Enhancing the Cost-Effectiveness of HIV Prevention in Kenya

East African Community

HIV Prevention Expert Think Tank Meeting

24-26 February 2009, Nairobi

Elliot Marseille and James G. Kahn

University of California, San Francisco

Purpose :
To address two questions

What does the best available data suggest about the cost-effectiveness of HIV prevention in Kenya?

- High risk groups
- General population

What does the answer suggest about HIV programming if . . . the goal is to prevent the most HIV infections with the available funds?

Methods
Quick and dirty

- Data sources: KAIS; MoT; published data on unit costs and effectiveness; some imputation (e.g., PwP, MSM interventions)

- CE calculations via spreadsheet model

Three factors determine intervention cost-effectiveness

1. Unit cost (eg, $ per person screened/treated in STI program or $ per condom distributed)

2. Effectiveness (risk reduction)

3. Incidence (risk of transmission if no intervention)

Large variation in all 3, but particularly incidence.

- Males in NE province: 0.001

- SWs in Nairobi: 0.052

Thus, ability and willingness to target high-risk groups is major determinant of CE outcomes

Intervention Effectiveness and Unit Costs Used in CE calculations

Intervention	Effectiveness	Cost (per 100 client/yr)
General Population		
Abstinence	10.0%	$1,000
CT	17.3%	$1,000
CSM	45.0%	$650
Schools	10.0%	$1,000
STI screen / treat	0.0%	$2,000
Vol. Adult MC	60.0%	$5,000
Higher-Risk Population		
SW	60.0%	$2,500
Truck drivers	50.0%	$2,000
Other clients	40.0%	$2,000
IDU RR	25.0%	$5,000
PwP	33.0%	$3,061
MSM	40.0%	$2,500
MSM - Female partners	40.0%	$3,000
Prison (male)	40.0%	$2,000
Partners of prisoners	40.0%	$2,500
Fishing community	50.0%	$2,500

Sources: published & unpublished data; review articles; meta-analyses; interpolations and evidence-based 'guesstimates'.

Cost-effectiveness in *high-risk* populations

Province	Population Group	HIV incidence per year (to or from)	Risk reduction — Decrease in risk	Risk reduction — Duration (yrs)	Infections averted per 100 clients	Cost per 100 clients (per year)	Cost-Effectiveness — Cost per HIV infection averted (Unadjusted for savings)	Interventions
Nairobi	**IDUs**	0.285	25%	1	7.1	$5,000	$703	Needle exchange; RR counseling
	IDU partners	0.071	25%	1	1.8	$5,000	$2,824	
	SWs	0.052	60%	1	3.1	$2,500	$794	CSM; CT; STIrx; PwP
	Truck drivers	0.023	50%	1	1.2	$2,000	$1,723	
	"Other" clients	0.013	40%	1	0.5	$2,000	$3,843	
	MSM	0.065	40%	1	2.6	$2,500	$965	
	MSM - Female partners	0.023	40%	1	0.9	$3,000	$3,248	
	Prison (male)	0.132	40%	1	5.3	$2,000	$377	
	Partners of prisoners	0.005	40%	1	0.2	$2,500	$12,450	
Coast	**IDUs**	0.211	25%	1	5.3	$5,000	$949	Needle exchange; RR counseling
	IDU partners	0.075	25%	1	1.9	$5,000	$2,685	
	SWs	0.047	60%	1	2.8	$2,500	$879	Outreach CSM; CT; STIrx; PwP
	Truck drivers	0.023	50%	1	1.1	$2,000	$1,751	
	"Other" clients	0.018	40%	1	0.7	$2,000	$2,704	
	MSM	0.065	40%	1	2.6	$2,500	$965	
	MSM - Female partners	0.023	40%	1	0.9	$3,000	$3,248	
	Prison (male)	0.132	40%	1	5.3	$2,000	$377	
	Partners of prisoners	0.005	40%	1	0.2	$2,500	$12,450	
Nyanza	**SWs**	0.029	60%	1	1.7	$2,500	$1,439	Outreach CSM; CT; STIrx; PwP
	Truck drivers	0.075	50%	1	3.7	$2,000	$534	
	"Other" clients	0.018	40%	1	0.7	$2,000	$2,719	
	MSM	0.089	40%	1	3.6	$2,500	$702	
	MSM - Female partners	0.025	40%	1	1.0	$3,000	$3,022	
	Prison (male)	0.132	40%	1	5.3	$2,000	$377	
'Guesstimate' of Intervention cost and CE for Fishing communities							
Nyanza; Rift; Coast	Fishing communities	0.025	50%	1	1.3	$2,500	$2,000	Outreach CSM; CT; STIrx; PwP; MC

Very CE	$2,000	Dark Green
CE Threshold	$4,000	Light green
Moderately unfavorable CE	$4,000 - $12,000	Orange
Very unfavorable CE	$12,000	Red

Note: Incidence estimates from Modes of Transmission Report - Appendix 3; only these three Provinces available.

