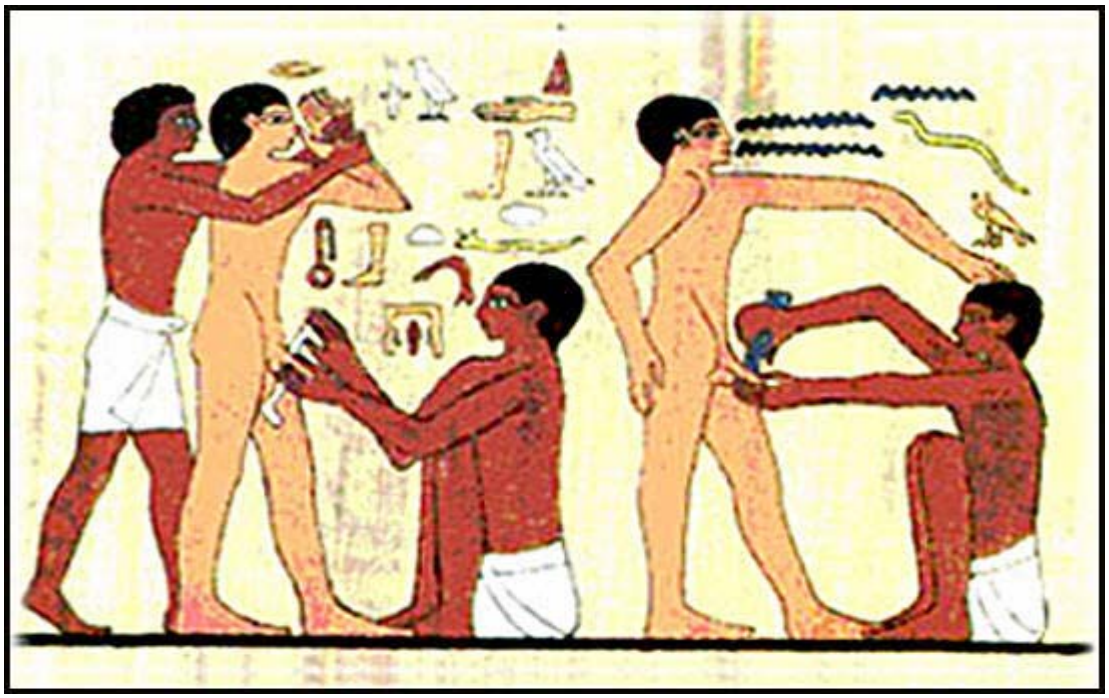
Male Circumcision in the U.S.: Determinants and Policy Implications

Arleen Leibowitz
Kate Desmond
Tom Belin



Objectives

- Examine relevance to U.S. of recent RCTs findings in Africa showing Male Circumcision (MC) is effective in reducing HIV infection
- Examine policy, demographic and hospital determinants of infant MC in U.S. using hospital data
- Calculate cost-effectiveness of increasing MC as a means of reducing future health disparities for infants in low income families.

Clinical Trials Confirm Reduced HIV Transmission From F to M

- Rakai, Uganda
  - N=4996
  - RR = 0.45 (CI=0.25 - 0.78)
  - Gray et al., *Lancet* 2007
- Kisumu, Kenya
  - N=2784
  - RR = 0.40 (CI=0.23 - 0.68)
  - Bailey, et al., *Lancet* 2007
- Orange Farm, South Africa
  - N=3128
  - RR 0.24 (CI=0.14 - 0.44)
  - Auvert et al., PLoS Med 2005

MC Negatively Related to HIV Infection in the U.S.

