

**Prevention of “second generation” perinatal HIV
transmission: characteristics of HIV-exposed deliveries
among women who acquired HIV infection as infants
through perinatal transmission, HIV-exposed deliveries
2005-2010 in New York City**

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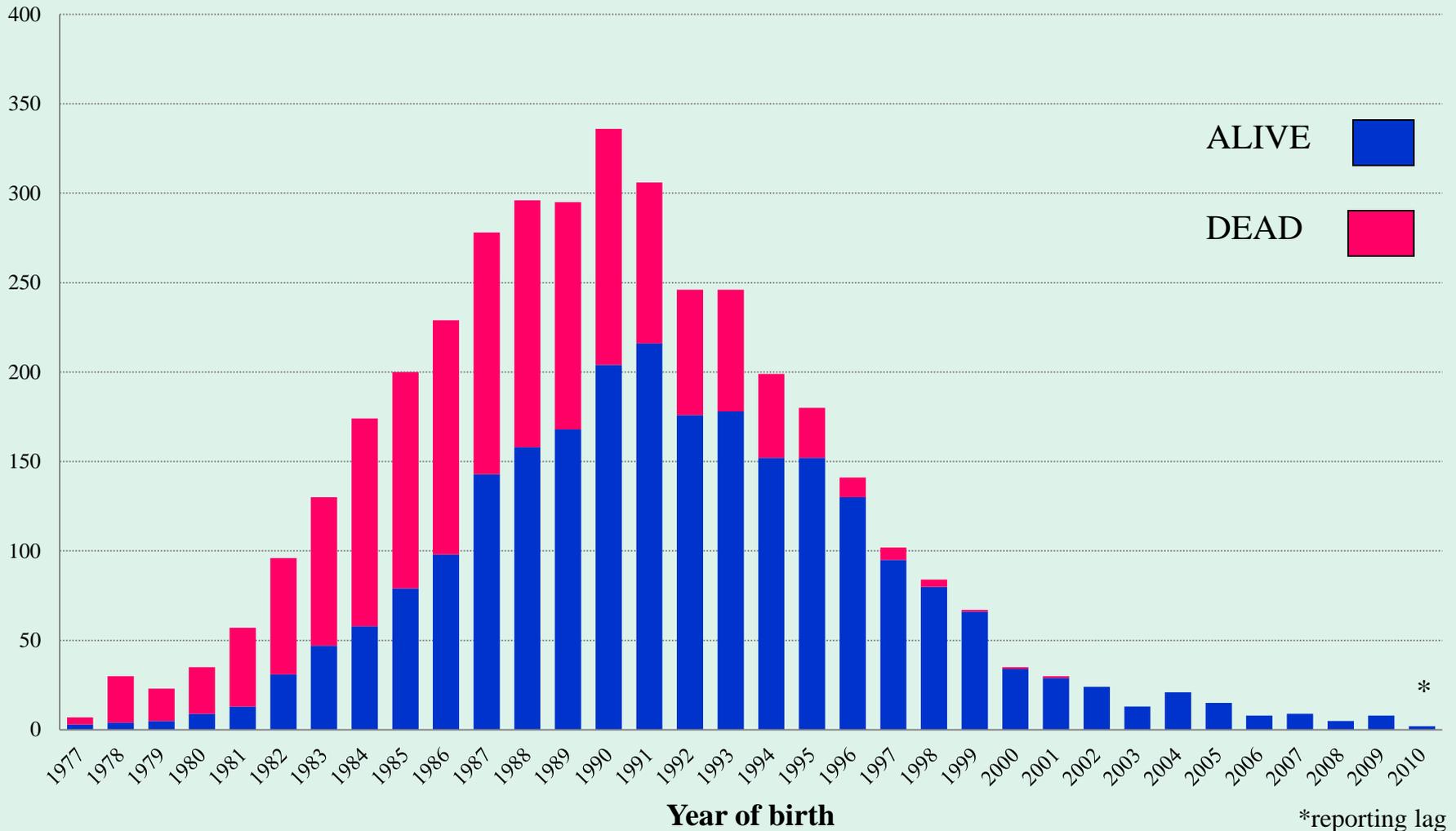
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Perinatal HIV Infection in the United States

- The perinatal HIV epidemic began in 1977
- Each year, there are an estimated **8,700** births to HIV-infected women (*5% from NYC in 2010*)
- In the early 1990's, between **1,000-2,000** HIV-infected infants were born each year
- In 2005, the estimated number of HIV-infected infants dropped to **100-200** (*without prevention, expect 2,000 each year*)

