Correction Appendix for "Sexually Transmitted Infections, Sexual Behavior and the HIV/AIDS Epidemic", Quarterly Journal of Economics May 2005

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Subsequent to the publication of this paper I have become aware of two errors in Table I, which calculates the transmission rates for the United States and Africa. The numbers for the United States are correct, but those for Africa are not. First, in the Quinn et al (2000) paper the transmission rates should be 21.9% from women to men and 21.3% from men to women; the original paper used 17.5% and 26.7% respectively. Second, the Grosskurth et al (1995) paper uses transmission rates from the wrong population; the transmission rates used in the original paper are 29.3% and 14.5% (M-to-F, and F-to-M, respectively); the correct transmission rates are 23.1% and 12.7%. In addition, while addressing these errors, it has come to my attention that the Gray et al (2001) paper and the Quinn et al (2000) paper use the same data. More specifically, the Gray et al (2001) paper uses a sub-sample of the data in the Quinn et al (2000) paper. This was not explicit in the original papers, but correspondence with an author on both papers has confirmed it. Given this, it is not appropriate to use both papers and I should have originally used on the Quinn et al (2000) paper, which covers the larger sample. This appendix presents corrected tables and figures adjusting for these three sources of error. Throughout (in footnotes) I will also give results adjusting only for the transmission rate error, and not for the study overlap.

The first change is, obviously, in Table I. The new version of Table I shows the studies used to calculate transmission rates in Sub-Saharan Africa, with the corrections for errors made in the previous version. The new estimated transmission rates (based on weighted averages) are: 24.5% M-to-F and 12.4% F-to-M.[1] This change will also affect Figures II, V, VI and VII and Table V.

The revised version of Figure II is shown below. The estimated prevalence rate in Africa is 12.2%, relative to 12.7% in the earlier version of the paper. This is lower, but the change is relatively

[1] If we do not leave out the Gray et al (2001) study, these numbers are 23.7% and 13.5%.

small. In the original paper, this prevalence is compared to an actual prevalence in Africa of 11.9%, so the new data still lines up well with that. The change does not affect the primary conclusion from this figure: that the United States and Africa would have had similar HIV prevalence in the late 1990s had the transmission rates been the same, but would *not* have had similar prevalence with the same sexual behavior.[2]

The revised versions of Figure V and VI are also shown. In Figure V, the estimated prevalence is extremely similar to what we see in the original figure, although it goes down slightly. In Figure VI, the estimated prevalence rates increase slightly, but again are quite close in magnitude to the original. The fact that the numbers in Figure V decrease a bit and in Figure VI increase a bit reflects the fact that the transmission rate for women, which goes down, is relatively more important in driving infection rates among pregnant women (Figure V) and the transmission rate for men, which goes up, is relatively more important in driving infection rates among the overall population (Figure VI).[3]

Finally, these transmission rates also affect Figure VII and Table V, which detail the effects of interventions on prevalence. The corrected version of Figure VII looks very similar to the original; again, we see that a 20% decrease in sexual behavior has a smaller effect on the path of the epidemic than a 20% decrease in transmission rates. In Table V, the changes relative to the original are also small. In the original paper, I argued that treatment of other STIs could save lives at a cost of $3.67 per life year; with the adjustment, this number if $4.03. I concluded that educational interventions would cost $16.82 per life year; the new figure is $17.84.[4] In addition to being small in magnitude, these changes do not alter in any way the ultimate conclusion that lowering transmission rates is more cost effective than behavior change.

In general, the central conclusions of the paper (that transmission rates drive differences in infection between the US and Africa, that sexual behavior and epidemic start date drive differences within Africa, and that lowering transmission rates is a cost effective way to combat HIV) are unaffected by these changes.

[2] If I do not leave out the Gray et al (2001) study, the estimated prevalence for Africa is actually 13.6%, and the patterns comparing the US to Africa are the same. The prevalence here is slightly higher, driven by the higher transmission rate among men.