- Cross-sectional study of MSM in U.S.
  - HIV twice as prevalent among uncircumcised MSM
  - Kreiss & Hopkins (*J. Infect. Dis*, 1993)
- Prospective study of MSM
  - HIV seroconversion twice as likely among uncircumcised men
  - Buchbinder, et al. (*JAIDS*, 2005)

Benefits of MC for Women

- Lower risk of cervical cancer in female partners
  - Pooled data from 7 case-controlled studies
    OR= 0.42 (CI=0.23-0.79)
  - Castellsague et al., *NEJM* 2002
- Observational data from Rakai
  - Circumcised HIV+ men less likely to infect female partner
  - RR=0.41 (CI= 0.1-1.1)
- RCT in Rakai
  - Higher rates of HIV in women partners of HIV+ circumcised men who resumed sex before full healing
  - Trial stopped early
- Lower prevalence of HIV in population

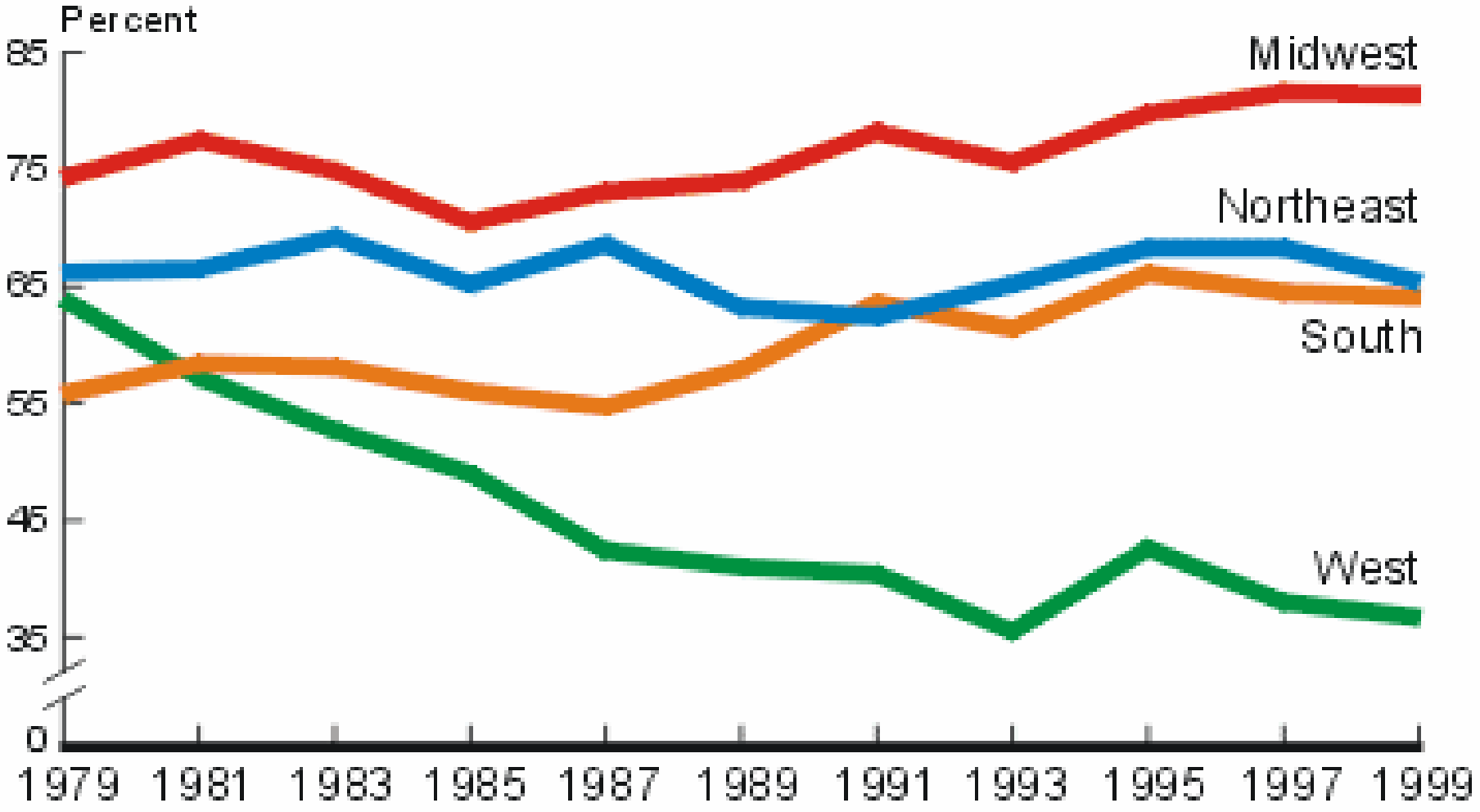
AAP Position on MC

- In 1999 AAP issued a neutral statement that medical benefits “not compelling enough to recommend routine neonatal circumcision”
- AAP currently reviewing its neutral stance
- CDC reevaluating its position on MC

