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Ready or Not—Intrapartum Prevention of Perinatal HIV Transmission in Illinois

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Abstract *Objectives*: The overall readiness of Illinois birthing hospitals to comply with the 2003 Illinois HIV Perinatal Prevention Act and prevent perinatal HIV transmission, and the hospital characteristics that predict readiness were examined. *Methods*: Nurse Managers of all 137 Illinois birthing hospitals were surveyed regarding current labor and delivery (L&D) practices for HIV status identification, documentation, testing and zidovudine (AZT) availability in March 2004. Bivariate and multivariable regression analysis was performed. *Results*: All 137 hospitals returned the surveys. Almost forty seven percent of Illinois birthing hospitals had adequate maternal HIV status documentation on arrival in L&D, 72.3% documented prenatal HIV results in the L&D chart, 65.7% documented prenatal HIV in the newborn chart, 38.7% ordered HIV tests on L&D if no prenatal HIV status was available, and 61.3% had AZT available. Only 17 hospitals (12.4%) met requirements for overall readiness to prevent perinatal HIV transmission. Sixteen hospitals (11.6%) met a minimal level of readiness (prenatal HIV status documentation and AZT availability). *Conclusions*: Despite passage of legislation to increase perinatal HIV testing and reduce transmission, Illinois birthing hospitals had an overall low level of readiness to implement the intrapartum interventions that are an essential part of eradicating pediatric HIV infection. Perinatal reduction protocols and implementation guidelines would improve the overall readiness of Illinois birthing hospitals to prevent perinatal HIV transmission.

Keywords Perinatal HIV prevention · Birthing hospitals · Perinatal HIV legislation · Perinatal HIV testing

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Introduction

In 1994, the Pediatric AIDS Clinical Trials Group showed that a combined regimen of zidovudine (AZT) provided during pregnancy, labor and to an exposed newborn for 6 weeks post-delivery, could reduce perinatal infection by 67% [1]. Currently in the United States, when maternal HIV status is known by perinatal care providers and appropriate interventions are provided, the risk of perinatal HIV transmission can be reduced to less than 2% [2]. However, in 2002 the Centers for Disease Control and Prevention (CDC) reported that approximately 40% of mothers of the 280–370

newborns infected with HIV were not aware of their HIV status at delivery [3]. These numbers represent "missed opportunities" for prevention of perinatal HIV transmission and for the elimination of pediatric HIV in the United States [4, 5]. Given that interventions are available to nearly eliminate pediatric HIV in the United States, each missed opportunity could be viewed as a breakdown in our public health system.

Missed opportunities to prevent pediatric HIV have arisen for a number of reasons: 1) women are not tested for HIV during pregnancy because they do not receive adequate prenatal care, their prenatal care providers do not provide HIV testing, or they refuse to be tested; 2) women are tested, but are not linked to specialized care so as to receive appropriate interventions during pregnancy, labor or postpartum; 3) women are tested, but, labor and delivery (L&D) providers are unaware of a patient's HIV status due to poor documentation or transfer of records; 4) women are tested but appropriate antiretroviral medication (AZT) is not available to treat women during labor or newborns after delivery [1, 5, 6]. Appropriate intrapartum interventions (such as: AZT in labor, appropriate use of scheduled cesarean section in the setting of non-suppressed viral load, avoidance of artificial rupture of membranes or instrumentation of the fetal scalp, avoidance of prolonged rupture of membranes, providing the newborn an early bath and AZT syrup in the delivery room, avoiding breastfeeding and 6 weeks of newborn antiretroviral therapy) are crucial for the prevention of HIV transmission. Approximately 60–70% of perinatal HIV transmission is thought to occur during late pregnancy or the intrapartum time period [7]. Yet, interventions applied as late as L&D can still reduce transmission by 40% [8]. Intrapartum interventions (ascertaining HIV status for those untested and applying appropriate interventions) are essential.

The most recent Illinois Seroprevalence Study of Childbearing Women conducted in 1998 by the Illinois Department of Public Health, through a cooperative agreement with the CDC, reported a 0.41% HIV seroprevalence for pregnant women in Chicago and 0.15% seroprevalence for pregnant women in Illinois [9]. Of note, only 50% of HIV exposed infants, identified anonymously by newborn heel stick sampling, had AZT metabolites in their blood specimen [10]. Lack of AZT metabolite among 50% of exposed infants is a clear indication that missed opportunities for prevention have occurred, whether due to a failure to diagnose maternal HIV status or to administer perinatal and intrapartum AZT.

