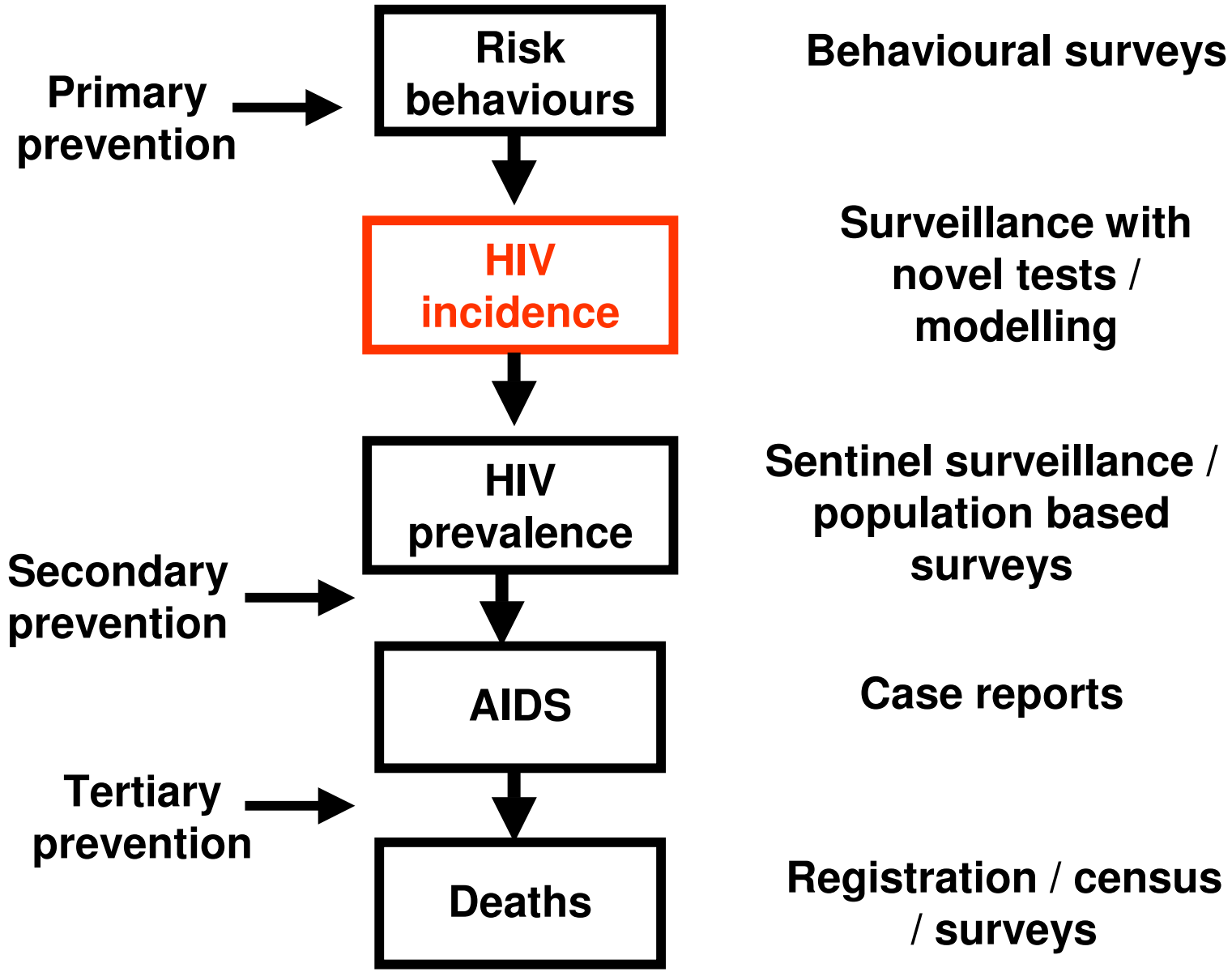
Evaluating the epidemiological impact of HIV interventions

Geoff Garnett

Measuring epidemiological impact



Is it possible to model the impact of interventions based on efficacy and coverage or observed behaviour change?
Assumes efficacy measured, generalisable and translates to scale

R_0 The Basic Reproductive Number - The number of new infections caused by one infection in an entirely susceptible population