Package of interventions for general population

Intervention	Coverage
Abstinence	0.2
CT	0.6
CSM	0.3
Mass media	0.2
School-based (comp.)	0.2
STI Rx	0.2
VAMC	0.2
PwP	0.2

Cost and cost-effectiveness in *general populations - 1*

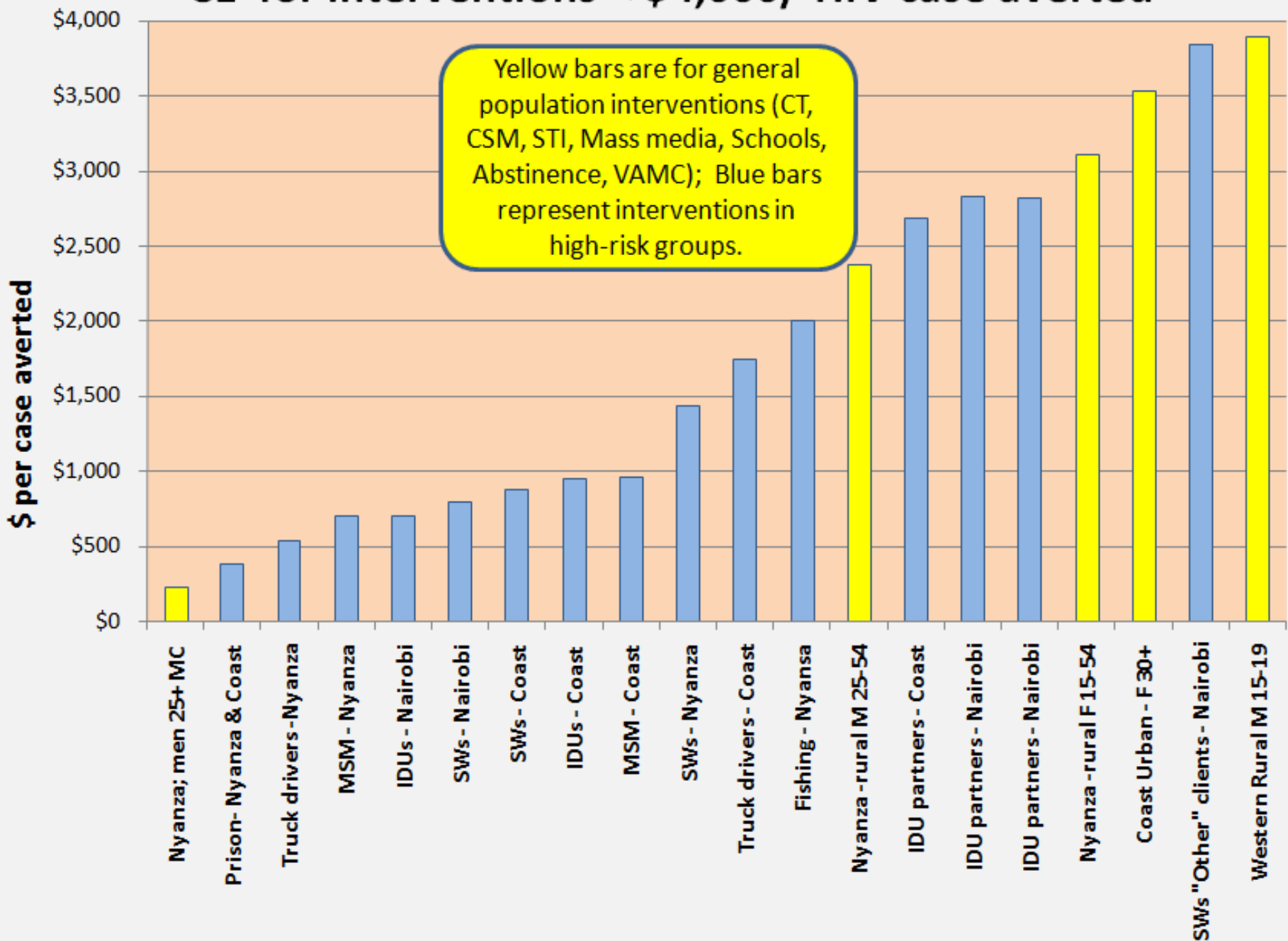| Province	Population Group	Prevalence	HIV incidence per year (to or from)	Risk reduction Decrease in risk	Duration (yrs)	Infections averted per 100 clients	Cost per 100 clients (per year)	Cost per HIV infect. averted *(Unadjusted for savings)*
Nairobi Urban	Male 20-29	0.022	0.005	39.4%	1	0.2	$2,180	$12,264
	Male 30-54	0.139	0.015	39.4%	1	0.6	$2,252	$3,833
	Male 55 - 64	0.018	0.002	39.4%	1	0.1	$2,178	$30,359
	Female 15-19	0.020	0.010	31.2%	1	0.3	$2,113	$6,679
	Female 20-44	0.135	0.014	31.2%	1	0.4	$2,183	$4,856
	Female 45-54	0.164	0.018	31.2%	1	0.6	$2,201	$3,979
Central - Rural	Male 15-34	0.052	0.008	39.4%	1	0.3	$2,199	$7,316
	Male 35-49	0.069	0.007	39.4%	1	0.3	$2,209	$7,812
	Male 50-64	0.012	0.001	39.4%	1	0.0	$2,174	$44,476
	Female 15-24	0.021	0.004	31.2%	1	0.1	$2,113	$16,322
	Female 25-34	0.095	0.010	31.2%	1	0.3	$2,158	$6,959
	Female 35-64	0.030	0.003	31.2%	1	0.1	$2,119	$22,193
Coast - Rural	Male 15-24	0.018	0.004	39.4%	1	0.1	$2,178	$14,904
	Male 25-49	0.071	0.007	39.4%	1	0.3	$2,210	$7,672
	Male 50-64	0.037	0.004	39.4%	1	0.1	$2,190	$14,614
	Female 15-29	0.039	0.004	31.2%	1	0.1	$2,124	$17,260
	Female 30-59	0.075	0.008	31.2%	1	0.2	$2,146	$8,845
Coast - Urban	Male 15-29	0.059	0.009	39.4%	1	0.3	$2,203	$6,431
	Male 30-64	0.096	0.010	39.4%	1	0.4	$2,226	$5,598
	Female 15-29	0.102	0.015	31.2%	1	0.5	$2,162	$4,572
	Female 30-49	0.182	0.020	31.2%	1	0.6	$2,212	$3,561
	Female 50-64	0.185	0.020	31.2%	1	0.6	$2,214	$3,505