In August 2003, Illinois passed the Illinois Perinatal HIV Prevention Act to improve perinatal HIV prevention practices in the state. The act mandates that all pregnant women must be counseled and offered an HIV test as early in pregnancy as possible [11]. Additionally, to ensure that intrapartum interventions are instituted, the act requires HIV test results be documented in the prenatal and L&D chart and mandates offering rapid HIV testing if a women's HIV status is undocumented on arrival to L&D ("opt-in") as well as requiring a rapid test for all newborns with undocumented maternal HIV status within the first 12 h after delivery unless the mother declines in writing ("opt-out"). In order to assist with implementation of the Illinois Perinatal HIV Prevention Act, the Perinatal Rapid Testing Implementation in Illinois initiative (PRTII) was formed and supported by the Illinois Department of Public Health (IDPH). Implementation planning began with a statewide needs assessment to determine current practices, needs and barriers around perinatal HIV transmission prevention.

The purpose of this study was to complete a survey of all Illinois birthing hospitals in 2004 to determine their overall readiness to identify HIV positive women in L&D and prevent perinatal transmission to newborns. This study identified hospital characteristics that predict specific components of readiness to prevent perinatal transmission. In addition, reported barriers to readiness were evaluated.

Methods

In February 2004, the PRTII Needs Assessment Survey was sent by fax and postal mail to L&D nurse managers of all 137 birthing hospitals in Illinois. These hospitals were identified using a combination of 2002 IDPH Hospital Profile data as well as data from the Illinois Regional Perinatal Network System [12]. The survey contained 24 questions regarding hospital demographics and the current practices in the hospital regarding perinatal HIV testing, documentation and treatment.

Dependent variables

Dependent variables studied included birthing hospitals readiness to prevent perinatal HIV infection, and the barriers to documentation of HIV status. The components of readiness included: 1) >75% of patients present to L&D with documentation of maternal HIV status available; 2) L&D staff routinely document prenatal HIV results in the maternal L&D chart; 3) pediatric staff routinely document maternal HIV results in the newborn chart; 4) L&D staff routinely order an HIV test for a woman in labor if the prenatal HIV status is not available; and, 5) the availability of AZT (both IV and syrup formulation) in L&D. Hospitals were characterized as having complete readiness if they reported that all 5 readiness components were operative. Hospitals that did not reach complete readiness, but reported >75% documentation of HIV status on L&D and availability of AZT were defined as achieving minimal readiness.

Barriers to documentation of HIV status were also assessed. L&D nurse managers were asked specific questions regarding what barriers they faced in having HIV test

results immediately available when a patient presents in labor. Barriers included: 1) prenatal HIV tests not offered by prenatal care providers; 2) HIV test results not documented in the prenatal record; 3) prenatal records not efficiently transferred to L&D from prenatal clinics; and, 4) prenatal records not always available to L&D on nights or weekends.

Independent variables

Independent variables were identified from several sources of secondary data. The 2002 IDPH Hospital Profile provided data on number of annual births by hospital in Illinois as well as demographic data of the population served by each hospital, including racial/ethnic mix and percent of population covered by Medicaid [12]. Data abstracted from this source were divided into statistical quartiles and hospitals were coded accordingly; where appropriate, top quartile versus the remaining 3 quartiles was used for bivariate analysis.

In addition, hospitals were classified as major academic and/or teaching institutions if the hospital reported that residents rotated on their L&D, the hospital had >100 house staff, or the ratio of total facility house staff to beds was greater than or equal to 0.25, as per the Illinois Hospital Association (IHA) [13].

Data on hospital perinatal level, county, and location (urban or rural) were abstracted from the IHA. Levels of perinatal care were defined previously by the IDPH as: Perinatal Level I (general perinatal care), Perinatal level II (intermediate perinatal care), Perinatal Level II+ (intermediate perinatal care with extended capabilities), and Perinatal Level III (intensive perinatal care) [14].

Hospital geographic location was coded as "urban" if defined by the IHA as located in metropolitan statistical areas with a city population greater than 50,000 or a total population greater than 100,000 people [14]. A hospital categorized as rural was not located in a metropolitan statistical area [14].

