







pro-viral particle by qualitative HIV DNA polymerase chain reaction on two separate specimens and HIV negative if he/she had two negative HIV test obtained at or after 1-month.

### Evaluate system improvement

Six predefined outcome measure were used to evaluate system improvement after 6 years (2007–2012).

- adequacy of prenatal care
- HIV diagnoses of expectant mothers prior to delivery
- appropriate use of ARV therapy before delivery
- appropriate use of cesarean section for delivery
- adequacy of zidovudine prophylaxis to newborn
- HIV transmission rate.

**Table 1: Seven-step approach to care of HIV-infected pregnant women and HIV-exposed infants**

Positive HIV tests are reported to the Clark County Health Department from all laboratories and physician practices as mandated by state law

Health Department Surveillance team reaches out to contact patient, and if confirmed pregnant, brings it to the attention of the maternal-child HIV team

Pregnant woman is assisted in enrolling into care at the wellness center under the care of an adult HIV specialist and an obstetrician. Patients are also assisted in identifying other care providers and obstetricians not within the county hospital system if they so desire

Pregnant women are scheduled to meet with pediatrician to discuss expected plan of care for their infant once he/she is delivered. Education is provided with regards to risk of transmission and available interventions to reduce risk of transmission

Social support is provided through the health department and AFAN including but not limited to transportation and housing as needed

All pregnant women presenting in labor at all hospitals in Las Vegas were assessed for documented HIV sero-status. Rapid HIV testing is performed on all pregnant women with unknown HIV sero-status unless patient declines

Patients are discussed during a monthly clinical meeting where barriers to care are assessed, identified and a specific plan was developed to eliminate or reduce barrier

AFAN: Aid for AIDS of Nevada

### Evaluate health outcomes and disseminate findings

Final HIV sero-status of the infant using appropriate diagnostic test for exposed infants was used to evaluate and define health outcomes and health-related quality of life. All descriptive and inferential statistics were calculated using IBM SPSS version 15.0.

## Results

### Overall

A review of the database for HIV infection maintained by the SNHD revealed that the final HIV status of all infants born between 2000 and 2004 were indeterminate due to “loss to follow-up” that did not allow a final HIV status to be established. In 2005, there were 5406 persons living with HIV/AIDS in Clark County, 495 (9%) were women of childbearing age. Twenty-six infants were born to women with HIV between September 2005 and June 2006. One hundred and five infants were born to women with HIV from 2007 to 2012. Demographic information is provided in Table 2. Of the HIV-positive women, 69% had Medicaid, 5% were uninsured and 27% had private health insurance.

Prior to 2007, only one hospital implemented a rapid HIV testing during labor for women presenting in labor with unknown HIV sero-status. At the end of 2012, all ten local hospitals in Clark County with a labor and delivery unit had a protocol for rapid HIV testing for women presenting in labor with unknown HIV sero-status.

### Evaluate system improvement

We evaluated improvements in the six predefined outcome measure after 6 years.

Among the 26 HIV-infected women who delivered prior to the implementation of the integrated program, 58% (15/26) had adequate prenatal care. Among women who delivered

**Table 2: Demographic characteristics of mothers: Pre- and post intervention**

Exposed infants		Sex		Race/ethnicity					
Year of birth	Number of births	Males	Females	African American	Hispanic	Caucasian	Native American	Pacific Islander/Asian	Other
Pre-intervention									
2005*	5	2	3	2	2	0	0	0	1
2006**	21	13	8	9	8	4	0	0	0
Total	26	15	11	11	10	4	0	0	1
Post-intervention									
2007	20	10	10	11	4	4	0	0	1
2008	19	7	12	10	3	4	1	1	0
2009	22	10	12	10	8	2	0	0	2
2010	24	8	16	13	5	5	0	0	1
2011	10	6	4	7	1	1	0	0	1
2012	10	4	6	7	1	1	0	0	1
Total	105	45	60	58	22	17	1	1	6

\*Pre-intervention data collection began September 2005, \*\*Pre-intervention ended June 2006

following the implementation of the integrated intervention, 85% (89/105) had adequate prenatal care. Preintervention, 46% (12/26) of HIV-positive mothers were diagnosed prior to pregnancy, 35% (9/26) during pregnancy, 4% (1/26) during labor and 15% after delivery. Postintervention, 63% (66/105) of HIV-positive mothers were diagnosed prior to pregnancy, 31% (33/105) during pregnancy, 5% (5/105) during labor and 1% (1/105) after delivery.