$$R_0 = D \cdot C \cdot \beta$$

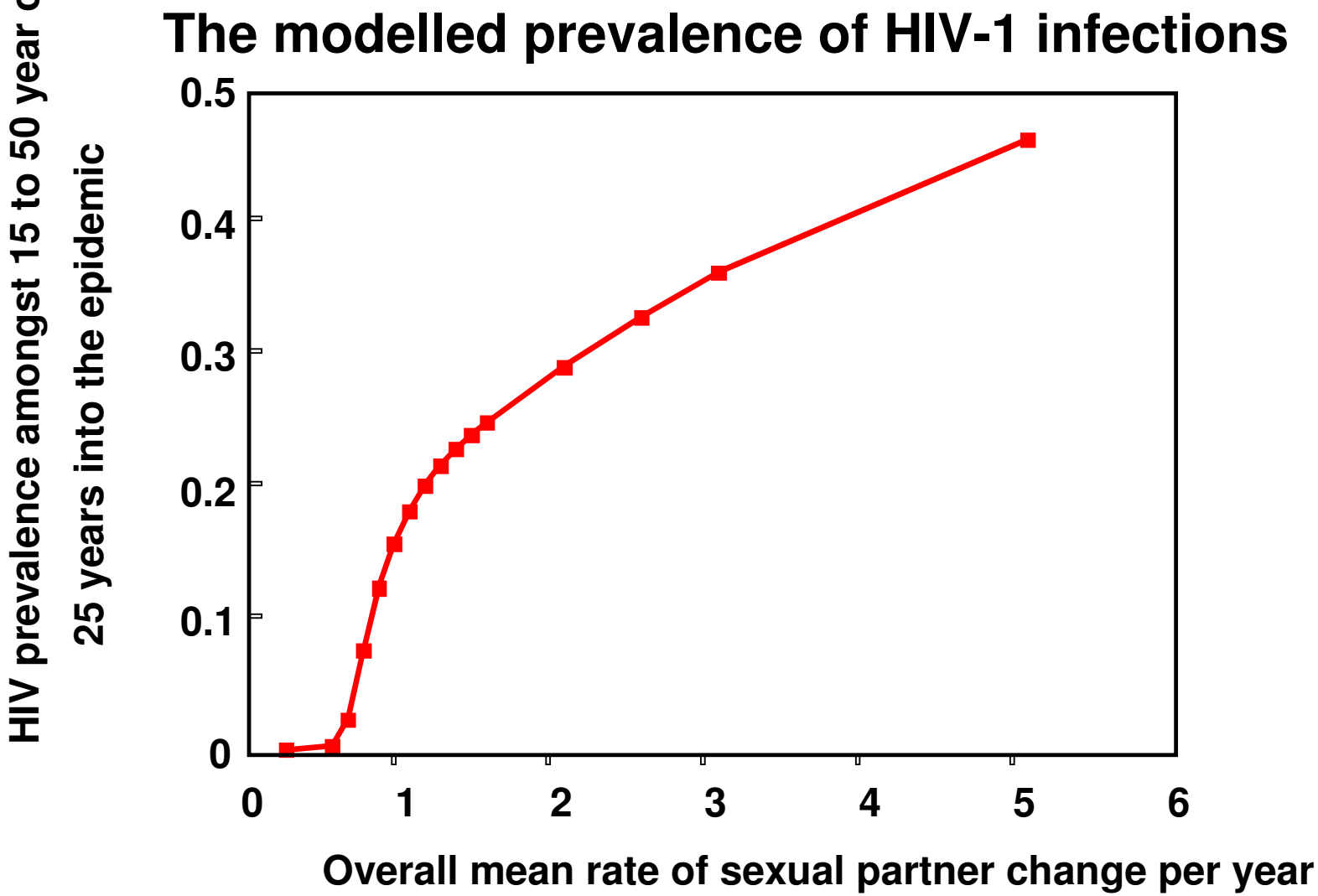
Likelihood of transmission on a sexual contact

Mean length of time infectious

Rate at which sexual contact occurs

Need to include heterogeneity, mixing, concurrancy, acts and partnerships

Depending on the potential for spread the HIV epidemic can be sensitive (rapid slope) or insensitive (saturated slope) to interventions



Estimating HIV Incidence

- Cohort studies – difficult, loss to follow up
- Indirectly from fitting models to prevalence and back calculating incidence on the basis of HIV survival
- From successive prevalence surveys accounting for mortality (need a way of estimating HIV and background mortality)
- Amongst young people (15 to 20 or 15-24)
- Using laboratory tests for recent infections (e.g. BED)
- Predicted for 1 year on the basis of numbers infected and numbers susceptible by risk