An HIV seroprevalance score was assigned to each hospital based upon the diagnosed cases of HIV in the county where the hospital was located since 1999 (abstracted from the August 2004 IDPH Surveillance Report), divided by the county 2000 census population, and multiplied by 100,000 to create a score for each hospital [15]. Seroprevalence scores were divided into statistical quartiles and top quartiles were used for bivariate analysis.

Data analysis

Bivariate analysis was conducted to determine the association between hospital characteristics and specific components of hospital readiness as well as barriers to appropriate documentation of perinatal HIV. Multivariable logistic regression models for three outcomes (AZT availability, HIV status documentation, and overall hospital readiness) were developed using backwards stepwise modeling. Variables found significant in the bivariate analyses were entered into the regression models. Using the stepwise procedure, all variables associated with the outcome at a significance level of less than 0.10, were retained in the model. SPSS 12.0 for Windows was utilized for all calculations (SPSS Inc, Chicago, IL).

To measure the accuracy of the survey responses we externally verified the reported perinatal HIV status documentation rates using 2 outside sources: a 2003 chart review of birthing hospital HIV documentation rates by the Illinois Department of Human Services (unpublished data, personal communication) and the perinatal HIV documentation rate reported by the 2002 Illinois Pregnancy Risk Assessment Monitoring System (PRAMS) [16].

Results

Birthing hospital characteristics

All 137 (100%) Illinois birthing hospitals returned surveys. Illinois birthing hospitals made up 72.1% of all hospitals in Illinois (Table 1). The majority of birthing hospitals, 72.9%, were urban, while 27.0% were rural. As the majority of HIV disease in Illinois was diagnosed within Cook County, hospitals were also classified in relation to Cook County: 19.7% were in urban Cook County (Chicago), 14.5% were in suburban Cook County, and 65.6% of birthing hospitals were

Table 1 Descriptive characteristics of Illinois birthing hospitals ($n = 137$)

Characteristics	*n*	%
Location		
Urban	100	72.9
Rural	37	27.0
Urban cook county (Chicago)	27	19.7
Suburban cook county	20	14.6
Not in cook county	90	65.7
Births		
<1 Birth/day	30	22.0
2–4 Births/day	55	40.2
5–7 Births/day	41	29.9
>8 Births/day	11	8.0
Perinatal level		
III	21	15.3
II+	23	16.8
II	73	53.3
I	20	14.6
Major academic		
Yes	18	13.1
No	119	86.9
Teaching		
Yes	89	65.0
No	48	35.0

not located in Cook County (11). Two thirds of the birthing hospitals were classified as Perinatal Level I or II; while 16.7% were Perinatal Level II+ and 15.3% were Perinatal Level III [13]. Average births-per-day for the year 2002 were as follows: 21.8% of hospitals averaged 1 birth-per-day, 40.1% averaged 2–4 births-per-day, 29.9% averaged 5–7 births-per-day and 8.0% of hospitals had greater than 8 births-per-day [11]. In total, in 2002 there were 175,949 births at birthing hospitals in Illinois [11]. The majority of hospitals (64.9%) self- identified as teaching hospitals, and 13.1% were considered major academic institutions by IHA [12]. The overall racial mix of patients served by Illinois birthing hospitals in 2002 was 69% white, 20% black, 9% Hispanic, 2% Asian- Pacific Islanders and 1% American Indian [11]. On average, 17% of the patients served by Illinois birthing hospitals received Medicaid (range 1–64%). The mean Cumulative County Seroprevalence Score assigned to these hospitals was found to be 88 (range 0–300) cases of HIV 1999–2004/county population × 100,000 [11] (Table 1).

Specific components of readiness

Only 47% of the hospitals reported achieving "$>$75% of women present to L&D with documented maternal HIV status," 72.2% reported that "staff routinely document prenatal HIV results in the L&D chart if available," 65.6% reported "staff routinely document prenatal HIV results in the newborn chart if available," 38.6% reported "staff routinely order HIV tests on L&D if no prenatal HIV result is available" and 61.3% reported that their "hospital stocked AZT" (Table 2).