[3] Again, these figures are quite similar if we do not leave out Gray et al (2001). Relative to those shown here, the estimated prevalence rates in those figures are slightly higher. These figures are available from the author if desired.

[4] If I do not leave out Gray et al (2001), the new figures are $3.82 and $16.76.

References

Gray, Ronald, Maria Wawer, Ron Brookmeyer, Nelson Sewankambo, David Serwadda, Fred Wabwire-Mangen, Tom Lutalo, Xianbin Li, Thomas vanCott, Thomas Quinn, and the Rakai Project Team, "Probability of HIV-1 Transmission Per Coital Act in Monogamous, Heterosexual, HIV-1 Discordant Couples in Rakai, Uganda," *The Lancet*, 2001, *357*, 1149–1153.

Grosskurth, Heiner, Frank Mosha, James Todd, Ezra Mwijarubi, Arnoud Klokke, Kesheni Senkoro, Philippe Mayaud, John Changalucha, Angus Nicoll, Gina ka Gina, James Newell, Kokugonza Mugeye, David Mabye, and Richard Hayes, "Impact of Improved Treatment of Sexually Transmitted Diseases of HIV Infection in Rural Tanzania: Randomized Controlled Trial," *The Lancet*, 1995, *346*, 530–536.

Quinn, Thomas, Maria Wawer, Nelson Sewankambo, David Serwadda, Chuanjun Li, Fred Wabwire-Mangen, Mary Meehan, Thomas Lutalo, and Ronald Gray, "Viral load and heterosexual transmission of human immunodeficiency virus type 1," *New England Journal of Medicine*, 2000, *342* (13), 921–929.

TABLE I
HIV Transmission Rates

Panel 1: Developed World

Citation	# of Subjects	M-to-F	F-to-M	Subpopulation	Location
Di Vincenzi et al. [1994]	121	10.8%	8.5%	Transfusion Recipients	Europe
Ragni et al.[1989]	45	13.3%	N/A	Hemophiliacs	United States
van der Ende et al.[1988]	13	0.0%	N/A	Hemophiliacs	Europe
Rockstroh et al.[1995]	198	10.1%	NA	Hemophiliacs	United States
Saracco et al. [1993]	113	11.5%	N/A	Hemophiliacs	Europe
Peterman et al. [1988]	80	18.2%	8.0%	Mixed	United States
Padian et al. [1991]	186	13.2%	1.4%	Transfusion Recipients	United States
Laurian et al. [1989]	31	9.7%	N/A	Hemophiliacs	Europe
Allain [1986]	148	6.8%	N/A	Hemophiliacs	Europe

Panel 2: Sub-Saharan Africa

Citation	# of Subjects	M-to-F	F-to-M	Subpopulation	Location
CAPS Data[1]	750	27.50%	7.10%	General Population	Kenya and Tanzania
Grosskurth et al [1995]	523	23.10%	12.70%	General Population	Tanzania
Quinn et al [2000]	415	21.30%	21.90%	General Population	Uganda

Notes: For the United States, transmission rates in each study are as reported for heterosexual, monogamous couples. "Mixed" may include intravenous drug users. For Sub-Saharan Africa, transmission rates are calculated from reported data on HIV incidence, sexual behavior of the population, condom usage and HIV prevalence in the study area. Details of this calculation are in Section IV.A. All transmission rates are per unprotected sexual partnership with an infected individual of the opposite sex.