Percent of U.S. Males Circumcised

	Total	White	A-A	Hispanic
Adults 1992	77%	81%	65%	54%
Infants 1999	65.3%	65.5%	64.4%	n.a.
Infants 2004	53.5	68.6	64.6	17.5

Figure 2. Percent of newborn males with circumcisions performed in short-stay hospitals by region



SOURCE: CDC/NCHS, National Hospital Discharge Survey, 1979–99.

Factors Affecting Newborn MC Rates

- Individual characteristics
  - More births to Hispanics, lower MC rates
  - Income and insurance
  - Preferences for “natural” methods (BF)
- Hospital characteristics
  - Short maternity stays
  - Increase in managed care
- State policy factors
  - Medicaid pays for almost 40% of all births, nationally
  - But Medicaid does not cover MC in 16 states
  - 10 states dropped coverage since 1999 AAP recommendations

Data

- 2004 National Inpatient Survey (NIS)
  - Stratified random sample in 37 states
  - 8 million hospital discharge records
- Selected all newborn males
  - With routine discharge
  - Discharged alive
  - N=417,282
- Hospital is unit of analysis (N=683)

Variables (1)

- Outcome: % of male newborns with MC
  - Individual has MC if any of 15 ICD-9 procedure codes indicate MC
  - Hospital %= #circumcised / #male newborns
  - Logit transformation used in estimation:
    y=log(p/(1-p)),
    where p = hospital circumcision rate

Variables (2)

- Individual characteristics

Length of stay

- Percent with LOS of 1 day only
- Percent with LOS of 6+ days
- Omitted=percent with LOS of 2-5 days

Income

- Percent living in a ZIP code with median income $36,000-44,999
- Percent living in ZIP code with median income $45,000-58,999
- Percent living in a ZIP code with median income $59,000 or more
- Omitted=percent living in a ZIP code with median income < $36,000

Variables (3)

- Individual characteristics (continued)

Race/ethnicity

Percent African American
Percent Hispanic
Percent other race/ethnicity
Omitted=percent non-Hispanic white

Insurance (primary payer)

Percent with Medicaid as primary payer
Percent uninsured
Omitted=percent with other insurance

Variables (4)

- Hospital characteristics
  - Size (small, medium, omitted=large; based on # beds)
  - Rural location (omitted=urban)
  - Teaching hospital (omitted=non-teaching)
  - Region (NE, MW, W; omitted=S)
- State policies
  - Medicaid covers routine MC for newborn males
  - 16 states do not cover MC

Statistical Methods

- Missing data
  - Complete data for LOS, and state and hospital factors
  - Insurance and income—used non-missing data to get hospital means
    - Primary payer known for at least 75% of patients in all hospitals
    - Income known for at least 67% of patients in all hospitals but one, and for at least 80% of patients in all hospitals but 8
  - Race/ethnicity: 214 hospitals with incomplete data
    - Race/ethnicity not reported in 10 states (178 hospitals)
    - Race/ethnicity reported for <50% of patients in 36 hospitals

- Two-step multiple imputation (using SAS PROC MI):

Step 1: For 140 hospitals with known county, impute racial/ethnic percents using county-level percents of males aged 0-4 in each racial/ethnic group as predictors, in addition to variables described.

Step 2: Include all hospitals, and impute using state-level percents of males age 0 in each racial/ethnic group as predictors.

- OLS estimation of logit-transformed MC rate

Each hospital weighted by normalized number of newborn males. Interactions and squared terms were included in the model.

Do separately by imputation, use SAS PROC MIANALYZE to combine.

Back-transform to obtain predicted values = (exp(XB)/(1+exp(XB)), where XB's are calculated from OLS estimates.