To determine the hospital characteristics associated with the individual components of readiness to prevent perinatal HIV transmission, bivariate analysis was performed (Table 2). Hospitals identified in the top quartile for percent white patients served ($>$95% white patients) were significantly more likely to achieve documentation of prenatal HIV test results on L&D (RR 1.44, 95% CI 1.02–2.02). Conversely, a high level of prenatal HIV test result documentation was negatively associated with hospitals that served the highest percentage of black patients (RR 0.48, 95% CI 0.27–0.86) or Medicaid patients (RR 0.37, 95% CI 0.19–0.73). However, routine HIV testing on L&D for women with unknown HIV status was significantly associated with hospitals that serve the top quartile percentage of black patients (RR 1.98, 95% CI 1.36–2.88). Additionally, AZT availability on L&D was significantly associated with the following hospital characteristics: urban location (RR 1.49, 95% CI 1.03–2.16), Perinatal Level III (RR 1.53, 95% CI 1.24–1.89), major academic (RR 1.44, 95% CI 1.14–1.82), top quartile births ($>$1904 births/year), (RR 1.65, 95% CI 1.34–2.03), top quartile percent Medicaid patients served ($>$19.7%), (RR 1.30, 95% CI 1.03–1.69), and top quartile of percent black patients served ($>$19.5%), (RR 1.5, 95% CI 1.23–1.90) (Table 2). Although hospitals serving the highest percentage black patients reported significantly lower rates of prenatal HIV test result documentation (RR 0.48, 95% CI 0.27–0.86), we found that these same hospitals had significantly higher rates of routinely ordering HIV testing for women on L&D with an unknown HIV status (RR 1.98, 95% CI 1.36–2.88) and higher rates of AZT availability (RR 1.5, 95% CI 1.23–1.90) (Fig. 1).

Multiple regression models to predict availability of AZT and HIV status documentation were developed (Table 3). The model to predict AZT availability contained the following independent variables: (1) urban location, (2) higher percentage of black patients (top quartile $>$20%), (3) higher number of births (top quartile $>$1904 births) and (4) higher HIV seroprevalence score (top quartile $>$103). Results showed that significant and independent predictors of AZT availability included top quartile births ($p = 0.001$) and top quartile black population served ($p = 0.002$). In contrast, the regression model for HIV status documentation on arrival to L&D indicated that hospitals that serve the top quartile of black patients negatively predict HIV status documentation on L&D ($p = 0.02$). The regression model controlled for race, teaching hospital status, and HIV seroprevalence score.

Overall level of readiness

Overall readiness of hospitals to prevent perinatal HIV transmission was assessed; only 17 birthing hospitals (12.4%) reported that their current L&D/newborn nursery practices complied with the 5 readiness components. The 17 hospitals account for only 9.5% of births reported in Illinois for 2002. A minimal level of readiness was assigned to hospitals who achieved at least $>$75% documentation of HIV on arrival to L&D and reported availability of AZT; however, only an additional 16 hospitals (11.6%) could meet this definition. The majority of hospitals in Illinois (75.9%) were found not to meet the overall or even minimal definition of readiness to prevent perinatal HIV transmission.

A multivariate logistic regression model was developed to assess predictors of overall hospital readiness (Table 3). The model controlled for: urban location, teaching hospital status, top quartile births ($>$1904 births/year) and top quartile for percent white population served (95.90–100%). Results showed that significant independent predictors of overall readiness were: hospitals in a rural location ($p = 0.024$), and hospitals with a more racially mixed population

Table 2 Association of hospital characteristics and reported components of readiness to prevent perinatal HIV transmission