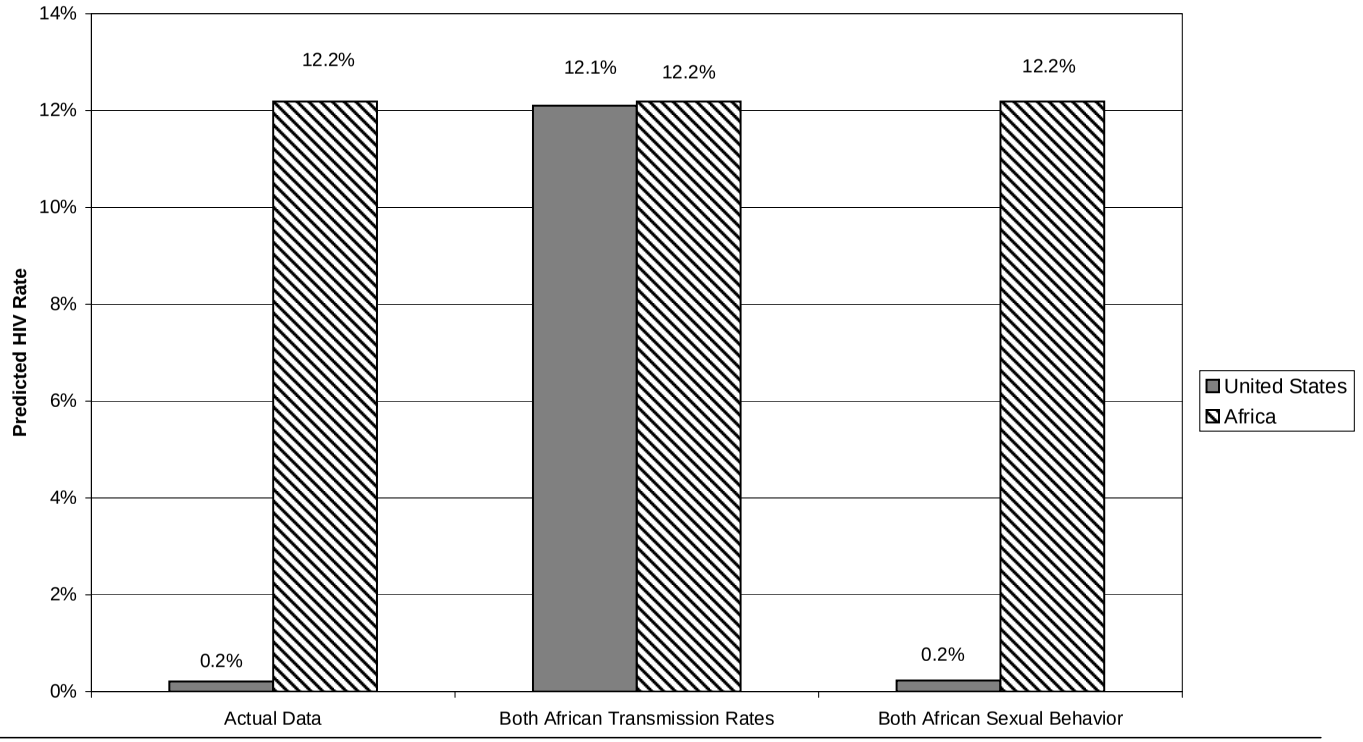
[1] The CAPS study is an individual-level survey run in Nairobi, Kenya and Dar-es-Salaam, Tanzania. Individuals were tested for HIV at the beginning of the study and then remained in the study population for a year. Follow-up surveys did additional HIV testing and asked individuals about their sexual behavior over the study period.

TABLE V
Cost-Effectiveness of Interventions

	Change Transmission Rates Through STI Treatment[a]	Change Behavior Through Education[b]
Cost	$1,068,326,724	$2,800,263,630
Life Years	265,101,346	156,976,833
DALYs	284,377,150	166,360,173
Infections Averted	12,901,555	6,260,146
Cost per LY	$4.03	$17.84
Cost per DALY	$3.76	$16.83
Cost per Infection	$82.81	$447.32