Lack of appropriate screening during pregnancy, labor and delivery led to missed opportunities to initiate ARV therapy to pregnant women. Of the 26 HIV-positive women who delivered from September 2005 to June 2006, 62% (16/26) received appropriate ARV therapy during pregnancy, and 73% (19/26) received ARV therapy during labor. Postintervention, 81% (85/105) of the HIV-positive women, received ARV therapy during pregnancy, and 86% (90/105) received ARV therapy during labor.

Preintervention, 62% (16/26) of HIV-infected pregnant received appropriate delivery by cesarean section. Postintervention, cesarean sections were performed on 74% (78/105) of the HIV-infected mother and all (100%) were judged to be medical appropriate. We made this determination by reviewing our cesarean section cases and found that the majority of cases were due to the history of previous cesarean and request by the pregnant women for repeat cesarean section. Cesarean sections were not related to persistent lack of viral suppression.

Only 69% (18/26) of the 26 infants born from September 2005 to June 2006 received adequate zidovudine prophylaxis defined as initiation of zidovudine within 12 h of birth and 54% (14/26) had documented completion of 6 weeks therapy with zidovudine. Postintervention, 87% (91/105) of HIV-exposed infants, received zidovudine within 12 h of birth, and 87% (91/105) had documented completion of 6 weeks therapy with zidovudine.

Six infants were documented to have been infected with HIV among the 26 infants delivered during the preintervention period September 2005 through June 2006. No MTCT was documented among the 105 infants born postintervention from 2007 to 2012.

## Discussion

The World Health Organization in its recent publication of PMTCT strategic vision 2010–2015 outlined that “priority will be given to strengthening linkages between PMTCT and HIV care and treatment services for women, their children, and other family members in order to support an effective continuum of care.”<sup>[22]</sup> Such an integrated approach between public health departments, primary care practices and hospitals, provides support to women who are known to be HIV-infected or test positive for HIV during pregnancy and is also in line with the World Health Organization and the IOM’s recommendations.<sup>[22,23]</sup>

The result from our program validates the point that MTCT of HIV can be eliminated when an integrated approach to the care of HIV-infected women and exposed newborns is implemented.

Although women accounted for an estimated 8% of HIV/AIDS infected adults in 1985, that proportion had increased steadily to an estimated 25% of new infections in 2006, with a majority of infections occurring among women of childbearing age.<sup>[24]</sup> Studies evaluating missed opportunities to prevent perinatal HIV transmission in the United States conducted between 1996–2000 and 2005–2008 noted that the majority of HIV-infected pregnant women had one or more missed opportunities to prevent perinatal HIV transmission.<sup>[25]</sup>

In response to the six cases of perinatal HIV-infection in newborns in 2005–2006, we began the process of implementing the comprehensive HIV program in Clark County. To obtain buy in from the community hospitals, we formed the community advisory board for the elimination of pediatric HIV. The advisory board was comprised of staff representatives from pediatric and adult HIV clinics, nursing case managers from the county Health Department and hospital representatives from the 10 local hospitals that had a delivery unit. This committee met once a month and reviewed the national HIV perinatal guideline to produce a local version that detailed the management of women who present in labor with known and unknown HIV status and their infants. These hospital representatives, who were in most cases nurses and directors of their hospital delivery units, were critical to the success of our program. They acted as liaisons between the hospitals and the SNHD. They were the contact person to verify the HIV status of women presenting in labor through the county name-based database. The privacy and confidentiality requirement was maintained through existing memorandum between the hospitals and the health department.

Once the local guidelines were approved by the hospitals, we embarked on a 6 months training session where in-service trainings were conducted in all the hospitals. Each hospital had four training sessions organized in such a manner that it occurred during the morning and evening hand-over session and included the nursing and laboratory staff. This allowed the team the opportunity to reach most of the nursing and laboratory staff including those on day and night shifts. The training curriculum included appropriate test requisitions, rapid HIV testing by the laboratory team, a protocol for the management of the HIV-exposed infant including the appropriate blood specimen for testing.