	>75% of patient charts have a documented HIV result on arrival to L&D			Routinely L&D staff document prenatal HIV status in the patient's L&D chart			When a patient presents with an undocumented HIV status an HIV test is routinely ordered on L&D			Routinely pediatric staff document maternal HIV status in newborn chart			Has syrup and IV AZT in hospital pharmacy		
Characteristics	$n = 64$, (47%)	RR	Cl (95%)	$n = 99$, (72%)	RR	Cl (95%)	$n = 53$, (39%)	RR	Cl (95%)	$n = 90$, (66%)	RR	Cl (95%)	$n = 84$, (61%)	RR	Cl (95%)
Location															
Urban	41 (64)	0.68	(0.48, 0.95)*	72 (73)	1.01	(0.80, 1.27)	39 (74)	1.08	(0.67, 1.73)	64 (71)	0.94	(0.74, 1.21)	67 (80)	1.49	(1.03, 2.16)*
Rural	23 (36)			27 (27)			14 (26)			26 (29)			17 (20)		
Cumulative county seroprevelance score†															
103–300	15 (23)	0.91	(0.60, 1.39)	25 (25)	1.00	(0.80, 1.27)	17 (32)	1.38	(0.90, 2.09)	19 (21)	0.86	(0.63, 1.16)	20 (24)	1.01	(0.75, 1.36)
<102	49 (77)			74 (75)			36 (68)			71 (79)			64 (76)		
Perinatal level															
III	7 (11)	0.72	(0.39, 1.34)	15 (15)	1.03	(0.78, 1.35)	9 (17)	1.12	(0.65, 1.90)	13 (14)	0.99	(0.71, 1.37)	19 (23)	1.53	(1.24, 1.89)*
I, II, II +	57 (89)			84 (85)			44 (83)			77 (86)			65 (77)		
Major academic															
Yes	6 (9)	0.74	(0.39, 1.44)	11 (11)	0.87	(0.60, 1.25)	8 (15)	1.26	(0.73, 2.15)	9 (10)	0.85	(0.55, 1.31)	14 (17)	1.44	(1.14, 1.82)*
No	58 (91)			88 (89)			45 (85)			81 (90)			70 (83)		
Teaching															
Yes	47 (76)	1.57	(1.00, 2.46)	65 (67)	1.00	(0.81, 1.25)	35 (69)	1.04	(0.66, 1.65)	59 (66)	0.89	(0.71, 1.13)	53 (64)	0.87	(0.67, 1.13)
No	15 (24)			32 (33)			16 (31)			30 (34)			30 (36)		
Births															
>1904 births/yr	13 (20)	0.79	(0.50, 1.25)	23 (23)	0.94	(0.73, 1.20)	10 (19)	0.74	(0.42, 1.28)	22 (24)	1.08	(0.84, 1.39)	30 (36)	1.65	(1.34, 2.03)*
<1903 births/yr	51 (80)			76 (77)			43 (81)			68 (76)			54 (64)		
Hospital population black															
>19.51%	9 (14)	0.481	(0.27, 0.86)*	23 (23)	0.926	(0.72, 1.19)	20 (38)	1.98	(1.36, 2.88)*	21 (23)	1.00	(0.77, 1.31)	28 (33)	1.53	(1.23, 1.90)*
<19.50%	55 (86)			76 (77)			33 (62)			69 (77)			56 (67)		
Hospital population white															
>95.90%	21 (33)	1.44	(1.02, 2.02)*	27 (27)	1.10	(0.89, 1.36)	12 (23)	0.81	(0.49, 1.35)	24 (27)	1.02	(0.79, 1.31)	13 (16)	0.58	(0.38, 0.90)*
<95.89%	43 (67)			72 (73)			41 (77)			66 (73)			71 (85)		
Hospital payer medicaid															
>19.65%	7 (11)	0.36	(0.19, 0.73)*	22 (22)	0.89	(0.68, 1.16)	15 (29)	1.32	(0.85, 2.05)	18 (20)	0.91	(0.68, 1.24)	25 (30)	1.32	(1.03, 1.69)*
>19.64%	56 (89)			76 (78)			37 (71)			71 (80)			58 (70)		

†Cases of HIV 1999–2004/county population × 100,000. *$P < 0.05$.

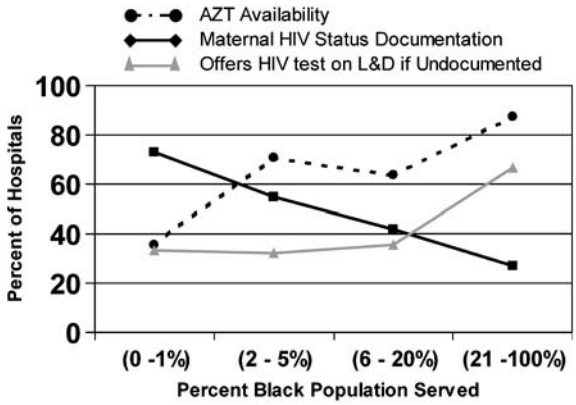

Fig. 1 Illinois birthing hospitals readiness to prevent perinatal HIV transmission by percent black patient population served

(hospitals not serving a population in the top quartile percent white) ($p = 0.014$).