Observed MC Rates by Payer

	% Circumcised
Proportion with Medicaid as primary payer	
Low	65%
Medium	60
High	37
Proportion with other insurance	
Low	36%
Medium	60
High	65
Proportion uninsured	
Low	57%
Medium	61
High	47
Medicaid covers (72% of hospitals)	70%
Medicaid doesn't cover (28% of hospitals)	31%

Predicted MC Rates by Hospital Characteristics - 2004

Region	NE	51.0%
(P<0.001)	Midwest	62.9%
	South	58.7%
	West	43.9%
Location	Rural	56.7%
(NS)	Urban	54.6%
Teaching Status	Teaching	54.8%
(NS)	Non-teaching	54.8%
Hospital size	Small	55.6%
(NS)	Medium	54.8%
	Large	54.6%

Predicted MC Rates – Patient Characteristics

	25%ile	75%ile	P-value
African-American	63.1%	64.7%	N.S.
Hispanic	62.3%	52.3%	P<.001
% High Income	53.6%	53.3%	N.S.

Predicted MC Rates – Delivery Characteristics

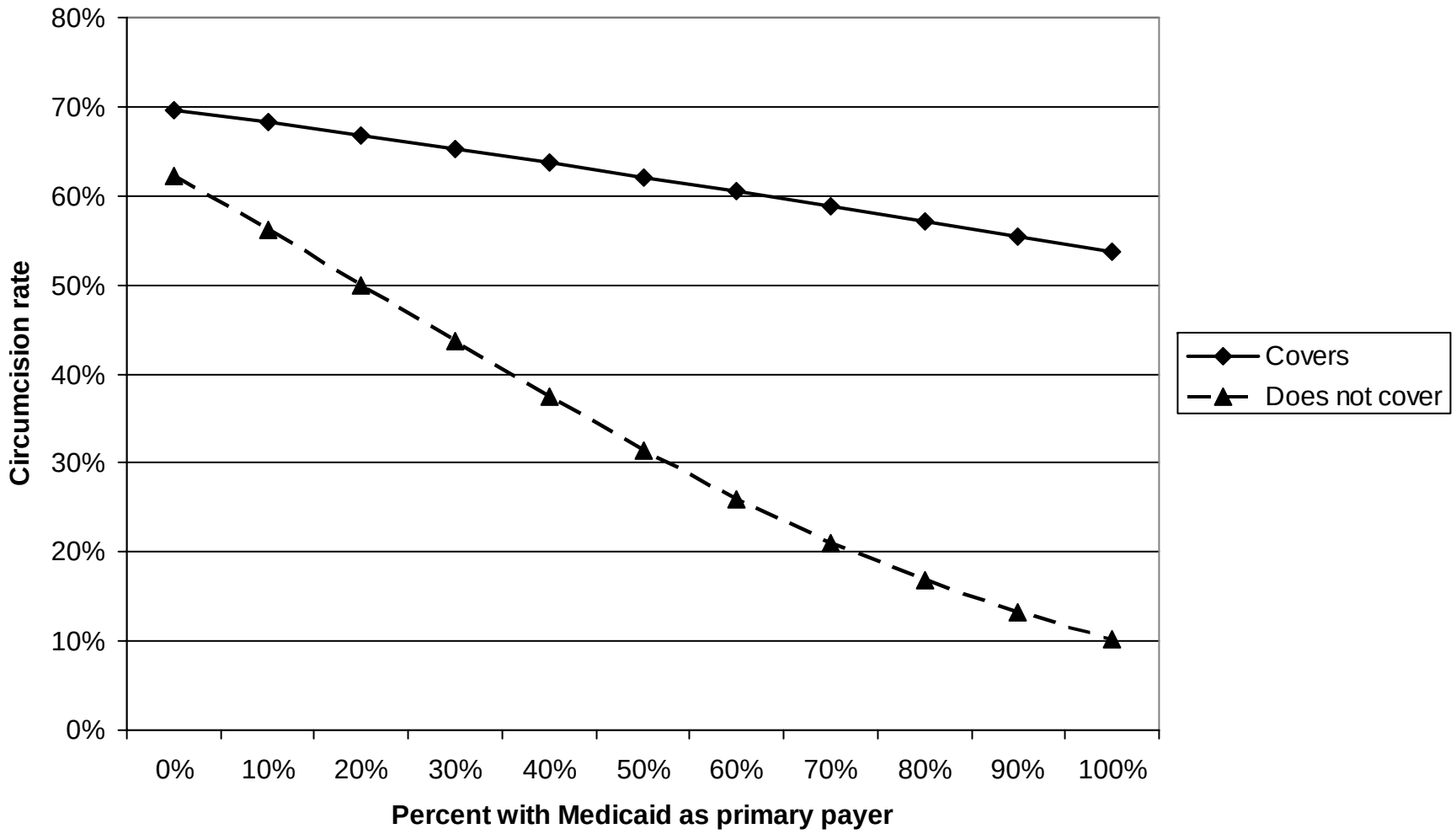
	25%ile	75%ile	P-value
One day stay	62.1%	57.6%	P<.001
LOS 6+ days	61.7%	57.4%	P<.001
Medicaid Insurance	58.8%	49.5%	P<.001
Uninsured	66.8%	65.6%	P=.006