Cost and cost-effectiveness in *general populations - 2*

Province	Population Group	Prevalence	HIV incidence per year (to or from)	Intervention characteristics				Cost per HIV infect. averted *(Unadjusted for savings)*
				Risk reduction		Infections averted per 100 clients	Cost per 100 clients (per year)	
				Decrease in risk	Duration (yrs)			
Eastern - Rural	Male 15-29	0.012	0.002	39.4%	1	0.1	$2,174	$33,402
	Male 30-64	0.036	0.004	39.4%	1	0.1	$2,189	$15,197
	Female 15-19	0.031	0.016	31.2%	1	0.5	$2,119	$4,354
	Female 20-54	0.061	0.006	31.2%	1	0.2	$2,137	$10,934
	Female 55-64	0.039	0.004	31.2%	1	0.1	$2,124	$16,973
Nyanza - Rural	Male 15-24	0.018	0.004	39.4%	1	0.1	$2,178	$14,945
	Male 25-54	0.221	0.025	39.4%	1	1.0	$2,302	$2,369
	Male 55-64	0.102	0.011	39.4%	1	0.4	$2,229	$5,277
	Female 15-19	0.079	0.041	31.2%	1	1.3	$2,149	$1,702
	Female 20-54	0.208	0.023	31.2%	1	0.7	$2,227	$3,104
	Female 55-64	0.072	0.007	31.2%	1	0.2	$2,144	$9,290
Rift Valley - Rural	Male 15-24	0.018	0.004	39.4%	1	0.1	$2,178	$14,945
	Male 25-49	0.085	0.009	39.4%	1	0.3	$2,219	$6,345
	Male 50-64	0.029	0.003	39.4%	1	0.1	$2,185	$18,687
	Female 15-24	0.036	0.007	31.2%	1	0.2	$2,122	$9,258
	Female 25-49	0.114	0.012	31.2%	1	0.4	$2,170	$5,772
	Female 50-60	0.062	0.006	31.2%	1	0.2	$2,138	$10,750
Western - Rural	Male 15-19	0.028	0.014	39.4%	1	0.6	$2,184	$3,888
	Male 20-64	0.042	0.004	39.4%	1	0.2	$2,192	$13,036
	Female 15-19	0.016	0.008	31.2%	1	0.3	$2,110	$8,225
	Female 20-49	0.078	0.008	31.2%	1	0.3	$2,148	$8,557
	Female 50-59	0.016	0.002	31.2%	1	0.0	$2,110	$42,823

Source: KAIS, 2008.
Note: Green = CE; Tables confined to Province – sex – age strata for which KAIS data available.

CE for interventions < $4,000/ HIV case averted

Yellow bars are for general population interventions (CT, CSM, STI, Mass media, Schools, Abstinence, VAMC); Blue bars represent interventions in high-risk groups.

$ per case averted

Categories (left to right):
- Nyanza; men 25+ MC
- Prison– Nyanza & Coast
- Truck drivers – Nyanza
- MSM – Nyanza
- IDUs – Nairobi
- SWs – Nairobi
- SWs – Coast
- IDUs – Coast
- MSM – Coast
- SWs – Nyanza
- Truck drivers – Coast
- Fishing – Nyanza
- Nyanza –rural M 25-54
- IDU partners – Coast
- IDU partners – Nairobi
- IDU partners – Nairobi
- Nyanza –rural F 15-54
- Coast Urban – F 30+
- SWs "Other" clients – Nairobi
- Western Rural M 15-19

Summary Results and Recommendations

CE Rank	Cost/case averted	Intervention	Population	Epi setting
Most favorable CE	~$2,500	VAMC	Males	Nyanza, Nairobi
		NE; RR counseling	IDUs	Nyanza; Coast
		CSM; CT; STIrx; PwP	Prison	Nairobi; Coast
			SW and partners	Nyanza, Nairobi
			MSM	Nyanza; Coast
Moderate CE	~ $6,000	Standard package	Females	Nairobi - Urban
			Males	Central - Rural
			Males & Females	Coast-Urban
			Females	Nyanza - Rural
			Females	Rift - Rural
			Males & Females	Western - Rural
Least favorable CE	~$14,000 +	Standard package esp. if emphasizes schools-based programs; IEC; female condoms; STI-Rx	General pop. Esp. Youth and those ~45+	Central Eastern North Eastern

Population and epi settings are confined to KAIS and MoT data. Thus, results and recommendations are partial and indicative, not exhaustive.

Other Likely Cost-Effective Interventions - Settings

- *Interventions for high-risk groups* in other geographic settings including PwP, SW and MSM outreach, IDU-RR.

- *Standard package for general population in other high-prevalence settings,* especially

emphasizing CT, pMTCT, PwP, condoms;

less emphasis on schools, female condoms, STI Rx, mass media.