Barriers to HIV documentation

Barriers to documentation of HIV status for women presenting to L&D were also explored (Table 4). The most common barrier, "prenatal records not always available on nights or weekends," was reported by 65.6% of hospitals. Other barriers reported were: "prenatal HIV testing not done" (62.7%), "HIV test results not documented" (40.1%) and "prenatal records not effectively transferred from prenatal clinics" (37.2%). The number of barriers reported for each hospital was calculated. Only 9.4% of hospitals reported no barriers to having HIV test results immediately available when a patient presents in labor. Twenty-four % of hospitals reported one main barrier, and 66.4% of hospitals identified 2 or more barriers to HIV status availability on admission.

Bivariate analysis showed that reporting "prenatal records not always available on nights or weekends" was significantly associated with hospitals in urban locations (RR 1.59, 95% CI 1.10–2.30), and hospitals identified in the top quartile for total births (RR 1.30, 95% CI 1.03–1.63). No specific hospital characteristics were associated with "prenatal care providers not performing HIV tests"; this barrier occurred in all types of hospitals. Reporting the barrier, "prenatal HIV test results are not documented" was significantly more likely in Perinatal Level III hospitals (RR 1.71, 95% CI 1.13–2.59), major academic institutions (RR 1.65, 95% CI 1.07–2.56), and hospitals in the top quartile for total births (RR 1.73, 95% CI 1.17–2.56). Hospitals that reported "prenatal records are not effectively transferred from prenatal clinics" were significantly more likely to serve a higher percentage black population (RR 2.28, 95% CI 1.53–3.38), serve a higher percentage Medicaid population (RR 2.28, 95% CI 1.53–3.38), and have the highest HIV seroprevelance score (RR 2.30, 95% CI 1.55–3.42). Hospitals that reported having all 4 barriers to HIV documentation were significantly more likely to have a higher (top-quartile) cumulative county seroprevalence score (RR 3.03, 95% CI 1.31–7.0).

Survey accuracy

The responses to the perinatal HIV documentation rate question were externally verified. The mean hospital documentation rate reported by nurse managers in our survey (72%) was found to be consistent with the mean documentation rate obtained through a 2003 chart review of Illinois birthing hospitals by the Illinois Department of Human Services (70%) (unpublished data, personal communication) and the 2002 Pregnancy Risk Assessment Monitoring System (PRAMS) mean perinatal HIV documentation rate for Illinois (73%)

Table 3 Multivariate models for AZT availability on L&D, >75% documentation on L&D and overall hospital readiness to prevent perinatal HIV transmission

Regression models	AOR	95% (CI)	*P*
(1) AZT Availability[†]			
Hospital population black (>19.51%)	8.83	2.22–35.10	0.002
Births (>1904 births/year)	9.72	2.50–37.85	0.001
Cumulative county seroprevalance score (>103)	0.35	0.11–1.08	0.068
(2) >75% Documentation on Labor and Delivery[‡]			
Hospital population black (>19.51%)	0.29	0.11–0.80	0.017
(3) Overall Hospital Readiness[§]			
Urban	0.46	0.00–0.67	0.046
Hospital population white (>95.90%)	0.03	0.00–0.49	0.014

Note. AOR indicates adjusted odds ratio. Each variable was adjusted for the other variables in each model.

Additional variables controlled for include:

[†]Urban location.

[‡]Cumulative County Seroprevalance Score and Teaching hospital.

[§]Teaching hospital status and Births (>1904 births/year).

Table 4 Association of hospital characteristics and reported barriers to HIV status identification on L&D