Tests for recent infections would be ideal

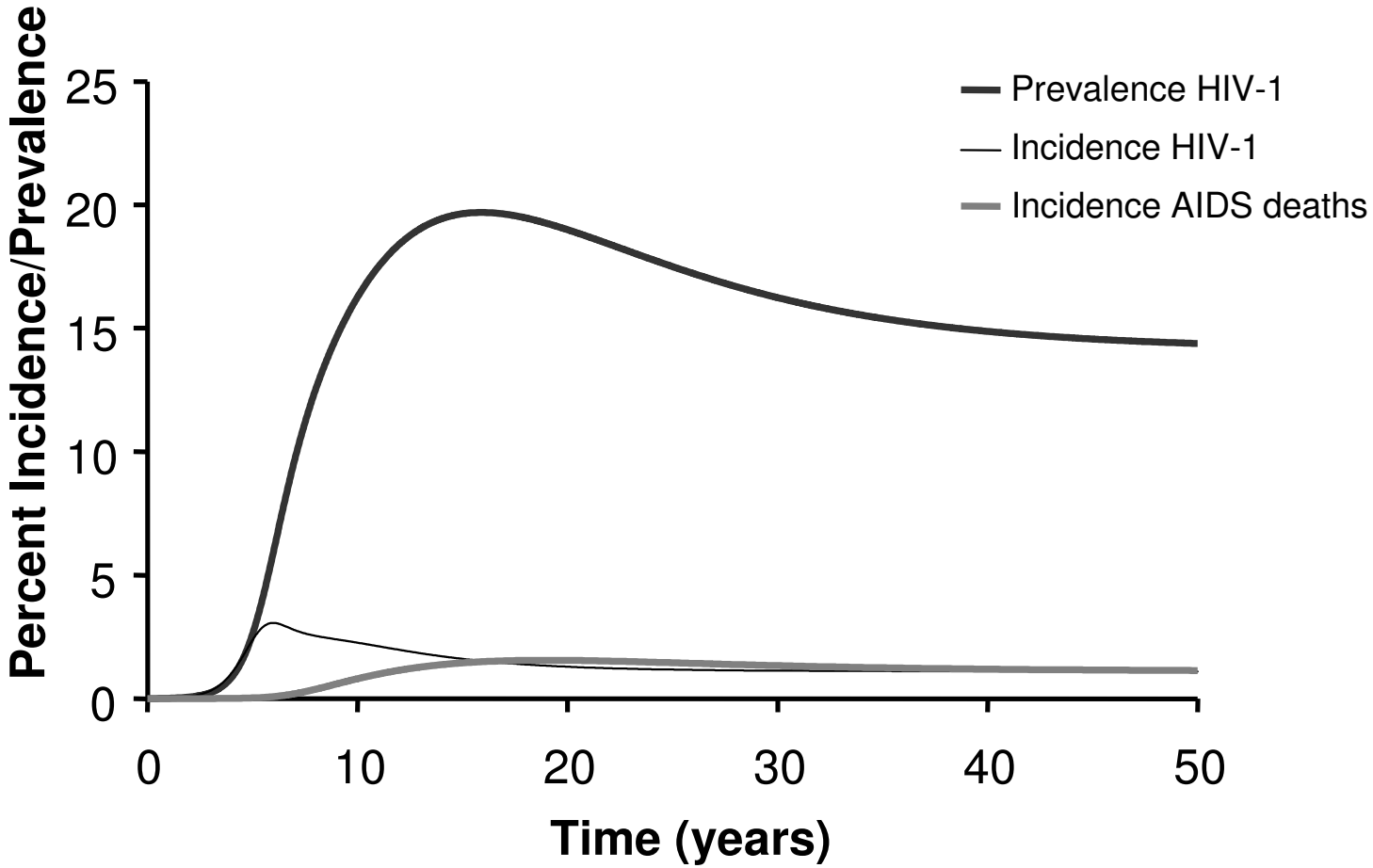
Prevalence and BED Estimated Incidence presented to UNAIDS reference group Dec '06

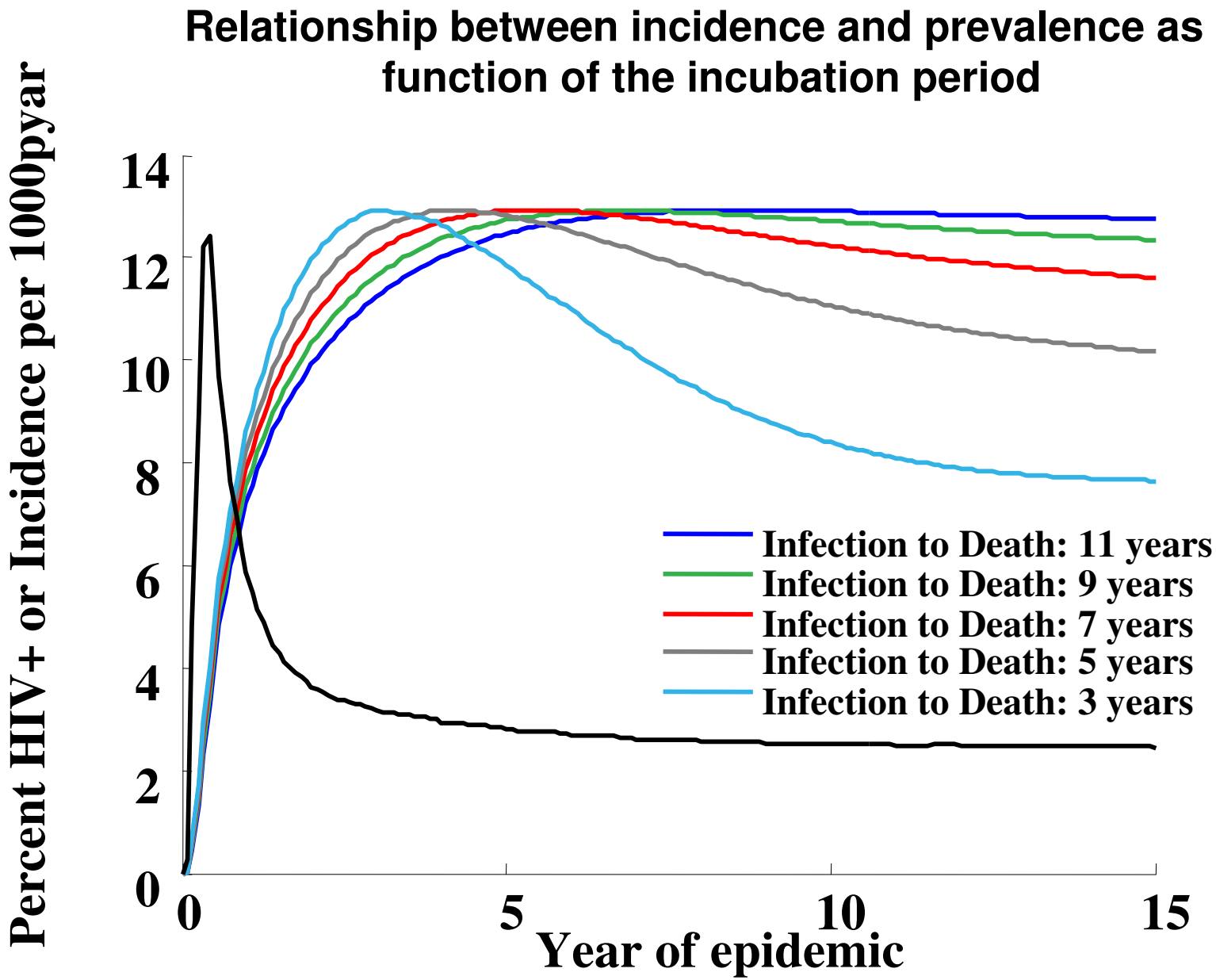
Site	Population	Prevalence	BED Incidence
Kakira, rural Uganda	Sugar plantation workers	9.8%	6.0%
Masaka, rural Uganda	All residents 3 villages	11.2%	6.7%
Kangemi, urban Kenya	Sex workers	16.5%	3.4%
Kilifi, semi urban Kenya	District residents and VCT clients	7.9%	3.0%