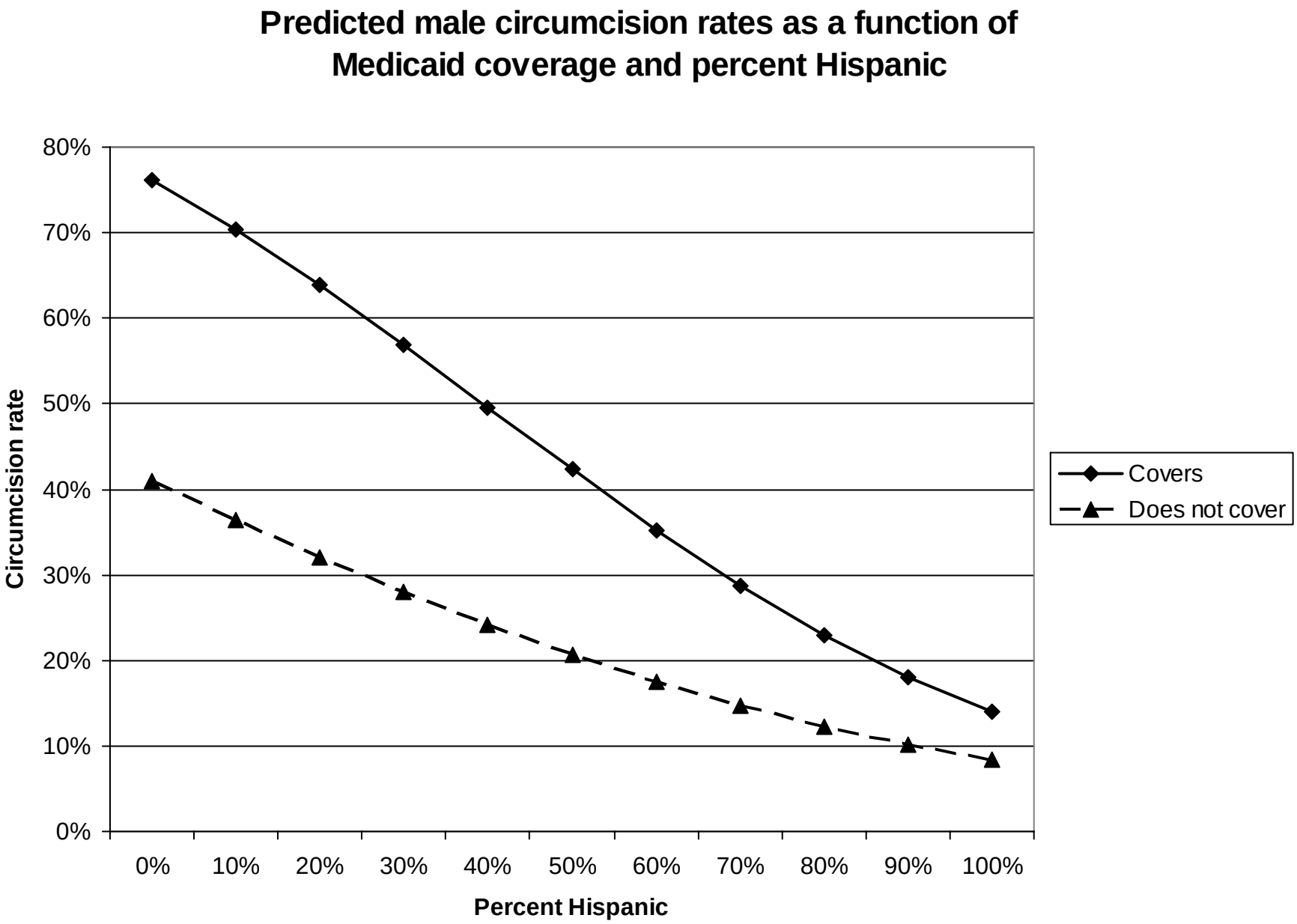
Predicted MC Rates – Policy Factors

	MC Rate
Medicaid does not cover MC	38.6%
Medicaid covers MC	62.7%

Medicaid coverage of MC interacts with Percent Medicaid

Medicaid coverage of MC interacts with Percent Hispanic


Predicted male circumcision rates as a function of Medicaid coverage and percent in hospital with Medicaid as primary payer
80%
70%
60%
50%
40%
30%
20%
10%
0%
Circumcision rate
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent with Medicaid as primary payer
Covers
Does not cover


Predicted male circumcision rates as a function of Medicaid coverage and percent Hispanic
Circumcision rate
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Hispanic
Covers
Does not cover

Policy Implications

- Lack of Medicaid coverage
  - Reduces MC primarily among low income infants, since Medicaid serves the poor
  - Can lead to future health disparities, given the positive effect of MC on health
- Deprives most disadvantaged of health benefits of MC

MC Appears Cost-Effective in Africa

- Cost per HIV infection averted
  - $181-$551/infection averted in South Africa
  - Lower cost at higher prevalence rates
  - CEA also depends on cost of MC and on HIV treatment costs
  - But does not vary much with % of population covered
  - (Kahn, et al., 2006)

Cost-Effectiveness Assumptions

- Transmission risk (r) is reflected in 2005 incidence rates by route of transmission