	Prenatal HIV tests are not done			HIV test results are not documented			Prenatal records are not efficiently transferred from prenatal clinics			Prenatal records are not always available or nights or weekends		
Characteristics	$n = 86$ (63%)	RR	CI (95%)	$n = 55$ (40%)	RR	CI (95%)	$n = 51$ (37%)	RR	CI (95%)	$n = 90$ (66%)	RR	CI (95%)
Location												
Urban	62 (72)	0.96	(0.72, 1.29)	44 (80)	1.48	(0.86, 2.65)	38 (75)	1.08	(0.65, 1.79)	73 (81)	1.59	(1.09, 2.30)*
Rural	24 (28)			11 (20)			13 (25)			17 (19)		
Cumulative county seroprevelance score†												
103–300	23 (27)	1.11	(0.84, 1.46)	17 (31)	1.36	(0.89, 2.06)	22 (43)	2.30	(1.55, 3.42)*	21 (23)	0.92	(0.69, 1.24)
<102	63 (72)			38 (59)			29 (57)			69 (77)		
Perinatal level												
III	13 (15)	0.98	(0.68, 1.42)	13 (24)	1.71	(1.13, 2.59)*	10 (20)	1.35	(0.81, 2.25)	16 (18)	1.19	(0.91, 1.57)
I, II, II +	73 (85)			42 (76)			41 (80)			74 (82)		
Major academic												
Yes	12 (14)	1.07	(0.75, 1.53)	11 (20)	1.65	(1.07, 2.56)*	8 (16)	1.23	(0.70, 2.17)	13 (14)	1.12	(0.81, 1.53)
No	74 (86)			44 (80)			43 (84)			77 (86)		
Teaching												
Yes	52 (61)	0.79	(0.62, 1.01)	33 (60)	0.78	(0.52, 1.16)	24 (48)	0.48	(0.31, 0.73)*	56 (63)	0.88	(0.69, 1.12)
No	34 (40)			22 (40)			26 (52)			33 (37)		
Births												
>1904 births/yr	22 (26)	1.04	(0.78, 1.39)	20 (36)	1.73	(1.17, 2.56)*	15 (29)	1.26	(0.80, 2.01)	27 (30)	1.30	(1.03, 1.65)*
<1903 births/yr	64 (74)			35 (64)			36 (71)			63 (70)		
Hospital population black												
>19.51%	22 (26)	1.05	(0.78, 1.40)	14 (26)	1.02	(0.64, 1.63)	22 (43)	2.28	(1.53, 3.38)*	25 (28)	1.17	(0.91, 1.06)
<19.50%	63 (74)			41 (76)			29 (57)			64 (72)		
Hospital population white												
>95.90%	21 (25)	0.98	(0.73, 1.33)	10 (18)	0.67	(0.38, 1.17)	12 (24)	0.92	(0.55, 1.55)	17 (19)	0.71	(0.49, 1.01)
<95.89%	64 (75)			45 (82)			39 (77)			72 (81)		
Hospital payer medicaid												
>19.65%	23 (27)	1.11	(0.84, 1.47)	16 (29)	1.23	(0.79, 1.90)	22 (43)	2.28	(1.53, 3.38)*	23 (26)	1.05	(0.79, 1.37)
>19.64%	62 (73)			39 (71)			29 (57)			66 (74)		

†Cases of HIV 1999–2004/county population × 100,000. *$P < 0.05$.

[15]. Accuracy rates for the perinatal HIV documentation question were calculated to be 98–99%.

Discussion

It appears that in February 2004, 6 months after passing the Illinois Perinatal HIV Prevention Act and prior to statewide perinatal rapid HIV testing implementation in 2005, birthing hospitals in Illinois had low overall levels of readiness to prevent perinatal HIV transmission and reported multiple barriers to appropriate prenatal HIV status documentation. Understanding hospital practices, and the barriers to practice change, appears to be the key to developing an effective strategy for perinatal rapid testing implementation and providing a statewide safety net of perinatal HIV transmission prevention.

Analysis of the CDC Pediatric Spectrum of HIV Disease Project showed that out of 4755 HIV exposed infants, 56% of mothers of HIV-infected infants experienced missed opportunities for prevention versus only 16% of the mothers of HIV-uninfected infants [5]. Missed opportunities were defined as failure to identify a pregnant women's HIV status before delivery or failure to provide timely antiretroviral therapy [5]. Given that missed opportunities to provide appropriate care have been shown to contribute to over half of the cases of HIV-infected infants it is crucial that the components of "readiness" necessary to provide a complete safety net of perinatal HIV prevention be defined and evaluated [5].

The 2004 PRTII Needs Assessment Survey results showed that Illinois birthing hospitals reported overall low levels of readiness to prevent perinatal HIV transmission and reported multiple barriers to identification of maternal HIV status on L&D. Only 17 Illinois birthing hospitals met the definition of complete readiness. Rural hospitals and those serving a more racially mixed population were most likely to demonstrate complete readiness. A minimal level of readiness (achieving $>75\%$ maternal HIV status documentation on L&D and having IV and syrup AZT available, but not meeting the other components) was met by only an additional 16 hospitals.