AIDS, 2007

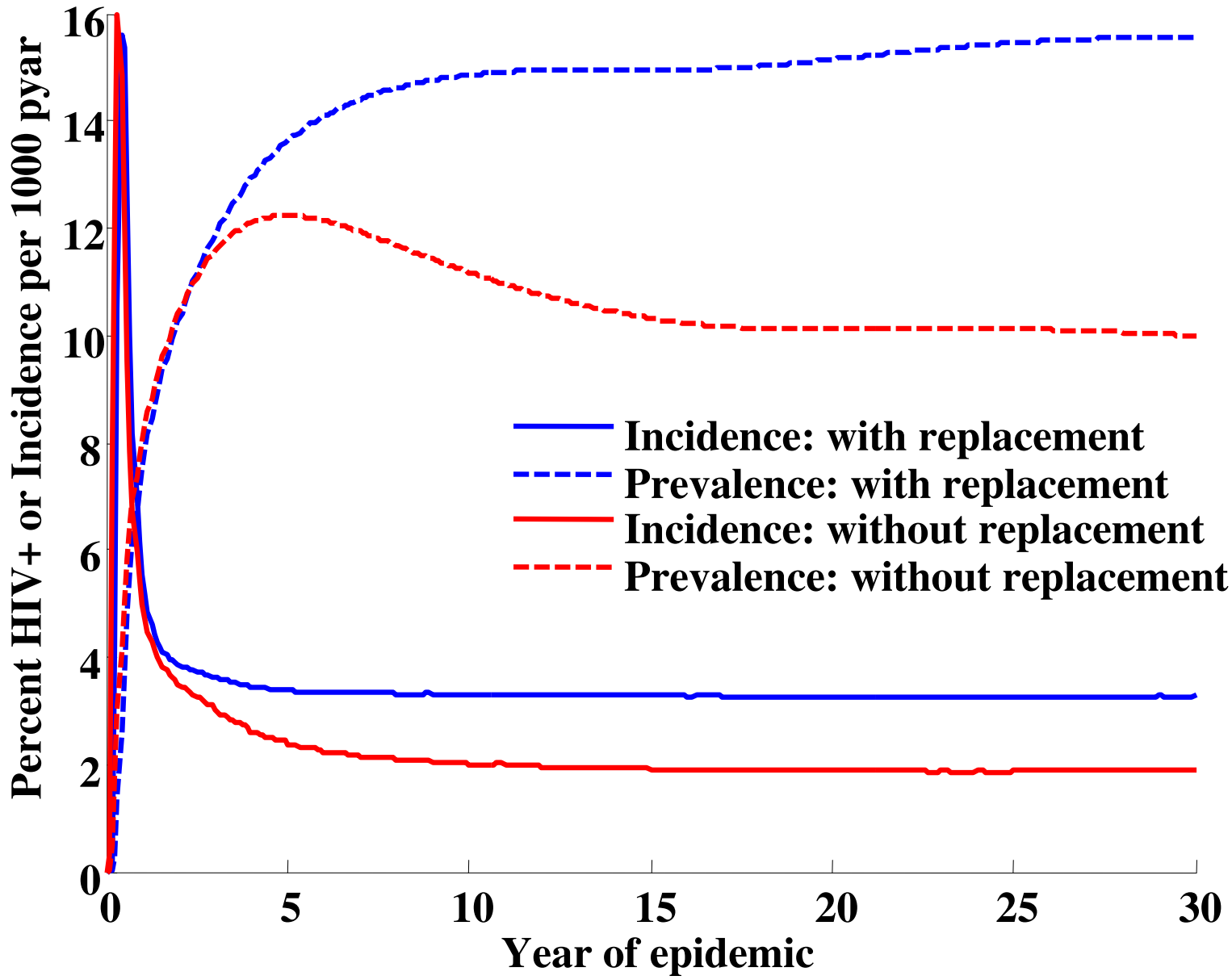
Subsequent adjustments based on specificity in Harare study but requires validations

