Punctures during prenatal care associated with prevalent HIV infection in sub-Saharan African women

Devon D. Brewer

John M. Roberts, Jr.

John J. Potterat

We thank ORC Macro (measuredhs.com), USAID, and the governments of participating countries for making the DHS data publicly available.

Presented at the 17th meeting of the International Society for Sexually Transmitted Diseases Research, Seattle, July, 2007

In sub-Saharan Africa, pregnant and post-partum women experience very high HIV incidence not accounted for by sexual factors (Gisselquist et al.; Gray et al.; Morrison et al. report one exception)

In fact, sex frequency and number of partners decline during pregnancy in Africa and elsewhere (Adinma; Onah et al.; Orji et al; Adeyemi et al.; Gray et al.; Morrison et al.)

These observations suggest need to examine nonsexual modes of HIV transmission in pregnant and postpartum women

Infection control procedures often lacking in ANC and other healthcare across sub-Saharan Africa and patients may be exposed to blood of others (dozens of references)

- lack of infection control materials (e.g., gloves, sharps box, soap and water)
- equipment shortages (e.g., syringes)
- no/broken/improperly used sterilizers
- untrained and unsupervised providers
- observed reuse of blood-contaminated syringes, lancets, etc.

Blood transfusions and medical injections (typically therapeutic) associated with prevalent and incident HIV infection in Africa (Gisselquist et al.)

Evidence against "reverse causation" (infected persons seeking injections for HIV-related symptoms):

- **association holds in healthy Zambian women and for exposure to tetanus toxoid vaccination in Burkina Fasoan, Kenyan, & Cameroonian women** (St. Lawrence et al.; Deuchert & Brody)

Goal for our analyses:

- **examine relationship between potential blood exposures to HIV in prenatal care and prevalent HIV infection across sub-Saharan Africa**
  - **include all publicly available data**
  - **tetanus toxoid vaccination**
  - **phlebotomy during prenatal care (typically for syphilis and/or anemia screening; schedule of care -- not in response to pt. request/symptoms)**

Demographic and Health Surveys

- multi-stage probability household samples of whole countries
- high response rates, high rates of accepting HIV testing
- face-to-face interviews, standardized questions
- finger stick DBS for HIV testing
- testing algorithm: 2 ELISAs; Western blot/3rd ELISA to resolve discrepancies

Women included in these analyses:

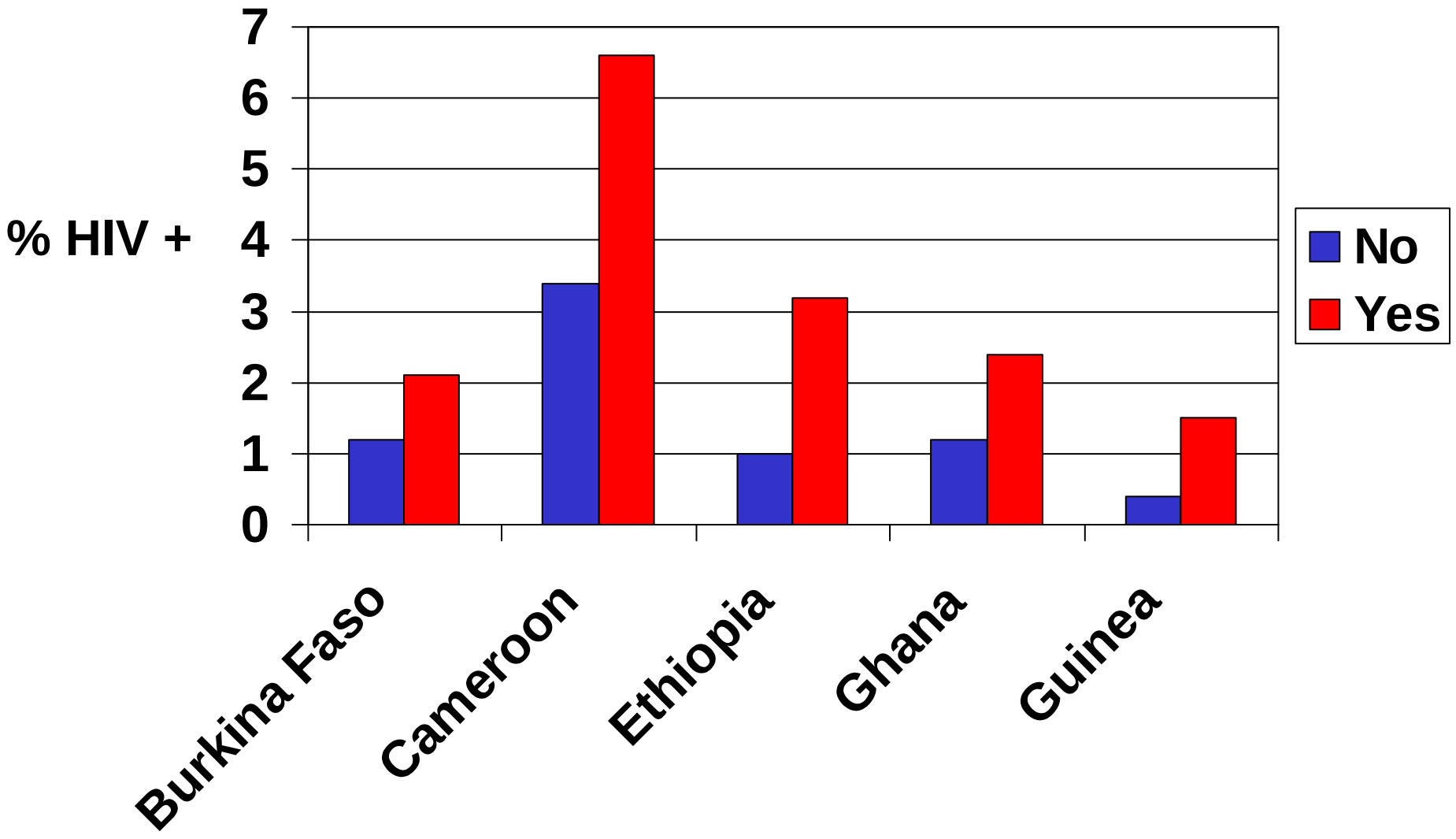
- **had given birth <= 5 years prior, and**
- **reported not testing for HIV previously**
  - **criteria make it unlikely that any association could be explained by women seeking prenatal care due to knowledge of HIV status**
- **combined measure of prenatal punctures: whether received a blood test and/or tetanus vaccination during last pregnancy**