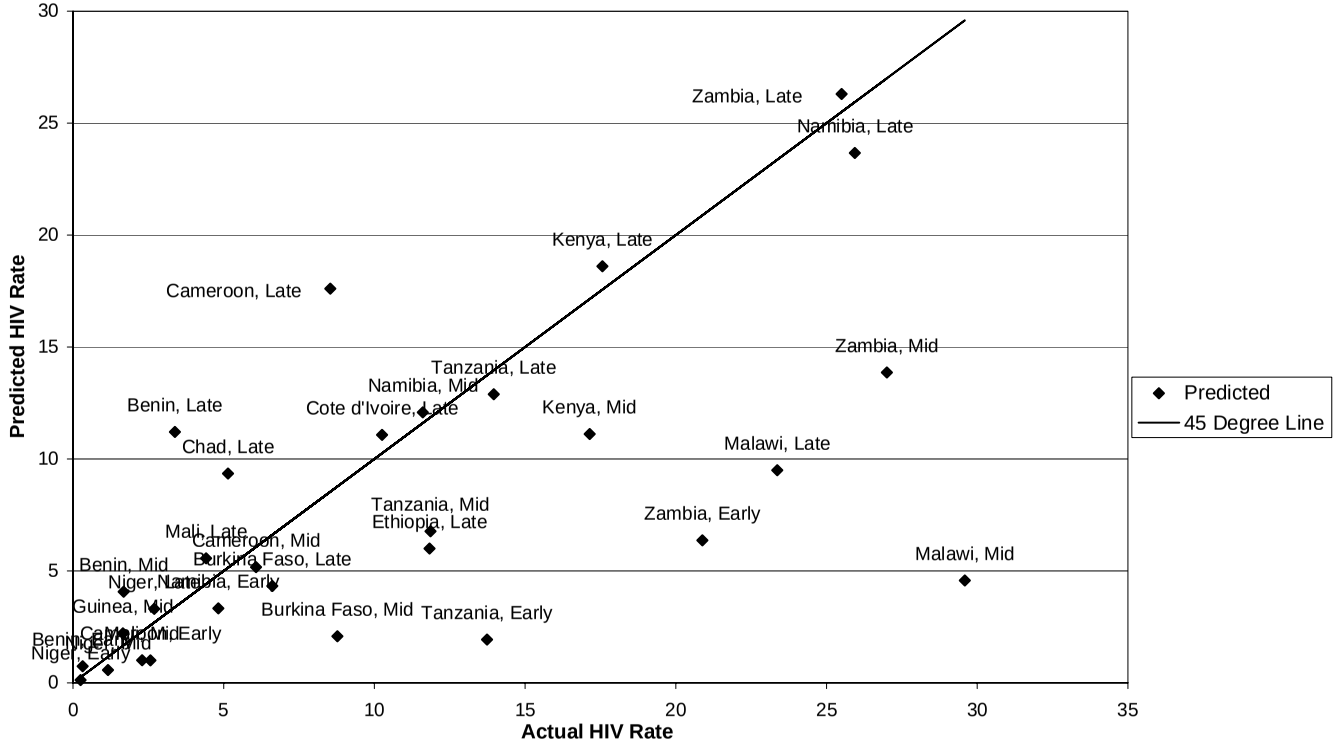
Notes: All costs include both delivery costs and drug costs
[a] treatment of bacterial STIs, including syphilis, gonorrhea, chancroid and others.
[b] intervention to decrease number of sexual partners; assuming intervention works on the population gradually

Figure II, Corrected
Predicted HIV Rates for the United States and Sub-Saharan Africa