Projecting the Consequences of Different Intervention Mixes

HIV infections averted by level of targeting for $10,000,000
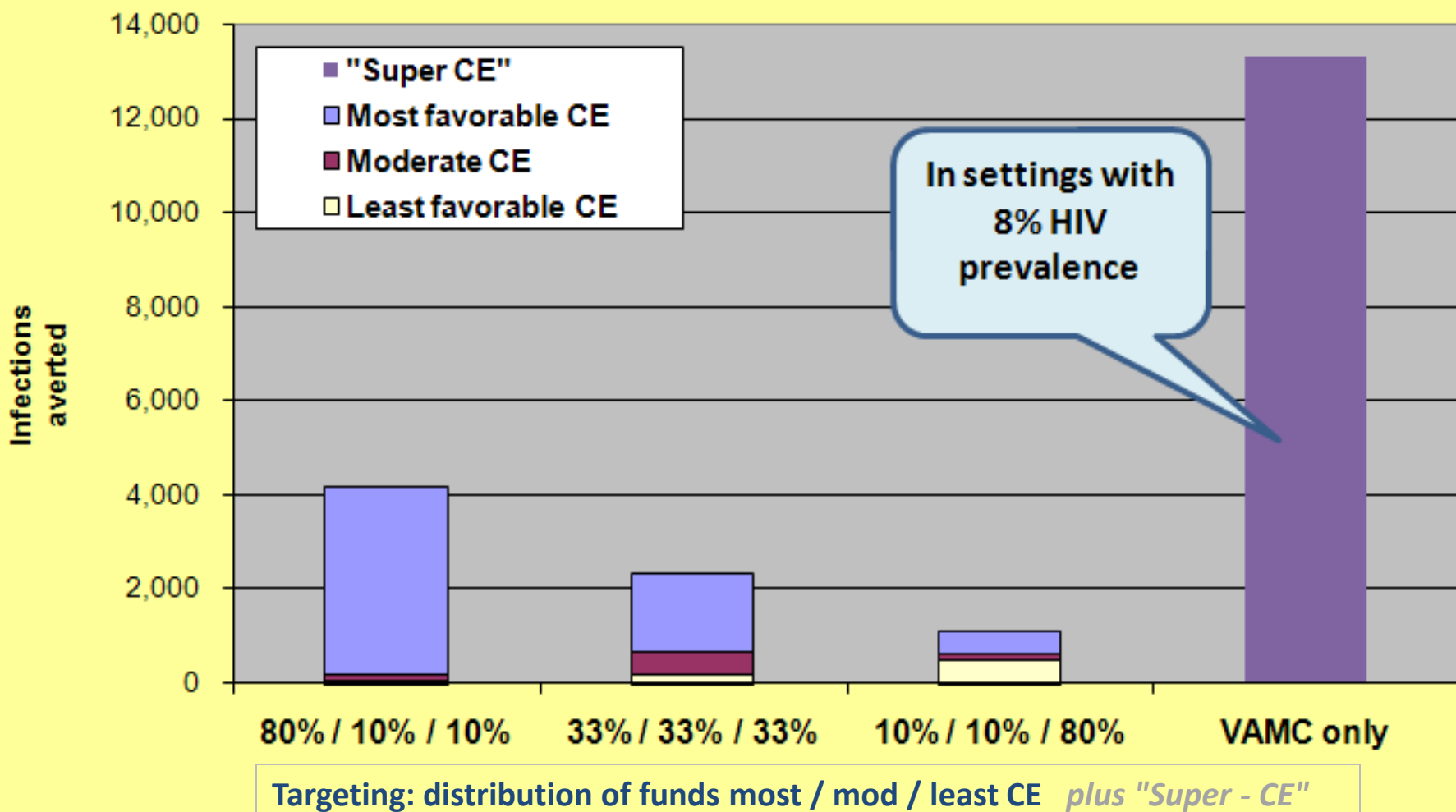
Quantifying the cost of low cost-effectiveness
Consequences of alternative allocations of $10 million spent on prevention

Infections *not* averted

If $10M spent on one of these:	Instead of one of these:		
	"Super CE"	Most favorable CE	Moderate CE
"Super CE"			
Most favorable CE	8,333		
Moderate CE	11,905	3,571	
Least favorable CE	12,619	4,286	714

Extra cost of ART needed

If $10M spent on one of these:	Instead of one of these:		
	"Super CE"	Most favorable CE	Moderate CE
"Super CE"			
Most favorable CE	$53,333,333		
Moderate CE	$76,190,476	$22,857,143	
Least favorable CE	$80,761,905	$27,428,571	$4,571,429

Note: Assumes universal access to ART and lifetime discounted cost of ART in Uganda $6,400; (Marseille, et al, forthcoming)