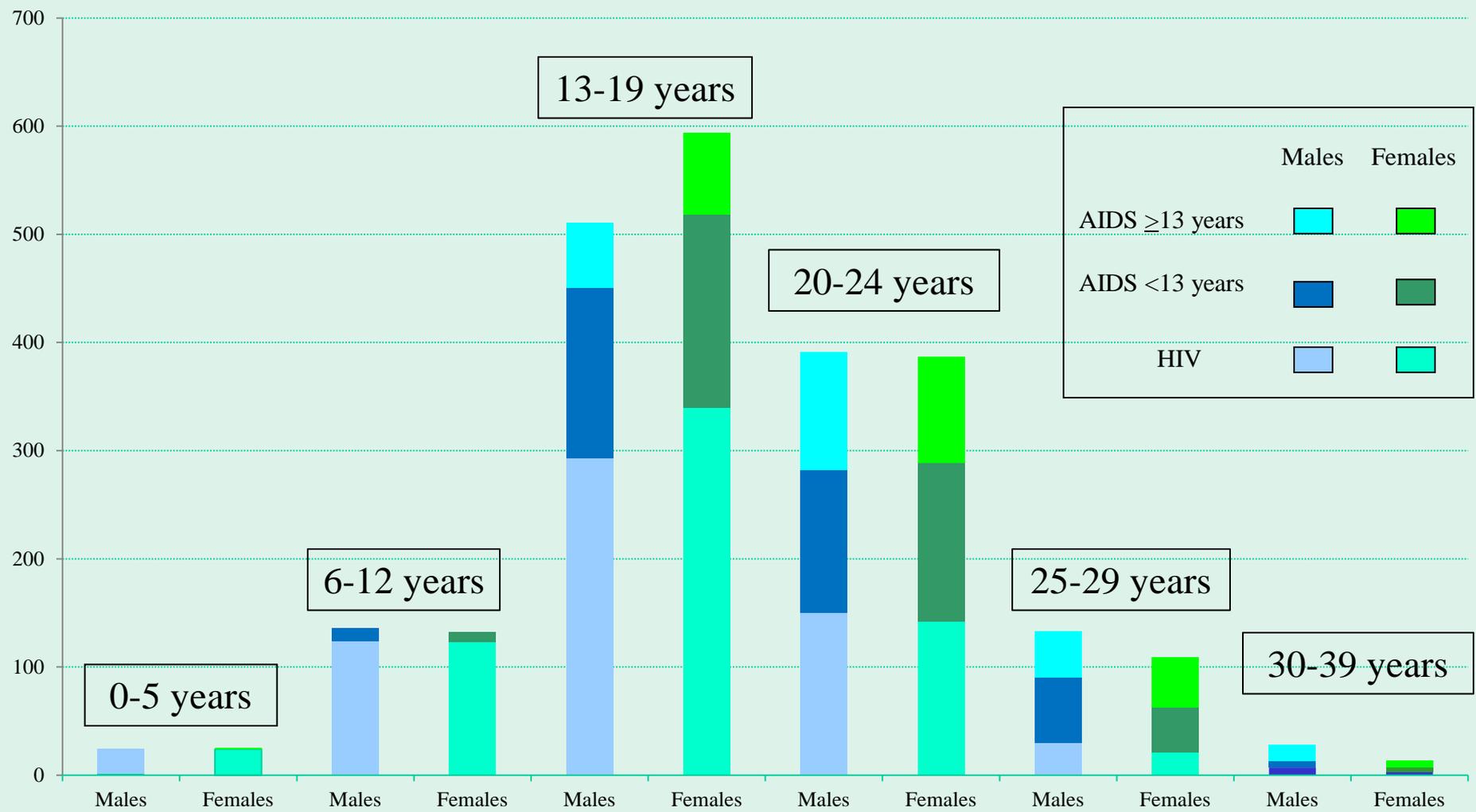
Source: JAMA 1999;282:531-8; MMWR 2001, 50 (RR-19): 1-1103; MMWR 2006, 55 (21):592-7; <http://www.cdc.gov/hiv/topics/perinatal/resources/factsheets/perinatal.htm>; <http://www.cdc.gov/hiv/topics/perinatal/>; J Acquir Immune Defic Syndr 2011;57:218–222.

Perinatally HIV-infected Children (N=3,927), by Year of Birth and Vital Status, 1977–2010, NYC



Among perinatally-infected children, 2,433 (62%) are alive, of whom 1,100 are females, 13-33 years of age, as of 12/2010.

Pediatric Cases (diagnosed <13 years of age), Living with HIV/AIDS (N=2,482), by Current Clinical Status and Current Age, as of December 31, 2010, NYC