The incidence and prevalence of HIV – Expected natural course of the epidemic

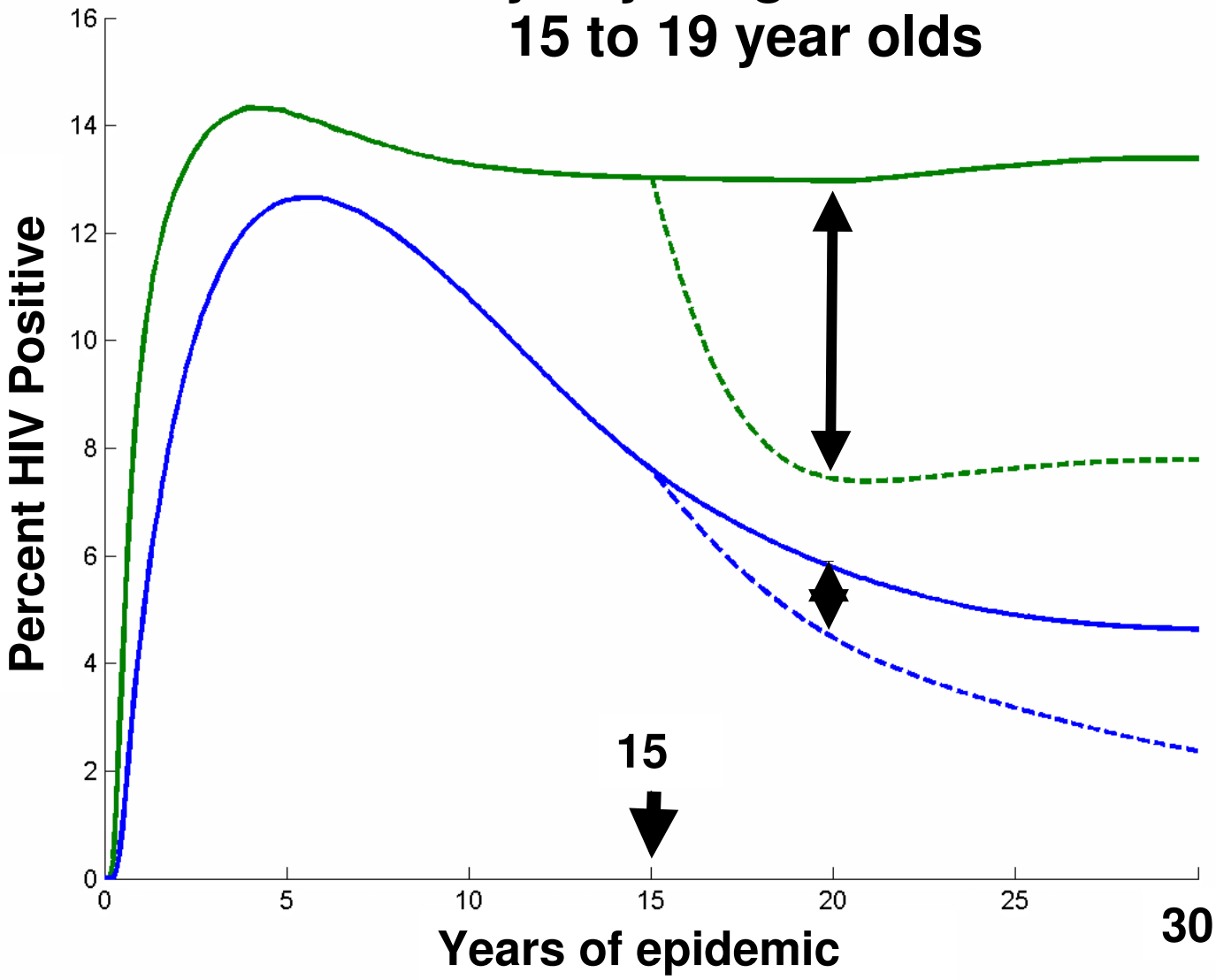