The effects of scale on cost

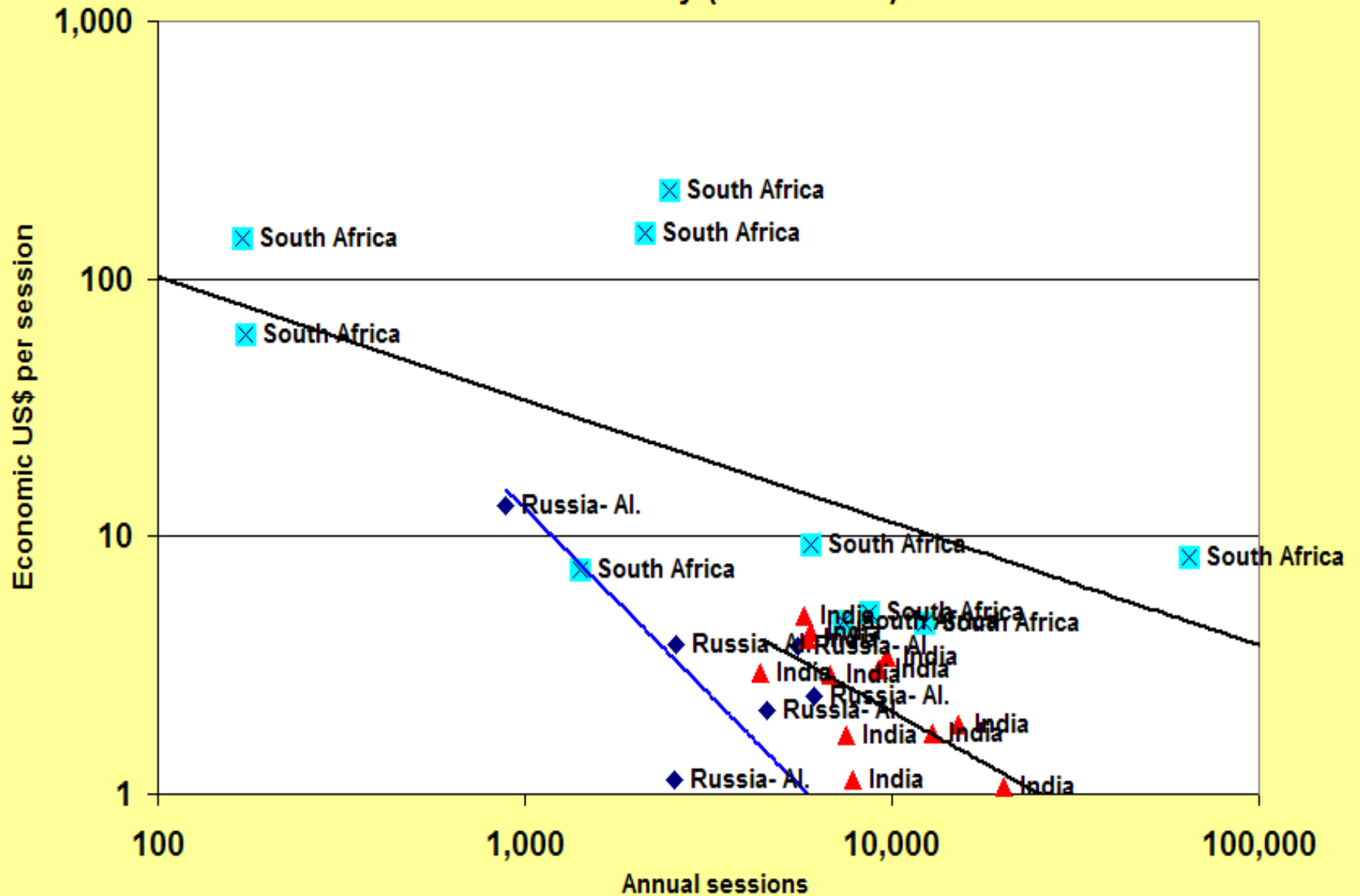Static CE estimates derived from observing projects at one moment

But . . .

As HIV prevention programs go to scale their cost-effectiveness profiles are likely to change *and probably for the better.*