It was unexpected that the hospitals that demonstrated readiness were more likely to be rural. It is possible that the 17 hospitals that were found to be ready represented rural hospitals that were small enough to provide adequate documentation systems, however, also had a moderately racially mixed patient population. We found that hospitals with a more racially mixed patient population were more likely to have AZT available and more likely to provide appropriate HIV testing on L&D.

Large hospitals and those that serve a higher percentage of black patients were more likely to have AZT available. In contrast, HIV status documentation in L&D is more likely in hospitals that have a lower percent population of black patients ($p = 0.02$). Alarmingly, those hospitals located in counties with the highest HIV prevalence reported the greatest number of barriers to HIV status documentation availability on L&D. Without elimination of these barriers, timely administration of antiretroviral medications in the intrapartum period will be delayed. Perinatal level III academic centers with the highest delivery rates were most likely to encounter problems with lack of documentation of the HIV result in the prenatal record; in turn, these barriers are likely to increase the number of rapid tests that would need to be done in the L&D in these large delivery centers. Problems with efficient transfer of prenatal records to L&D was reported significantly more often by hospitals serving a higher percentage black population, a higher percentage Medicaid population and hospitals with the highest HIV seroprevalence scores.

These results show that the ability of hospitals to achieve key components of readiness to prevent perinatal HIV transmission is significantly associated with the racial mix of patients served. Documentation and identification of HIV status on arrival to L&D are significantly associated with hospitals having a higher percentage white population and a lower percentage black population. Barriers to transfer of prenatal records, and thus availability of prenatal HIV status on L&D, were more often reported in hospitals with a higher percentage of black patients, hospitals with a higher percentage of patients using Medicaid, and hospitals with a higher HIV seroprevalence score. On the other hand, hospitals serving a higher percentage of black patients more often reported they routinely offer HIV tests on L&D for women with undocumented status, and reported significantly higher rates of AZT availability.

It is possible that the survey identified few birthing hospitals with complete readiness to prevent perinatal HIV transmission (only 12.4%) because hospitals have different components of the perinatal HIV prevention safety net appropriately in place depending on the sociodemographics of patients served. The hospitals that served the highest percentage of white patients, and served fewer black and Medicaid patients, seemed to have better information technology to ensure the timely availability of prenatal records when a women presents in labor; however, these hospitals may have assumed lower levels of risk in their patient population and therefore may not have as effectively offered HIV tests for undocumented women in labor, or consistently have had AZT available. Also hospitals that served a higher percentage of black patients may historically have had more experience with programs and practices to prevent perinatal HIV transmission. These hospitals also may have assumed their patient population was at higher risk and therefore reported higher rates of routinely offering HIV tests in labor and higher rates of AZT availability; however, these same hospitals appeared to report lower rates of HIV status

documentation in labor and more barriers to effective transfer of prenatal records. These barriers may have been due to fewer resources allocated to information technology in these hospitals and a population that may present later for prenatal care, seek prenatal care in more than one location or have higher rates of no prenatal care [17–19].

Limitations

This study has several limitations that may have affected our overall results. The survey was completed by L&D nurse managers reporting current practices and issues in their hospitals. To measure the accuracy of the nurse managers' responses we externally verified the reported perinatal HIV status documentation rates question using data from 2 outside chart review surveys and found an accuracy rate of 98–99% for this question. The accuracy of the documentation rates reported may reflect favorably on the accuracy of answers reported for other survey questions. Other limitations of this study include important information that was not covered in the initial survey. Information on hospitals existing HIV prevention protocols, and their ability to link HIV positive women and exposed newborns to care postpartum was not obtained.

Future directions

The majority of birthing hospitals in Illinois in 2004 did not have in place the key components necessary to prevent perinatal HIV transmission to newborns. Readiness levels in Illinois hospitals prior to statewide perinatal rapid HIV testing implementation were likely similar to current hospital practices in other states. This research supports the importance of state policies and public health guidelines for perinatal HIV transmission prevention that address hospital protocols for prenatal testing and documentation of HIV status, effective transfer of prenatal records to L&D, rapid testing on L&D for women with undocumented status, and antiretroviral treatment availability. Regardless of patient demographics, resources must be provided to improve overall hospital readiness in all hospitals if the safety net of HIV prevention is to be extended to the perinatal setting. Without active implementation of systems to improve HIV testing, documentation and AZT availability, passage of laws to prevent potential transmission will remain in the realm of good intentions.

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