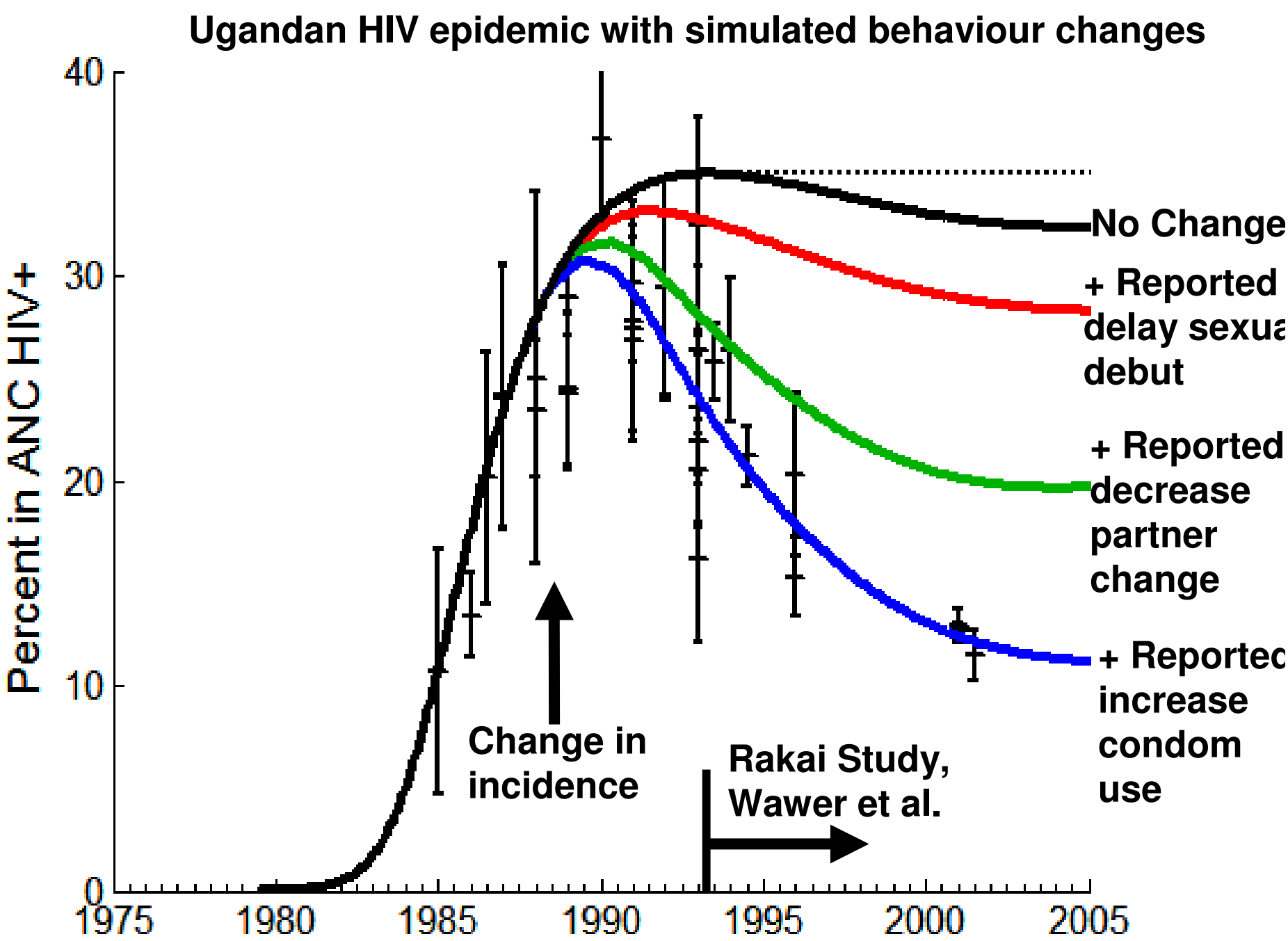


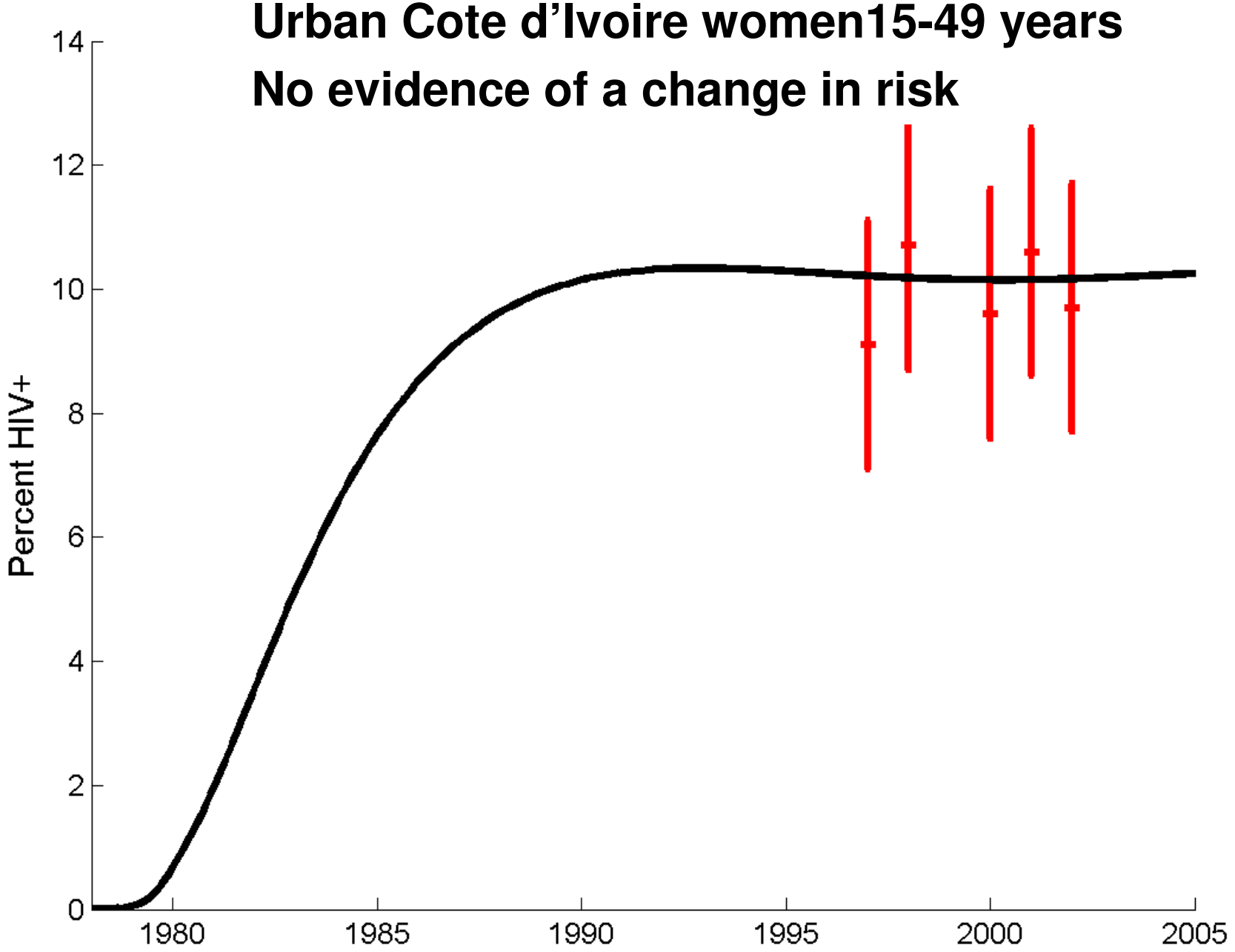
Peaked initial incidence maximises subsequent expected decline in prevalence

