (0.36–1.96)
56 (92)	5 (8)	0.47 (0.16–1.37)
39 (87)	6 (13)	0.76 (0.28–2.08)
33 (83)	7 (18)	Referent
73 (90)	8 (10)	0.60 (0.25–1.47)
78 (86)	13 (14)	0.87 (0.40–1.91)
46 (84)	9 (16)	Referent
1 (—)	0	
194 (89)	24 (11)	Referent
4 (40)	6 (60)	5.45 (2.90–10.25)‡
175 (86)	28 (14)	Referent
23 (92)	2 (8)	0.58 (0.15–2.29)
103 (98)	2 (2)	Referent
64 (93)	5 (7)	3.80 (0.76–19.06)
31 (82)	7 (18)	9.67 (2.10–44.53)‡
NA	16 (100)	NA
81 (84)	15 (16)	Referent
117 (89)	15 (11)	0.73 (0.37–1.42)
78 (100)	0	NA
40 (91)	4 (9)	0.73 (0.23–2.27)
56 (88)	8 (13)	Referent
24 (—)	18 (—)	
32 (76)	10 (24)	2.19 (1.11–4.33)‡
164 (89)	20 (11)	Referent
2 (—)	0	
3 (60)	2 (40)	3.40 (1.09–10.60)‡

180 (88)	24 (12)	Referent
15 (—)	4 (—)	

RR, relative risk; CI, confidence interval; HIV, human immunodeficiency virus; IDU, intravenous drug user; AIDS, acquired immunodeficiency syndrome; NA, not applicable.

Data are n (%) unless otherwise specified.

* Initial receipt of HIV-related care is after diagnosis.

† RR of not initiating care compared with referent.

‡ Statistically significant RR, 95% CI does not include 1.

§ Percentage of persons living below poverty in the census tract of mother's residence at delivery.

Table 2

Loss to Follow-up in the First Year Postpartum Among Human Immunodeficiency Virus–Infected Women With a Live Birth Who Were Diagnosed During Pregnancy and Linked to Care Before Delivery

Characteristic	Total (N=198)	Lost to Follow-up		RR (95% CI)*	Adjusted RR (95% CI)*†
		Yes (n=60)	No (n=138 [70])		
Race–ethnicity					
Black	121 (61)	38 (31)	83 (69)	Referent	Referent
White	12 (6)	6 (50)	6 (50)	1.59 (0.85–2.97)	1.91 (1.08–3.40)‡
Hispanic	51 (26)	11 (22)	40 (78)	0.69 (0.38–1.23)	0.79 (0.44–1.40)
Other or unknown	14 (7)	5 (36)	9 (64)	1.14 (0.54–2.41)	1.22 (0.59–2.54)
HIV transmission risk					
Heterosexual	194 (98)	60 (31)	134 (69)	Referent	NA
IDU	4 (—)	0	4 (100)	NA	NA
Concurrent HIV and AIDS diagnosis					
No	175 (88)	56 (32)	119 (68)	Referent	Referent
Yes	23 (12)	4 (17)	19 (83)	0.54 (0.22–1.36)	0.45 (0.20–1.00)
Trimester of HIV diagnosis					
1st	103 (52)	26 (25)	77 (75)	Referent	Referent
2nd	64 (32)	17 (27)	47 (73)	1.05 (0.62–1.78)	1.05 (0.62–1.77)
3rd	31 (16)	17 (55)	14 (45)	2.17 (1.37–3.44)‡	2.21 (1.41–3.45)‡
Delivery type					
Vaginal	81 (41)	16 (20)	65 (80)	Referent	Referent
Cesarean	117 (59)	44 (38)	73 (62)	1.90 (1.16–3.13)‡	1.76 (1.07–2.91)‡
CD4 count/mm^3 at delivery§					
0–350	47 (24)	13 (28)	34 (72)	0.89 (0.53–1.49)	NA
350 or more	151 (76)	47 (31)	104 (69)	Referent	NA
Viral load at delivery§					
Suppressed	144 (77)	36 (25)	108 (75)	Referent	NA
Not suppressed	42 (23)	20 (48)	22 (52)	1.90 (1.25–2.91)‡	NA
Missing or unknown	12 (—)	4 (—)	8 (—)		
Low-birth-weight neonate					
Yes	32 (16)	8 (25)	24 (75)	0.80 (0.42–1.53)	NA
No	164 (84)	51 (31)	113 (69)	Referent	NA
Unknown	2 (—)	1 (—)	1 (—)		
Neonate's HIV infection status					
Infected	3 (—)	0	3 (100)	NA	NA
Uninfected	180 (98)	51 (28)	129 (72)	Referent	NA
Unknown	15 (—)	9 (—)	6 (—)		

RR, relative risk; CI, confidence interval; HIV, human immunodeficiency virus; IDU, intravenous drug user; AIDS, acquired immunodeficiency syndrome; NA, not applicable.

Data are n (%) unless otherwise specified.

[*] RR of being lost to follow-up compared with referent.

[†] Parsimonious model shown. Variables considered in model selection were: residence at diagnosis, race–ethnicity, age at diagnosis, year of diagnosis, percent below poverty, concurrent HIV and AIDS diagnosis, trimester of diagnosis, delivery type, number of previous live births, viral load at delivery, low birth weight.

[‡] Statistically significant RR, CI does not include 1.

[§] Test closest to but preceding delivery.