	Pop	Cases	Rate/population/yr
MSM age 14-64	6.878 mil	16,561	.0024
Heterosexual men	91.381 mil	3,110	.000034

- MC halves risk of transmission
- Probability of remaining uninfected is
  - (1-r)**t, where t=age (13-64); if uncircumcised
  - (1-r/2)**t, where t=age (13-64); if circumcised
- MC costs $250
- Number of infections averted discounted at 1%, 3%, 5%/year

Cost-Effectiveness of MC in Averting Lifetime HIV Infection

Discount rate	Gay	Straight	Weighted Average
1%	$ 5,727	$ 404,530	$ 376,614
3%	$11,211	$ 791,139	$ 736,544
5%	$20,227	$1,428,571	$1,329,987
MC cost=$250			

How Relevant Are RCT Findings to U.S.?

- RCT findings only for F to M transmission
  - But US HIV epidemic centered on MSM
  - Observational studies in US suggest effect on M to M transmission (RR=.5)
- Results for M to F transmission inconsistent
    - Observational studies in Africa show RR of .41
    - But RCT showed increased risk of MC on adults

Is MC Cost-Effective For HIV-Prevention?

- May be, if include other benefits
  - Other STI in men
  - Lower transmission to sexual partners, either male or female
  - Other health benefits to women (e.g., HPV)
- Depends on discount rate and procedure cost
- Should the AAP change its position on MC?

Cost Per Infection Averted

	$250	$300
White	$206,313	$247,575
African-Am.	$ 26,025	$ 31,230
Hispanic	$ 68,078	$81,693
Medicaid Pop.	$161,136	$200,195