DHS data sets analyzed

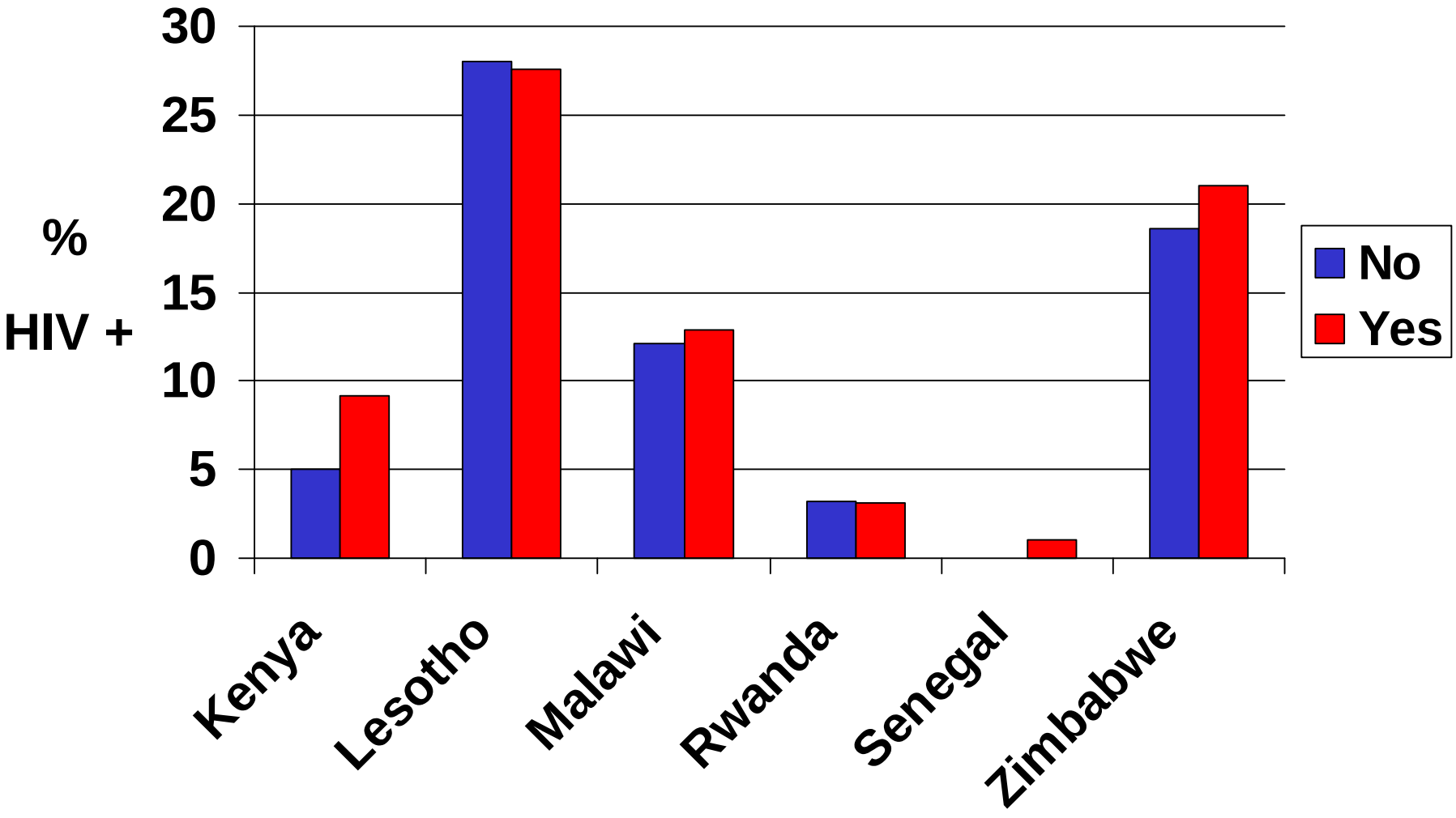
Country/Year	*n*	% received prenatal punctures	% HIV+
Burkina Faso, 2003	2440	69.7	1.8
Cameroon, 2004	1918	80.3	5.9
Ethiopia, 2005	2393	41.8	1.9
Ghana, 2003	2200	88.7	2.3
Guinea, 2005	2090	77.8	1.2
Kenya, 2003	1319	84.9	8.6
Lesotho, 2004	922	87.2	27.7
Malawi, 2004	1528	86.5	12.8
Rwanda, 2005	1696	61.1	3.1
Senegal, 2005	1903	90.4	0.9
Zimbabwe, 2005-6	2067	88.8	20.8