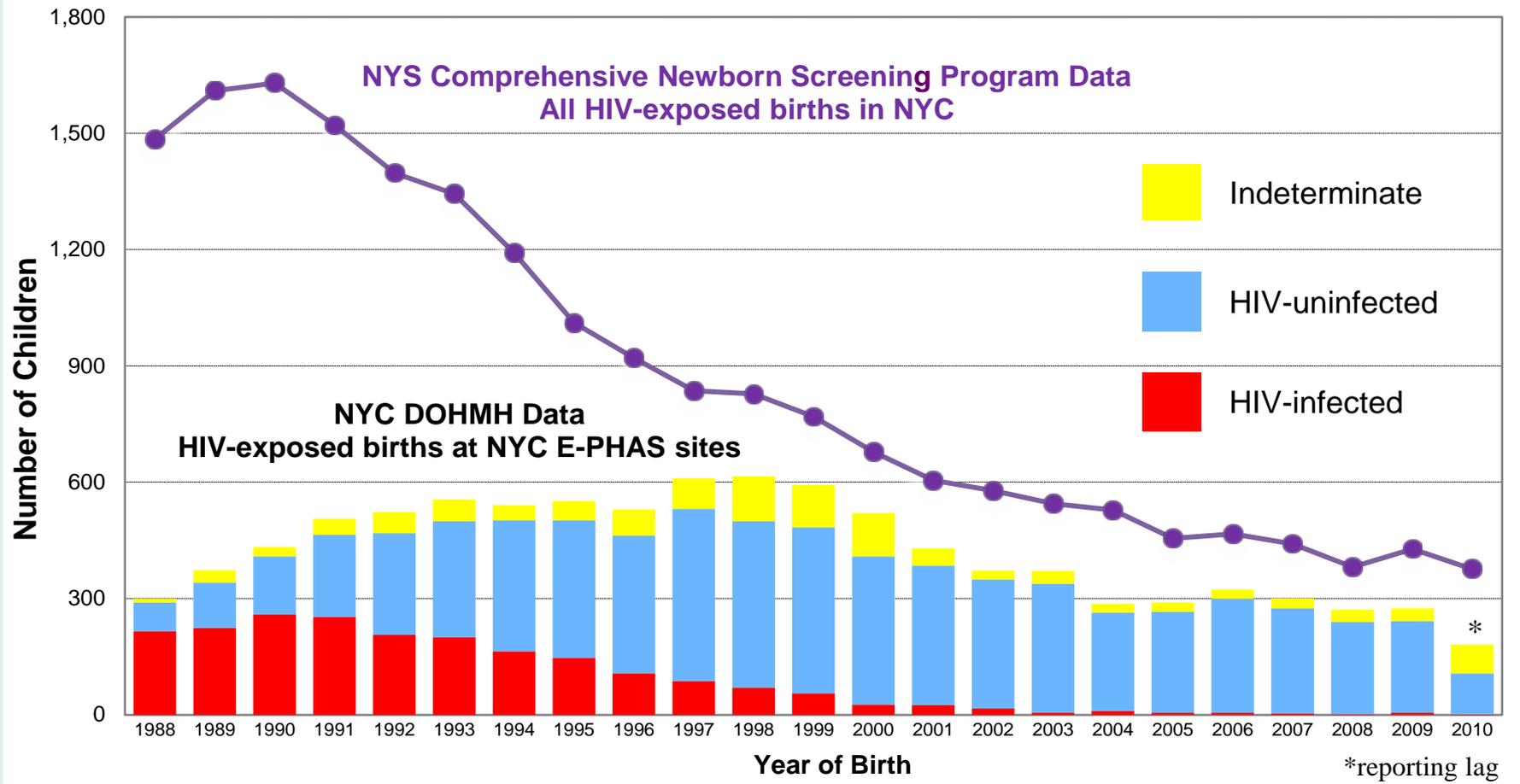
This figure includes all pediatric cases (98% were infected through perinatal transmission).
 2,166 (87%) are 13-39 years of age of whom 1,180 (54%) have AIDS.

Trends in Perinatal HIV Prevention in New York City, 2005-2010 Births

- Surveillance activities conducted by NYC-DOHMH: chart review
 - Enhanced Perinatal HIV Surveillance (EPS) at 16 NYC sites *that conduct expanded pediatric HIV/AIDS surveillance (E-PHAS) where 65% of NYC's HIV-exposed infants were born**
 - Routine HIV/AIDS surveillance citywide
- Analyses on the 2005-2010 EPS birth cohort
 - Overall trends in methods to prevent perinatal HIV transmission
 - Perinatal HIV transmission rates by maternal characteristics
 - Compare maternal characteristics by maternal HIV transmission risks (perinatal and other risks)
- Analyses were based on 1,659 deliveries (35 sets of twins, none infected) (*ascertainment of 98% of births at 16 sites*).
- Chi-square test was used to compare characteristics