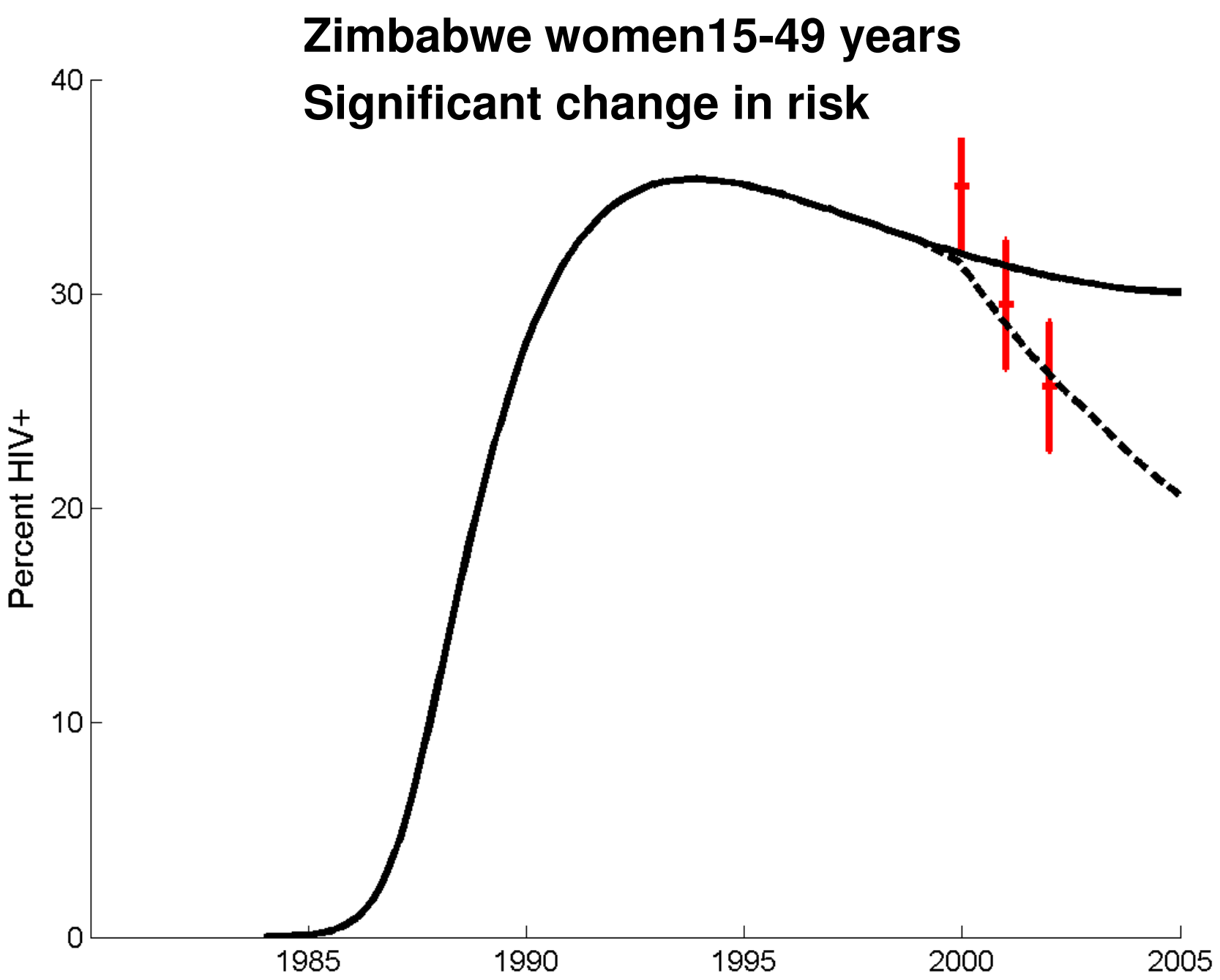

Percent HIV+ or Incidence per 1000 pyar
16
14
12
10
8
6
4
2
0
0
5
10
15
20
25
30
Year of epidemic
Incidence: with replacement
Prevalence: with replacement
Incidence: without replacement
Prevalence: without replacement

If incidence per susceptible changes 15 years into the epidemic then prevalence changes more markedly in young adults