Range of median months since last birth = 21-25 (median recall periods 9 months longer for prenatal variables)

Prenatal punctures and prevalent HIV infection



Prenatal punctures and prevalent HIV infection



AOR prenatal punctures x HIV, adjusted for country = 1.42 (95% CI 1.19-1.69)

Further adjustments for:

- **age (years)**
- **urban vs. rural residence (dichotomy)**
- **wealth (quintiles within country, treated as interval scale)**
- **number of sex partners in last 12 months**
- **STD diagnosis or symptoms in last 12 months (dichotomy)**

Multiple logistic regression: prevalent HIV infection

	AOR	95% CI
Age	1.02	1.01-1.02
Urban residence	1.37	1.15-1.62
Wealth	1.13	1.07-1.19
# sex partners	0.86	0.74-1.00
STD dx/sx	2.06	1.74-2.45
Prenatal punctures	1.29	1.08-1.54

Country $p < .0001$ $n = 20333$

Test of homogeneity of association across countries:

- **adding prenatal punctures x country interaction to the same model does not improve model fit significantly (*p* > .05)**

Prenatal punctures AOR = 1.28 (1.07-1.54) for 10 countries excluding Burkina Faso (no questions asked about prior HIV testing in Burkina Faso)

Same model, except combined prenatal punctures variable replaced with:

- **phlebotomy [alone] AOR 1.23 (1.08-1.40)**
- **tetanus vacc. [alone] AOR 1.19 (1.02-1.38) (separate models)**

Phlebotomy and tetanus vaccination in same model together:

- **phlebotomy AOR = 1.22 (1.06-1.40)**
- **tetanus vacc. AOR = 1.17 (0.99-1.37)**

phlebotomy x tetanus vacc. *r:* median = .32, range = .09-.61 across countries

Discussion

Modest association between prenatal phlebotomy and tetanus vaccination with prevalent HIV infection in sub-Saharan African women

- **reverse causation very unlikely**

Variability in results across countries within sampling variation

Limitations

- **cross-sectional (time ordering of associations not known)**
- **very incomplete assessment of blood and sexual exposures to HIV**
- **underestimation of association for punctures because women who hadn't given birth in last 5 years were excluded**

  Prenatal punctures during last pregnancy may also represent such exposures for prior pregnancies

Potential mechanisms for transmission

- contaminated syringe/needle/lancet
- contaminated gloves/provider fingers
- contaminated multi-dose vials
- these pertain to phlebotomy, vaccination, and injection/transfusion treatment of conditions discovered through blood screening (e.g., syphilis, malaria, etc.)

Universal precautions must be ensured for current prenatal care and initiatives to expand prenatal syphilis/anemia screening and tetanus vaccination (Gisselquist et al.)

Priority to determine transmission modes:

- **comprehensive assessment of sexual and nonsexual exposures**
- **tracing of corresponding contacts of infected and uninfected persons**
- **DNA sequencing of infected persons' HIV isolates**