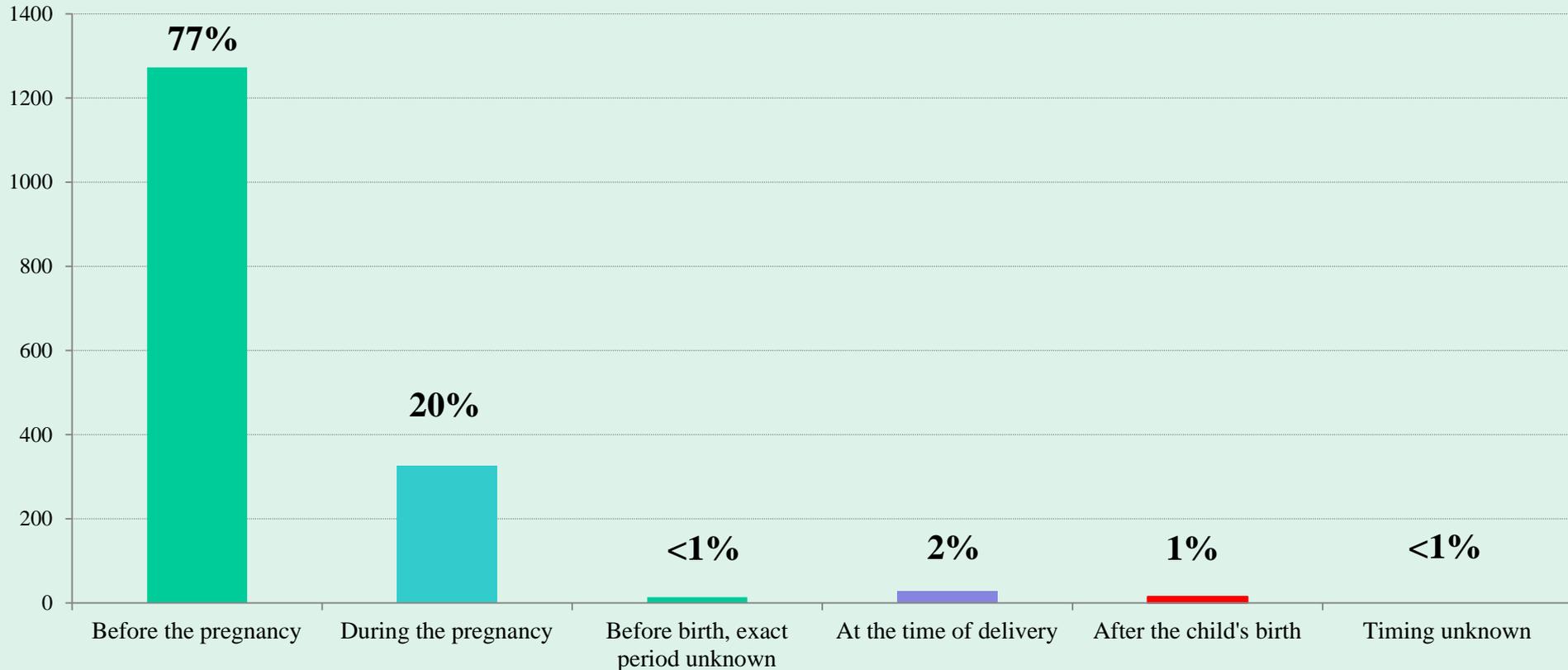
**NYS-DOH shares data collection at 8/16 sites and conducts EPS at remaining sites*

HIV-exposed Births in New York City, 1988–2010



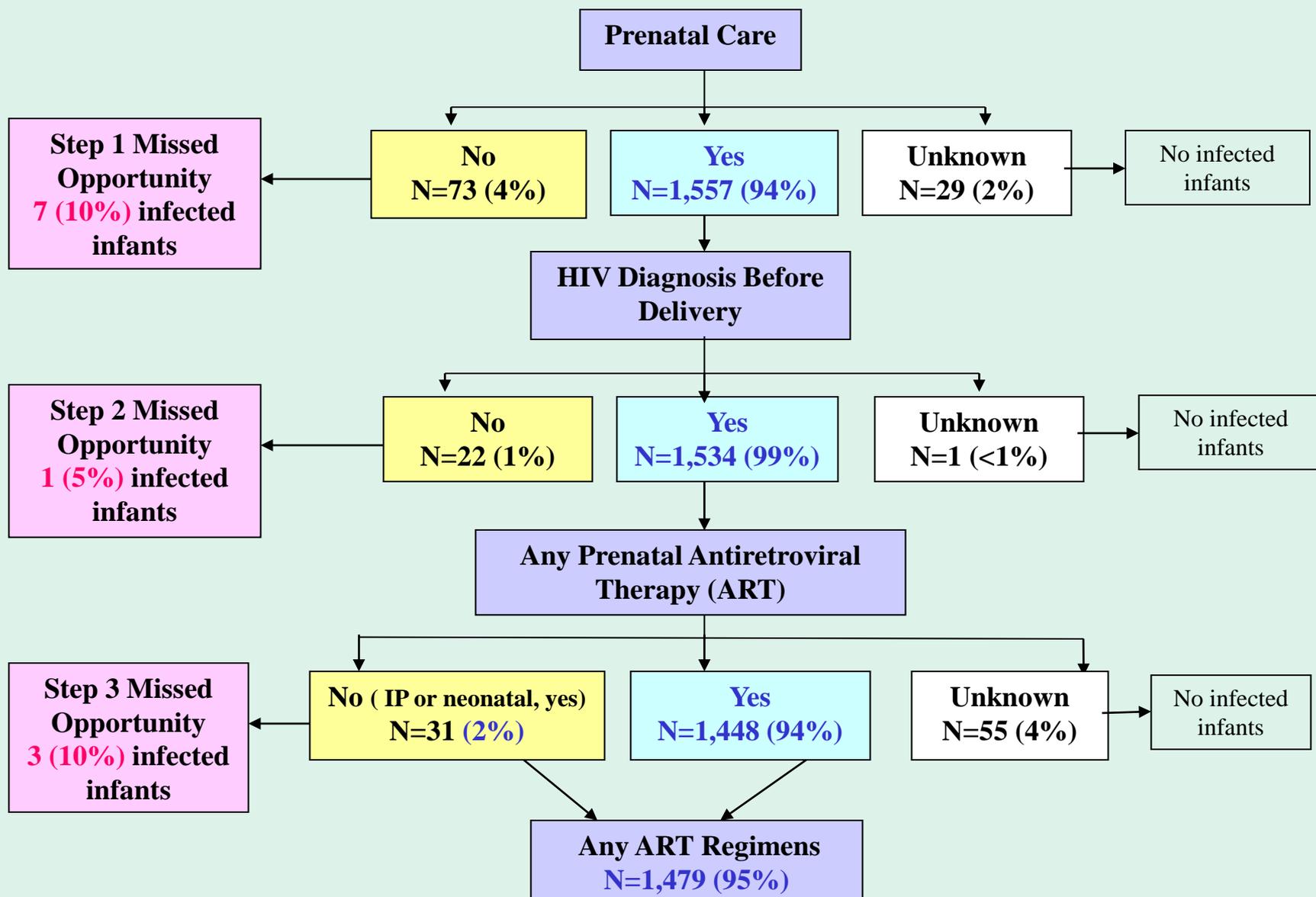
During 2005-2010, 65% of NYC HIV-exposed deliveries were at 16 NYC EPS sites where expanded pediatric HIV/AIDS surveillance (E-PHAS) is conducted. Perinatal HIV transmission rate was **1.3%**.