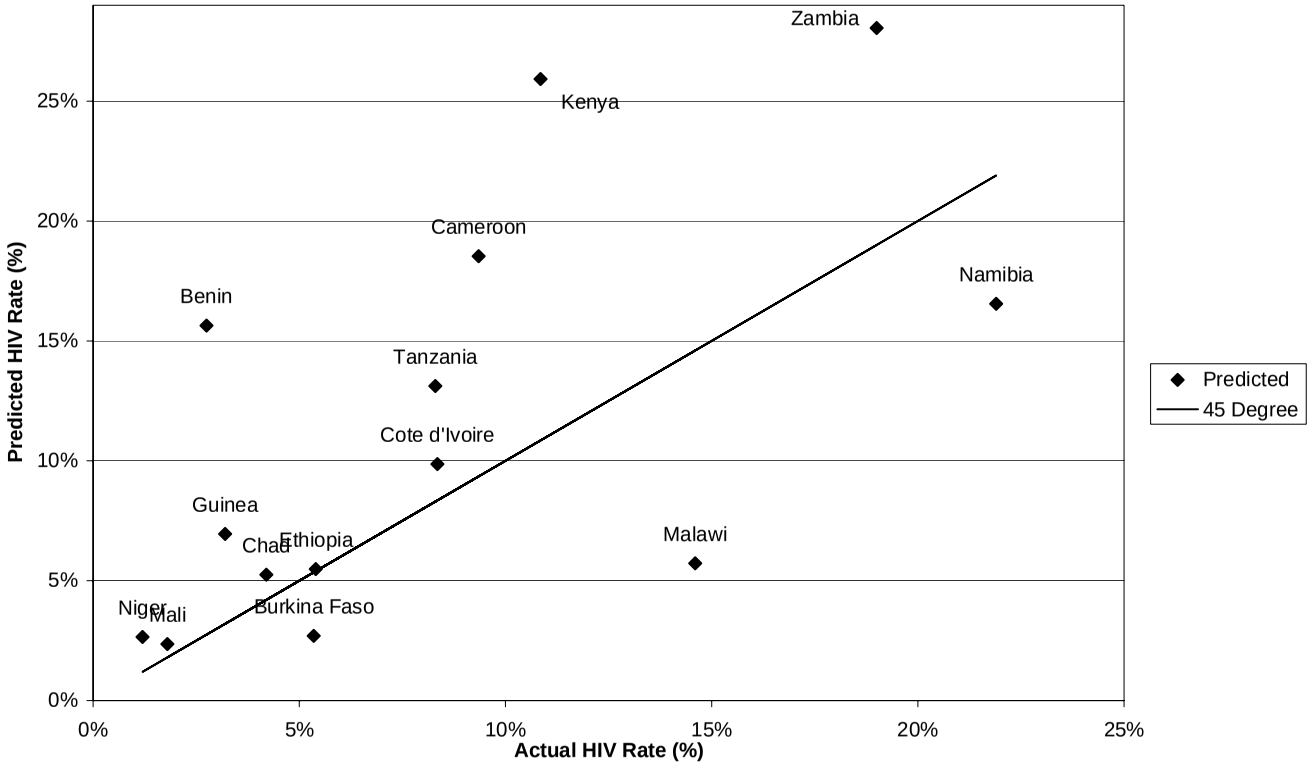
Notes: Figure reports HIV rates predicted by the simulation model for the United States and Sub-Saharan Africa. HIV rate is an average for 1998-2000. First columns: predicted rates using own sexual behavior and transmission rates; second columns: predicted rates using own sexual behavior, and Sub-Ssaharan Africa transmission rates; third columns: predicted rates using own transmission rates, Sub-Saharan Africa sexual behavior.