Scale and efficiency of VCT programs in 5 countries
PANCEA Study (UCSF - NIH)
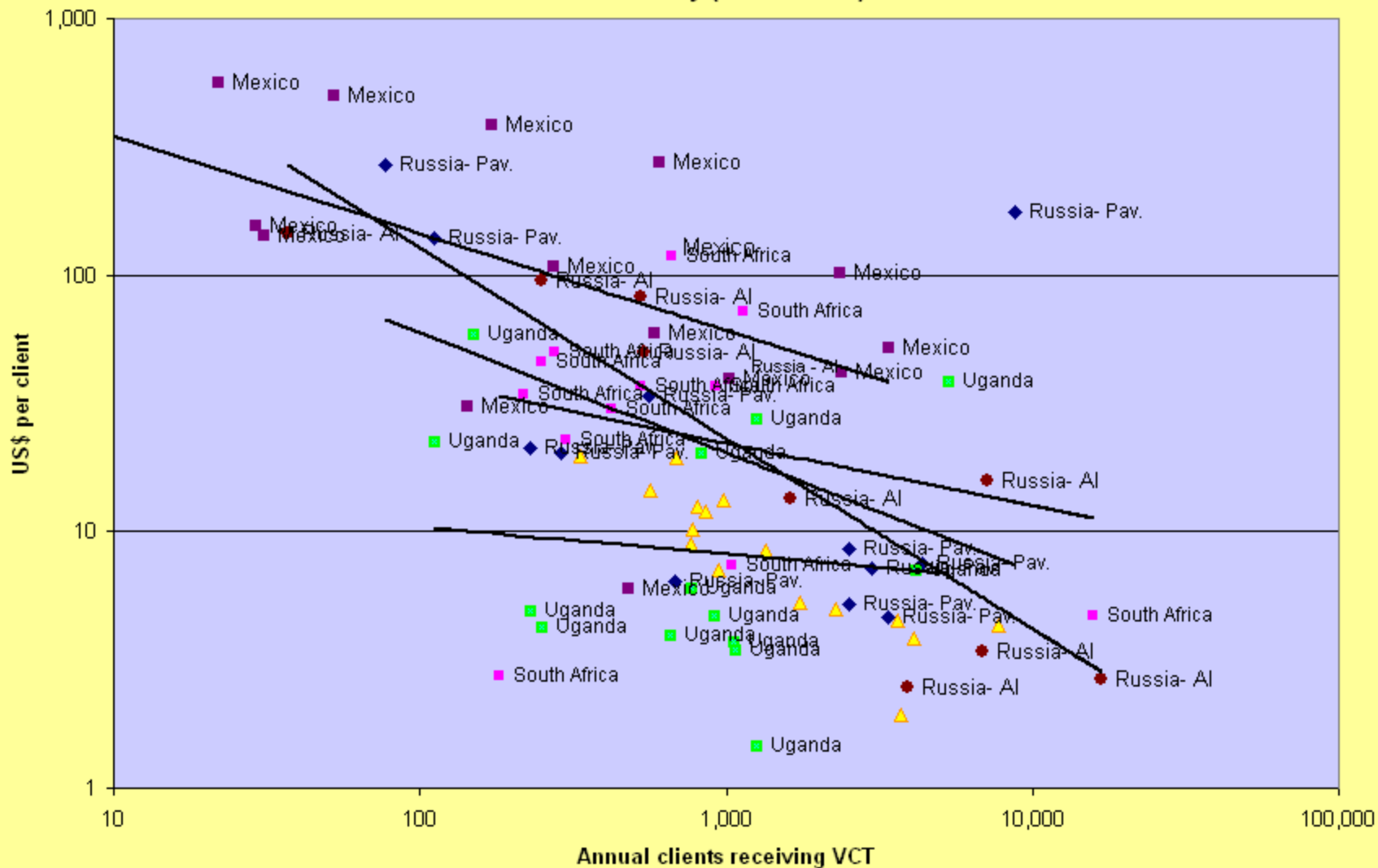
Scale and efficiency of SW programs in 3 countries
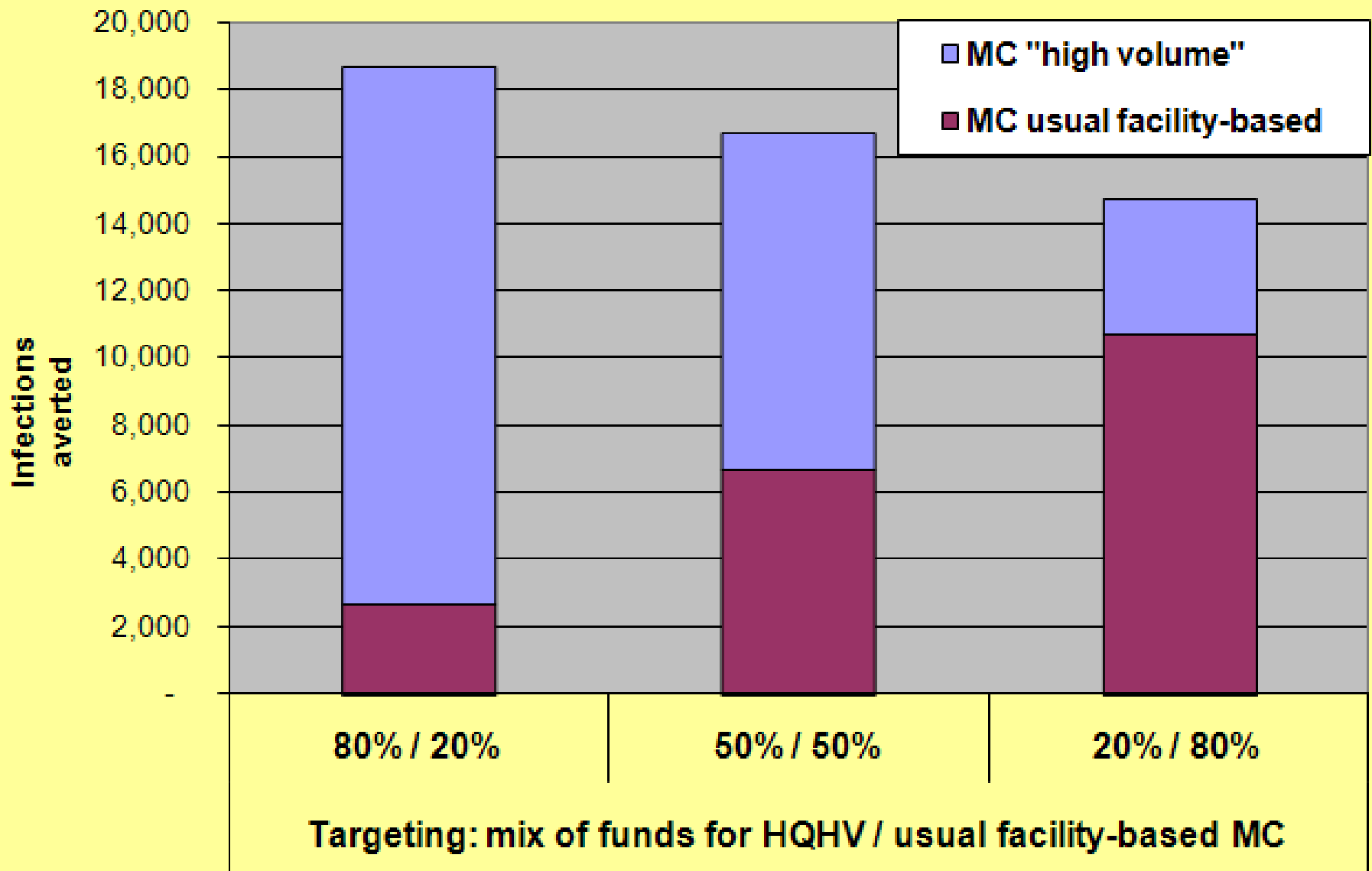PANCEA Study (UCSF - NIH)
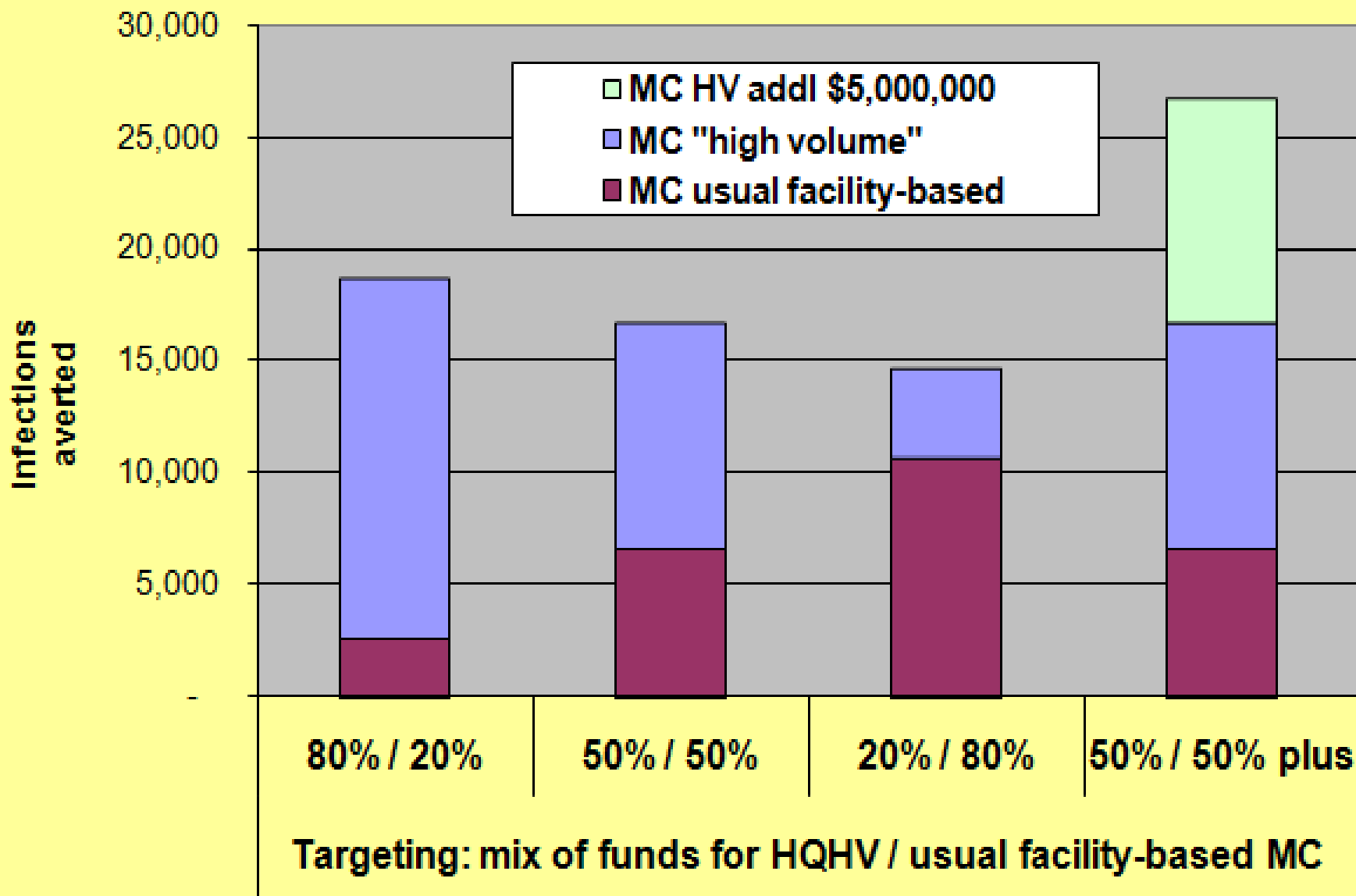
Scale effects and efficiency:

Example #1: VAMC

HIV infections averted by mix of VAMC delivery type, for $10,000,000

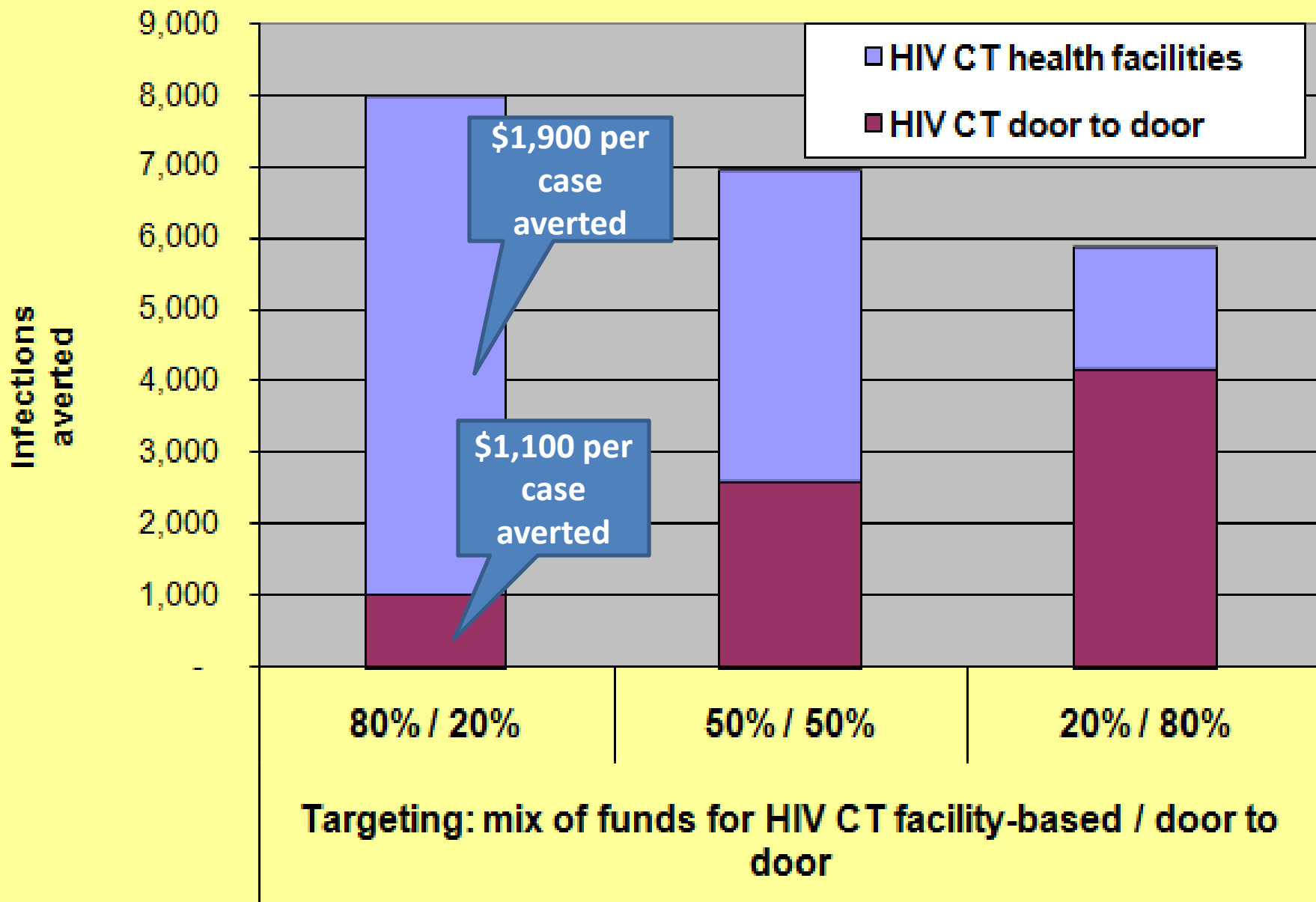# HIV infections averted by mix of MC delivery type, for $10,000,000 or $15,000,000