Timing of Maternal HIV diagnosis, 1,659 Deliveries, 16 NYC Sites, 2005-2010

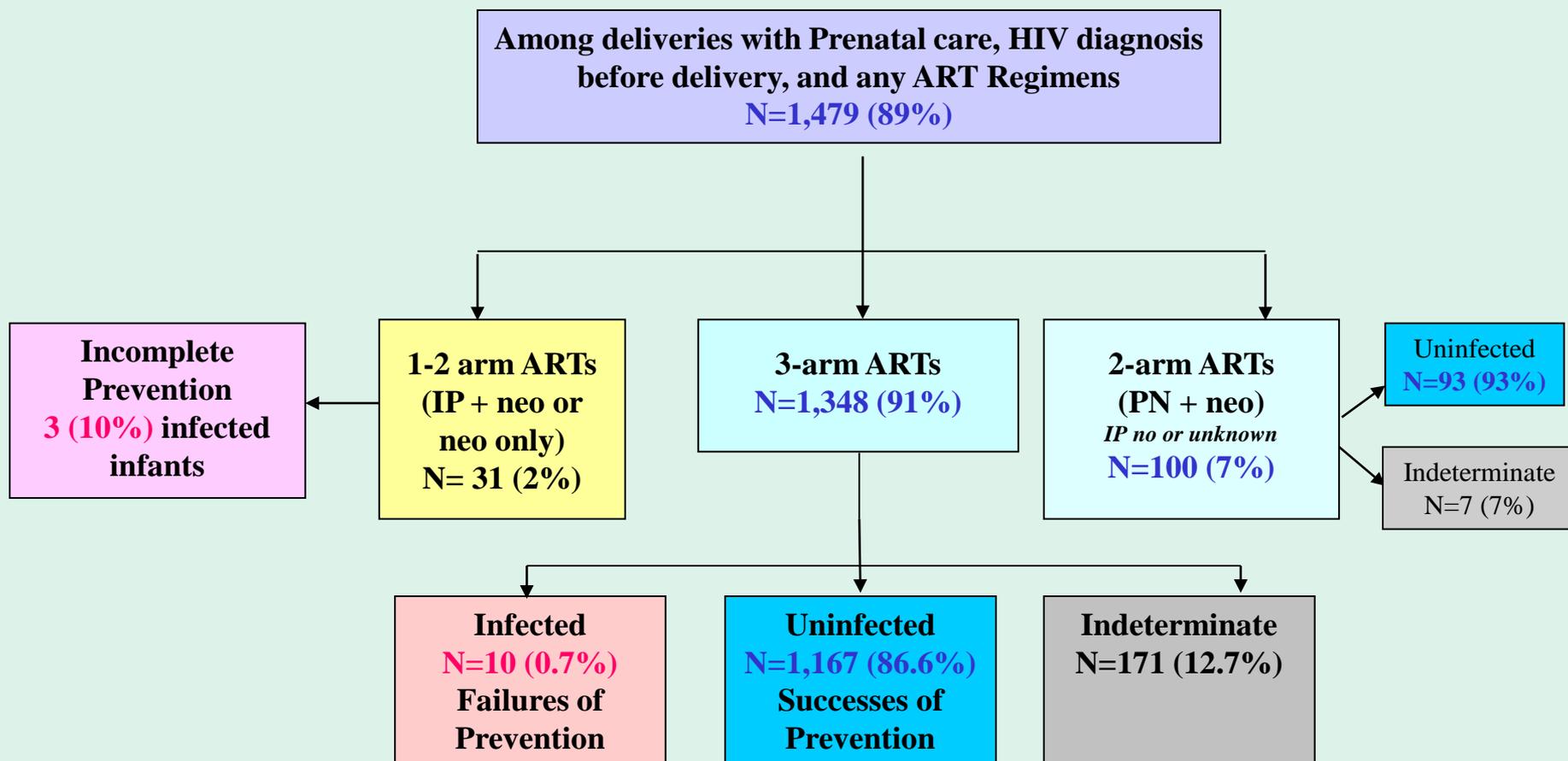


During 2005-2010, **97%** of mothers were diagnosed before their child's birth including **20%** who were diagnosed during the pregnancy.

Perinatal HIV Prevention, 1,659 Deliveries, 16 NYC Sites, 2005-2010



Perinatal HIV Prevention, 1,659 Deliveries, 16 NYC Sites, 2005-2010



During 2005-2010, 1,448 (87%) deliveries with recommended prevention had a transmission rate of **0.7%** and 126 (8%) deliveries with a missed opportunity, had a rate of **8.7%**.

Perinatal HIV Transmission by Maternal and Neonatal Antiretroviral Use, 1,659 Deliveries, 2005–2010, 16 NYC Sites

Antiretroviral Regimens Prescribed	N	% Infected	% Uninfected	% Indeterminate
Any 3-arm regimen (Prenatal + Intrapartum + Neonatal)	1,369	0.7%	86.5%	12.8%
Any 2-arm regimen (Prenatal + Neonatal)	67	-	91.0%	9.0%
Any 2-arm regimen (Prenatal + Neonatal) (IP unknown)	43	-	97.7%	2.3%
Any 2-arm regimen (Intrapartum + Neonatal)	57	7.0%	80.7%	12.3%
Any 1-arm (Neonatal only)	31	12.9%	74.2%	12.9%
No antiretroviral therapy	13	23.1%	53.8%	23.1%
Regimens with unknown antiretroviral data (in one of the arms)	79	-	82.3%	17.7%
Total	1,659	1.3%	86.1%	12.7%

Transmission rates were lowest among deliveries with 3-arm regimens prescribed during the prenatal, intrapartum, and neonatal periods.

Among 1,659 deliveries: **21** infected, **1,428** uninfected, **210** indeterminate status.

Perinatal HIV Transmission Rates by Maternal HIV Transmission Risk, 1,659 Deliveries, 2005–2010, 16 NYC Sites