The program team met once a month with the nursing case management team from the health department. Under an existing memorandum of understanding, we discussed each new HIV case documented in a pregnant woman. We also reviewed the care of existing pregnant women who were in care to identify barriers to care especially social issues that included but were not limited to transportation and housing during pregnancy. We

discussed postpartum follow-up and discharge of infants from the program to their regular pediatricians once HIV infection had been ruled out. A result of the work of the program team was mandatory HIV screening for all pregnant women, which was implemented in Nevada following the passage of Nevada Senate Bill 266. This bill was passed in 2007 and was instrumental for enhanced identification of HIV-infected women who became pregnant.<sup>[26]</sup> The comprehensive nature of this intervention and the taskforce approach was instrumental to reducing the missed opportunities for PMTCT in our community.

After the integrated intervention, women who were identified early in their pregnancy had multiple opportunities to be brought into care. The integrated approach provided coordination and collaboration where prenatal care was provided by an obstetrician. In addition, they meet at least once with the pediatric infectious diseases physician during pregnancy to discuss factors that affected the risk of perinatal transmission and to develop a plan of care once the infant was delivered. Our report shows that such initial contact with a pediatrician led to increased compliance with follow-up of the infant and compliance with postnatal zidovudine prophylaxis. Approximately 69% of our patient had some form of public sponsored insurance which presented an initial challenge to enrollment into prenatal care, but ultimately removed cost as a barrier to prenatal care attendance.

Our report shows that lack of prenatal screening for HIV during pregnancy and labor increased the risk that HIV-infected women were not identified in time and opportunities for initiating zidovudine prophylaxis were missed. The lack of a coordinated program led to poor follow-up of HIV-exposed infants and adherence to zidovudine prophylaxis during the preintervention period which improved dramatically to 87% postintervention. We believe that early involvement of a pediatrician can tremendously improve follow-up after delivery as relationship are established early, and a clear follow-up plan is developed. This analysis showed that all cases of perinatal transmission in the preimplementation period of the integrated program were among minority women (25% Hispanics and 75% African American) who had limited or no prenatal care. This is consistent with recent results in the US that showed that during 2007–2009, 85% of diagnoses of perinatal HIV-infection were in Blacks (63%) or Hispanics (22%).<sup>[27]</sup> Overall, while the proportion of women with HIV infection has risen in the US, the number of reported cases of perinatal transmission has declined from an estimated annual peak of 1650 infected infants in mid-1990s to 162 infants in 2010.<sup>[27]</sup> Our finding of no cases of perinatal transmission diagnosed postimplementation is consistent with other studies that showed reductions in perinatal transmission with successful implementation of strategies aimed at identifying HIV-infected pregnant women before or early in pregnancy, treating HIV-infection in pregnant women with highly active ARV therapy, zidovudine prophylaxis during labor and delivery, and zidovudine prophylaxis to HIV-exposed infants.<sup>[10]</sup>

## Limitations

Our analysis has a number of limitations. First, it is a single site experience, and even though it included all deliveries in the county, our experience may be different from other part of the country. Second, care for HIV-infected adults and children were concentrated in two major medical centers in our community, and it was easier to implement an integrated program. It may be more difficult to implement in communities without consolidated HIV care centers. Thirdly, successful passage of the Nevada Senate Bill mandating HIV screening of all pregnant women in our community could have made our educational and outreach interventions more successful by allowing for increased communication between obstetricians and pediatricians and greater collaboration among HIV service organization, hospitals and the health district.

## Conclusion

Our study indicated that an integrated approach to the care of pregnant HIV-infected women and their newborns can lead to a reduction in missed opportunities for prevention and eventual eradication of perinatal HIV transmission by increasing the odds that the women and their newborns receive recommended interventions.

## Ethical approvals

This project received ethical approval from the University of Nevada Institutional Review Board and the Institutional Review Board of the University Medical Center of Southern Nevada.

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