Infections averted (y-axis): -, 5,000, 10,000, 15,000, 20,000, 25,000, 30,000

Legend:
- ☐ MC HV addl $5,000,000
- ☐ MC "high volume"
- ☐ MC usual facility-based

X-axis categories: 80% / 20%, 50% / 50%, 20% / 80%, 50% / 50% plus

Targeting: mix of funds for HQHV / usual facility-based MC

Scale effects and efficiency:

Example #2: CT

HIV infections averted by mix of HIV CT delivery type, for $10,000,000

HIV infections averted by mix of HIV CT delivery type, for $10,000,000 or $15,000,000
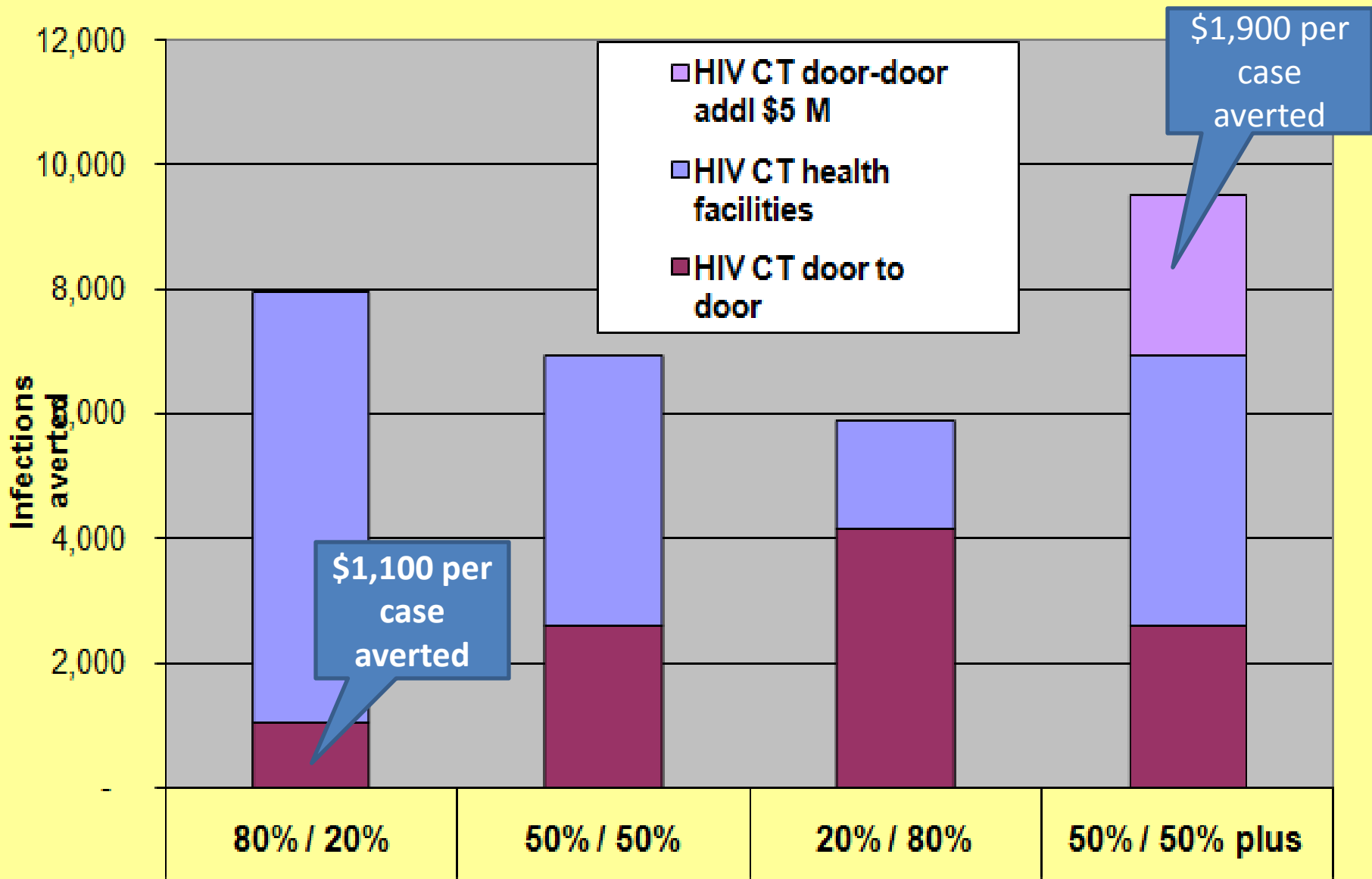
Final Remarks

Targeting matters!

Cost-effectiveness analysis can help quantify the epidemic control implications of new epidemiologic data.

The examples presented here illustrate potential gains in HIV infections averted due to improved cost-effectiveness.

This CE tool can be readily adapted to other data and different interventions.