Maternal HIV transmission risk factor	Total N (%)	% Infected	% Uninfected	% Indeterminate
Injection drug use (IDU)	63 (4%)	6.3%	76.2%	17.5%
Perinatal	103 (6%)	1.9%	88.4%	9.7%
Heterosexual sex	1,017 (61%)	1.3%	84.7%	14.0%
Not specified (<i>not IDU</i>)	463 (28%)	0.4%	90.1%	9.5%
Other (<i>blood products, sexual abuse</i>)	13 (1%)	0.0%	76.9%	23.1%
Total	1,659	1.3%	86.1%	12.7%

The highest HIV transmission rates were among deliveries with maternal risk factor of injection drug use (4% of mothers) or perinatal HIV infection (6% of mothers).

Perinatal HIV Transmission Rates by Maternal Age at Delivery, 1,659 Deliveries, 2005–2010, 16 NYC Sites

Maternal age, at delivery, years	Total N (%)	% Infected	% Uninfected	% Indeterminate
15-19	100 (6%)	3.0%	84.0%	13.0%
20-24	294 (16%)	2.0%	86.4%	11.6%
25-29	367 (20%)	0.3%	88.3%	11.4%
30-34	447 (28%)	1.8%	85.0%	13.2%
35-47	449 (30%)	0.7%	85.5%	13.8%
Not specified	2 (<1%)		100%	
	1,659	1.3%	86.1%	12.7%

The highest HIV transmission rates were among deliveries with younger maternal age at delivery (22% of mothers <25 years of age).

Perinatal HIV Transmission Rates by Substance Abuse during pregnancy, 1,659 Deliveries, 2005–2010, 16 NYC Sites

Substance abuse	Total N (%)	% Infected	% Uninfected	% Indeterminate
Yes	368 (27%)	3.3%	81.2%	15.5%
No	1,073 (60%)	0.7%	87.7%	11.6%
Not specified	218 (13%)	0.9%	86.2%	12.9%
	1,659	1.3%	86.1%	12.7%

The highest HIV transmission rates were among deliveries with maternal substance abuse during pregnancy (27% of mothers).