Figure V, Corrected
Actual and Predicted HIV Rates for Urban Pregnant Women



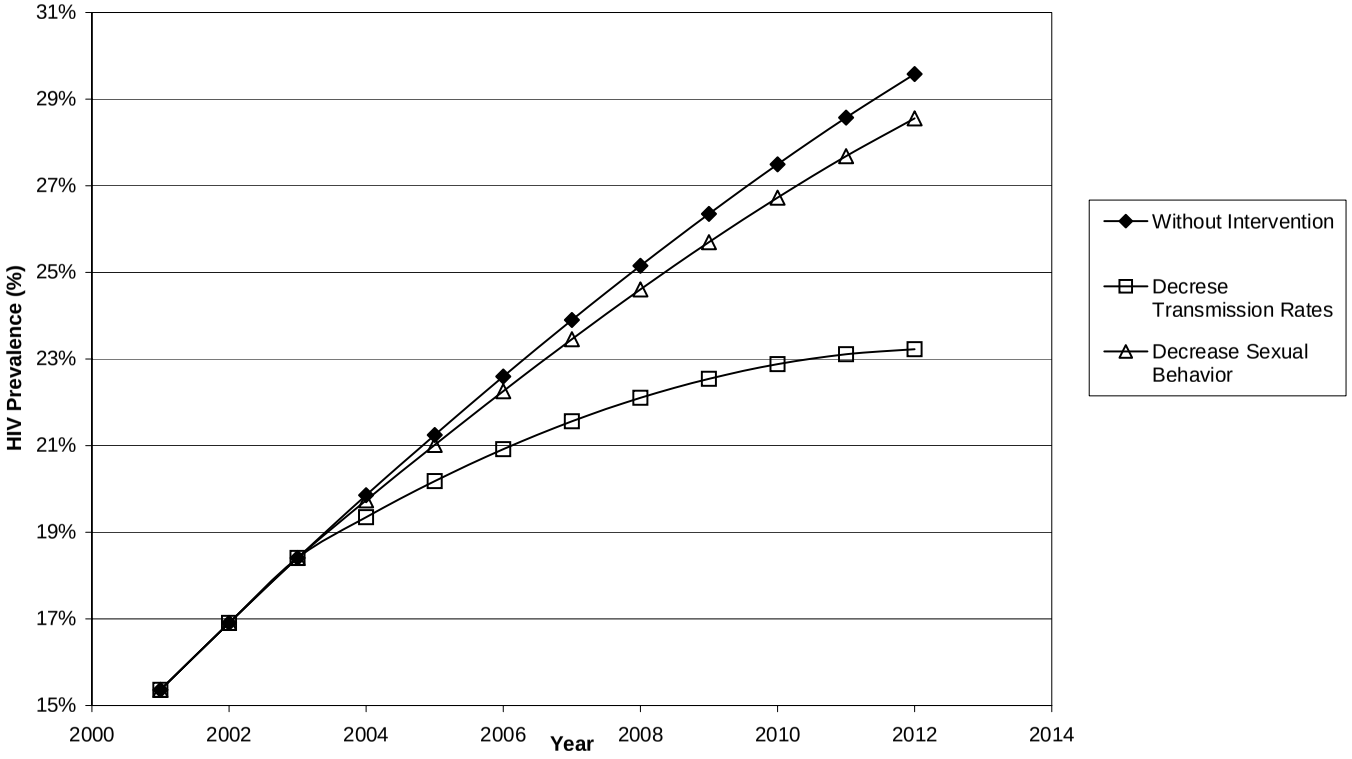
Notes: Actual HIV prevalence calculated from the U.S. Census Surveillance Database as an average for urban-dwelling pregnant women in the country between 1998 and 2000 (late), 1994-1996 (mid) and 1990-1992 (early). Predicted values are produced by the simulation model, and are an weighted average of the predicted rates for urban pregnant women from 1998-2000 (late), 1994-1996 (mid) and 1990-1992 (early), where the weighting is determined by the number of studies from each year that determine the actual HIV rate.

Figure VI, Corrected
Actual and Predicted HIV Rates for All Individuals



Notes: Actual HIV prevalence is overall adult prevalence as reported by the UNAIDS 2001 and 2004 Factsheets . Predicted values are produced by the simulation model, and are an average for the end of the decade for all adults.

Figure VII, Corrected
Epidemic Path With and Without Interventions



Notes: This figure shows the time path of the HIV epidemic in Africa under the case of no intervention, a 20% decrease in transmission rates and a 20% decrease in all aspects of sexual behavior.