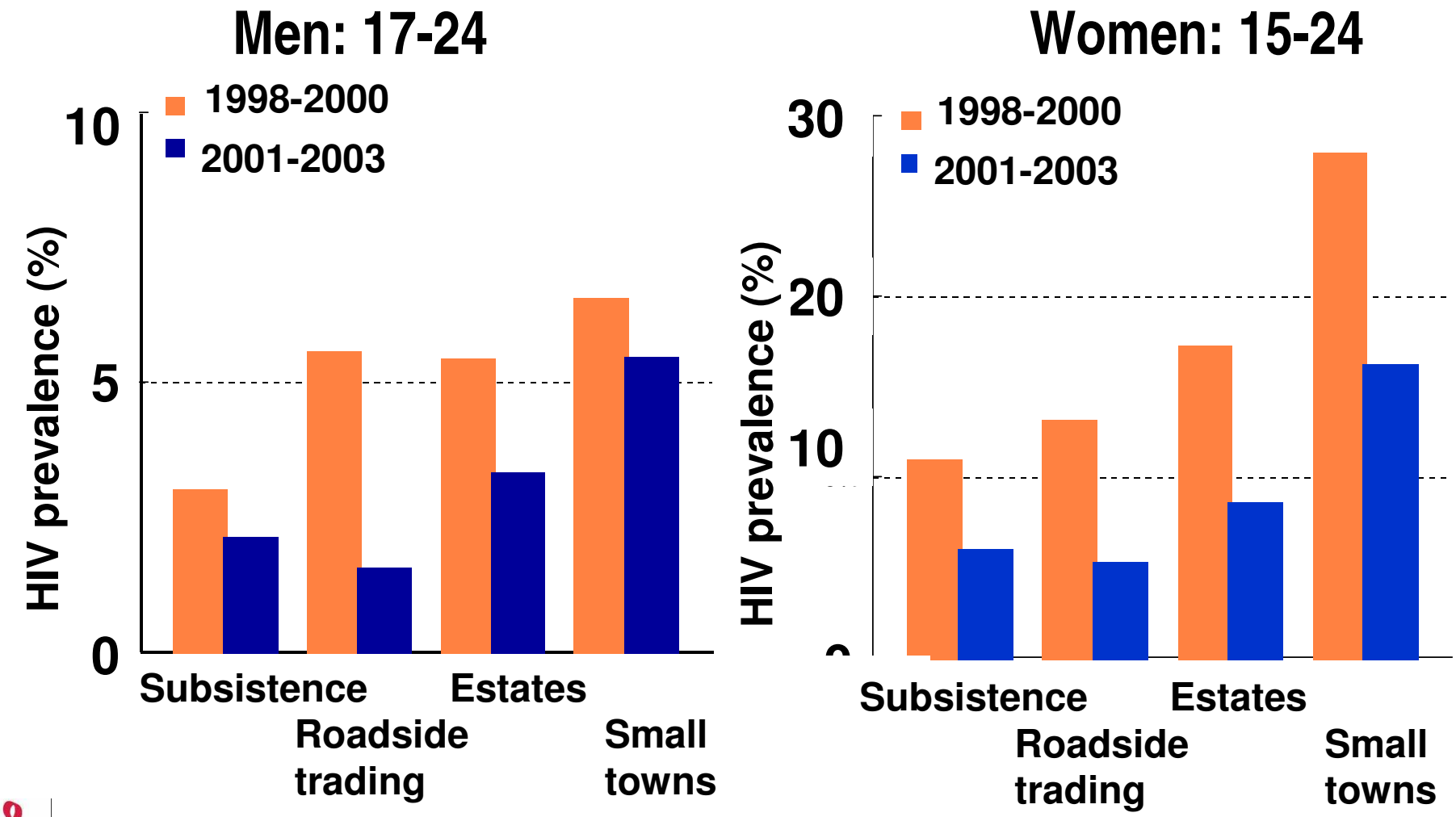



Ugandan HIV epidemic with simulated behaviour changes
Percent in ANC HIV+
40
30
20
10
0
1975
1980
1985
1990
1995
2000
2005
No Change
+ Reported delay sexua debut
+ Reported decrease partner change
+ Reportec increase condom use
Change in incidence
Rakai Study, Wawer et al.


Urban Cote d'Ivoire women15-49 years
No evidence of a change in risk
Percent HIV+
0
2
4
6
8
10
12
14
1980
1985
1990
1995
2000
2005


Zimbabwe women15-49 years
Significant change in risk
Percent HIV+
40
30
20
10
0
1985
1990
1995
2000
2005

Reduction in HIV prevalence – in eastern highlands of Zimbabwe



MANICALAND HIV/STD PREVENTION PROJECT

Imperial College London

Reported behaviours from 12 rural communities reduced significantly Gregson et al, 2006

Men behaviours associated HIV : Round 1 1998-99 Round 2 2001-03

Risk behaviour	R1	R2	OR*	*P* Value	N
New partner in last year	0.509	0.355	0.52	<0.001	4,311
More than one partner in last month	0.083	0.062	0.73	0.011	4,299
More than one current partner	0.156	0.083	0.51	<0.001	4,309
Last or previous partner a casual partner	0.283	0.174	0.59	<0.001	2,536
Unprotected sex with recent casual partner	0.608	0.693	0.76	0.382	364

Conclusions

- **Declines in incidence expected as normal part of epidemic – are these greater than expected or do they occur after initial decline.**
- **Modelling on the basis of behaviour insufficient to quantify success of interventions.**
- **Combining trends in prevalence (from similar samples) and risk behaviour data can retrospectively identify successful prevention.**
- **Ideally want tests to detect incidence <u>but</u> these have to be valid.**