Perinatal HIV Transmission Rates by Any Prenatal Antiretroviral Therapy, 1,659 Deliveries, 2005–2010, 16 NYC Sites

Prenatal ARVs	Total N (%)	% Infected	% Uninfected	% Indeterminate
Yes	1,478 (89%)	0.7%	87.0%	12.3%
No	102 (6%)	10.8%	75.5%	13.7%
Not specified	79 (5%)	-	82.3%	17.7%
	1,659	1.3%	86.1%	12.7%

The highest HIV transmission rates were among deliveries without prenatal antiretroviral therapy (6% of mothers).

Perinatal HIV Transmission Rates by Maternal HIV Viral Load, closest to delivery, 1,659 Deliveries, 2005–2010, 16 NYC Sites

Viral load, copies/ml	Total N (%)	% Infected	% Uninfected	% Indeterminate
Undetectable	849 (51%)	0.4%	87.4%	12.2%
<1,000	341 (21%)	0.9%	83.3%	15.8%
1,000-10,000	157 (9%)	1.9%	85.4%	12.7%
10,001-50,000	63 (4%)	7.9%	82.6%	9.5%
50,001-100,000	27 (2%)	7.4%	88.9%	3.7%
>100,000	15 (1%)	100.0%	0.0%	0.0%
Not specified	207 (12%)	2.4%	85.5%	12.1%
	1,659	1.3%	86.1%	12.7%

The highest HIV transmission rates were among deliveries with maternal HIV viral load $\geq 1,000$ copies/ml closest to delivery (16% of mothers).

Perinatal HIV Transmission Rates by Key Maternal Characteristics, 1,659 Deliveries, 2005–2010, 16 NYC Sites

Among deliveries with recommended 3-arm (prenatal-intrapartum-neonatal) antiretroviral therapies: rate was **0.7%**.

Maternal characteristics with the highest rates:

- younger age, <25 years of age (**2.3%**)
- HIV transmission risk of injection drug use (**6.3%**) or perinatal HIV transmission (**1.9%**)
- history of use substance drug use during pregnancy (**3.3%**)
- lack of prenatal care (**9.6%**)
- lack of prenatal antiretroviral therapy (**10.8%**)
- HIV diagnosis at the time of delivery (**3.6%**) or after delivery (**20%**)
- HIV viral load $\geq 1,000$ copies/ml closest to the time of delivery (**1.9-7.9%**)

Comparison of Maternal Factors by HIV transmission risk, 1,659 Deliveries, 2005–2010, 16 NYC Sites

RISK	N	%
Perinatal HIV infection	103	6%
Injection Drug Use	63	4%
Other Risks	1,493	90%
<i>heterosexual</i>	<i>1,017</i>	<i>61%</i>
<i>no specified risk-not IDU</i>	<i>463</i>	<i>28%</i>
<i>sexual abuse, receipt of blood products</i>	<i>13</i>	<i>1%</i>

- Comparisons are shown by column percent
- Factors were grouped for statistical analysis (*age <25y vs. ≥25y, vaginal vs. any C-section, VL <1,000 vs. ≥1,000, alive vs. dead*)
- Chi-square analysis was used to compare characteristics
 - $p=0.03-0.05$ designated by *
 - $p=0.001-0.0002$ designated by **
 - $p<0.0001$ designated by ***

MATERNAL FACTORS, 2005-2010 deliveries, 16 NYC sites	Perinatal (N=103)	IDU (N=63)	Other (N=1,493)
Maternal age, at delivery, years			
15-19	35.9%	3.2%***	4.1%***
20-24	55.3%	6.4%***	15.6%***
25-29	6.8%	20.6%	23.3%
30-34	2.0%	23.8%	28.8%
35-47		46.0%	28.1%
Not specified			0.1%
Mother's Country of Birth			
U.S.	85.4%	73.0%	43.8%***
U.S. Possession	1.0%		0.1%
Puerto Rico	5.8%	9.5%	2.2%
Foreign born	2.9%	4.8%	39.6%
Not specified	4.9%	12.7%	14.3%
Mother's Race/Ethnicity			
Black, not Hispanic	64.4%	37.7%**	72.8%
Hispanic	33.7%	55.1%	23.8%
White, not Hispanic	1.9%	7.2%	2.0%
Other			1.3%
Not specified			0.1%

Perinatal mothers were significantly more likely to be <25 years of age at delivery (*both*), born in U.S. (*other*), and Black (*IDU*).

MATERNAL FACTORS, 2005-2010 deliveries, 16 NYC sites	Perinatal (N=103)	IDU (N=63)	Other (N=1,493)
Timing of maternal HIV diagnosis			
Before the pregnancy	97.1%	87.3%*	74.9%***
During the pregnancy		6.3%	21.6%
Before birth, exact period unknown	1.9%	1.6%	0.7%
At the time of delivery		3.2%	1.8%
After the child's birth		1.6%	0.9%
Timing unknown	1.0%		0.1%
STDs during pregnancy			
Yes	18.5%	39.7%**	23.0%
No	9.7%	3.1%	11.1%
No and not specified	71.8%	52.4%	63.1%
All not specified		4.8%	2.8%
Substance abuse during pregnancy			
Yes	7.8%	76.2%***	20.9%**
No	81.5%	20.6%	65.4%
Not specified	10.7%	3.2%	13.7%
Prenatal care			
Yes	98.0%	76.2%***	94.3%
No	1.0%	20.6%	4.0%
Unknown	1.0%	3.2%	1.7%

Perinatal mothers were significantly more likely to be diagnosed before pregnancy (*both*), less likely to have an STD (*IDU*) or substance abuse (*both*), more likely to have prenatal care (*IDU*).

Maternal and Neonatal Antiretroviral Use, 2005-2010 deliveries, 16 NYC sites	Perinatal (N=103)	IDU (N=63)	Other (N=1,493)
Prenatal Antiretroviral Use			
Yes	99.0%	71.4%***	89.2%**
No	1.0%	22.2%	5.8%
Not specified		6.4%	5.0%
Intrapartum Antiretroviral Use			
Yes	95.2%	80.9%**	88.4%*
No	1.9%	14.3%	7.0%
Not specified	2.9%	4.8%	4.6%
Neonatal Antiretroviral Use			
Yes	100.0%	98.4%	99.2%
No		1.6%	0.8%

Perinatal mothers were significantly more likely to have received prenatal and intrapartum ARVs (*both*).

Maternal HIV viral load and CD4 staging, closest to delivery, 2005-2010, 16 sites NYC sites	Perinatal (N=103)	IDU (N=63)	Other (N=1,493)
Viral load, closest to delivery, copies/ml			
Undetectable	33.0%	34.9%	53.1%
<1,000	31.1%	28.6%	19.5%
1,000-10,000	18.4%	12.7%	8.7%***
10,001-50,000	7.8%	4.7%	3.5%***
50,001-100,000	2.9%	1.6%	1.5%***
>100,000	3.9%	1.6%	0.7%***
Not specified	2.9%	15.9%	13.0%
CD4 staging, closest to delivery			
STAGE 1. CD4 ≥500 or >29%	15.5%	27.0%	28.0%
STAGE 2. CD4 200-499 or 14-28%	27.2%	34.9%	31.7%
STAGE 3. CD4 <200 or <14%	30.1%	17.5%*	9.8%***
Not available	27.2%	20.6%	30.5%

Perinatal mothers were significantly more likely to have an HIV viral load $\geq 1,000$ copies/ml (*other*) and severe CD4 immunosuppression (*both*).

Maternal & Infant factors, 2005-2010 deliveries, NYC 16 sites	Perinatal (N=103)	IDU (N=63)	Other (N=1,493)
Mode of delivery			
Vaginal	21.4%	36.5%	44.8%
Elective C-section	69.9%	47.6%*	45.7%***
Non-elective C-section	8.7%	11.1%*	8.4%***
C-section, reason not specified		4.8%*	1.1%***
Birth weight, grams			
<1,000		6.3%	1.6%
1,000-1,499	1.0%	3.2%	2.1%
1,500-2,199	8.7%	9.5%	8.1%
≥2,200	90.3%	81.0%	88.1%
Not specified			0.1%
Maternal Vital Status			
Alive	89.3%	95.0%	90.1%
Died within one year of delivery	-	3.3%	0.6%**
Died >one year of delivery	10.7%	1.7%	2.0%**
Unknown vital status			7.3%

Perinatal mothers were significantly more likely to delivered by C-section (*both*) and to have died (*other*).

Comparison of Perinatally HIV-infected Mothers with mothers who acquired HIV infection through behavioral and other risks 1,659 Deliveries, 2005–2010, 16 NYC Sites

Perinatally infected mothers were significantly

- more likely to be younger than 25 years of age at delivery*
- more likely to be diagnosed with HIV infection before the pregnancy*
- more likely to be U.S. born (*compared to non-IDU mothers*)
- less likely to have history of substance abuse during pregnancy*
- more likely to have prenatal care (*compared to IDU mothers*)*
- more likely to have prenatal and intrapartum ARVs*
- more likely to deliver by Cesarean-section*
- more likely to have a viral load $\geq 1,000$ copies/ml closest to the time of delivery (*compared to non-IDU mothers*)*
- more likely to have severe CD4 immunosuppression*
- more likely to have died after birth (*compared to non-IDU mothers*)

*associated with lowest transmission rates and *with higher transmission rates.

CONCLUSIONS

- Perinatally HIV-infected mothers:
 - more likely to have taken measures to prevent HIV transmission, such as, receiving prenatal care, receiving prenatal ART, delivering by C-section
 - less likely to use illicit drugs
 - more likely to have HIV viral loads closest to delivery that confer a higher risk of HIV transmission to their newborns
 - had perinatal HIV transmission rate 1.9% despite receiving the necessary interventions for perinatal prevention
 - more likely to die after birth
- Although perinatal HIV transmission rates are at historic lows, new challenges to perinatal prevention and medical care are expected now that the majority of U.S. perinatally HIV-infected children are of child-bearing age.
- Enhanced perinatal HIV surveillance is warranted for years to come.

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