

**National HIV incidence estimates:
direct measures compared with
mathematical modeling**

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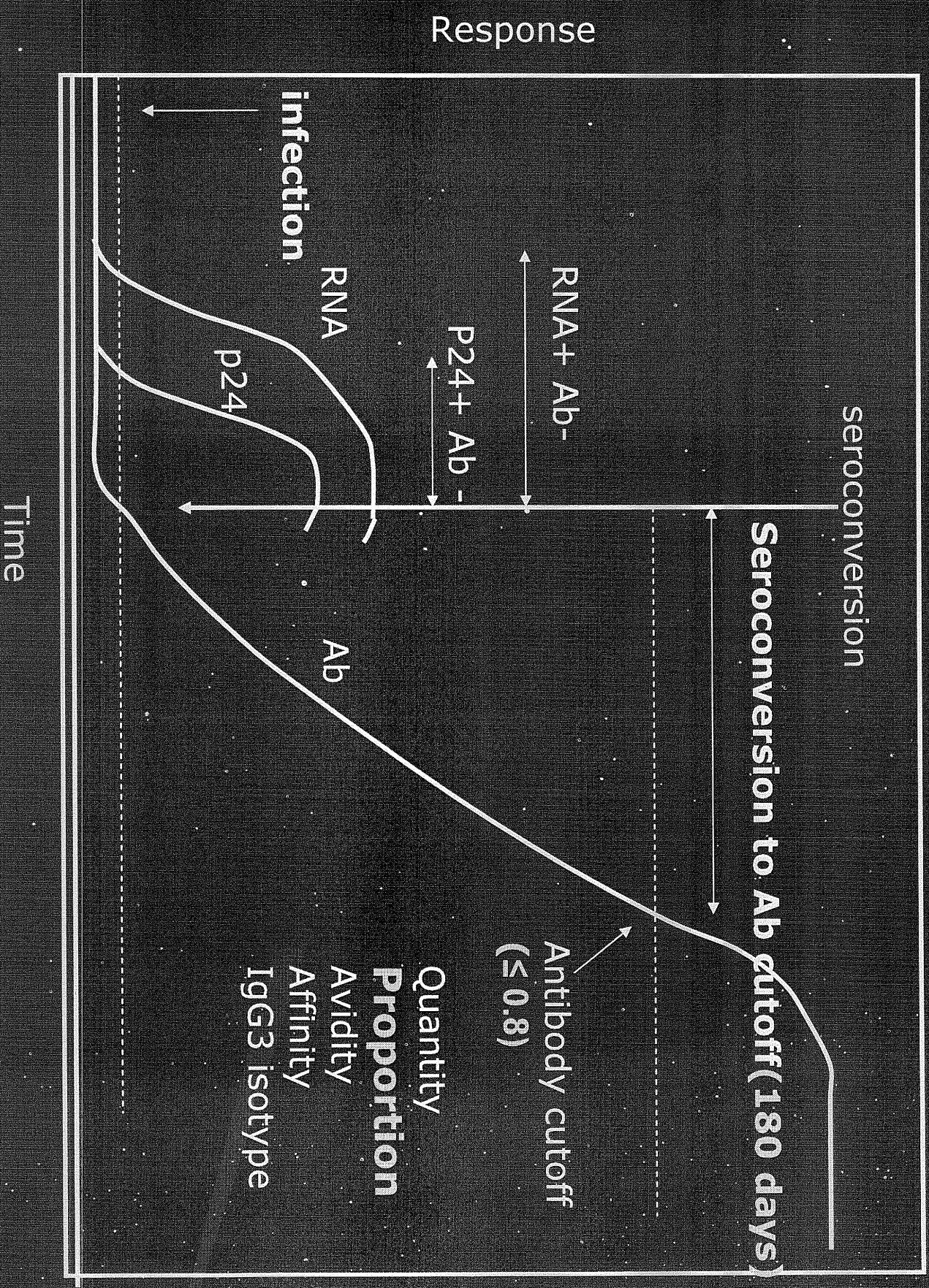
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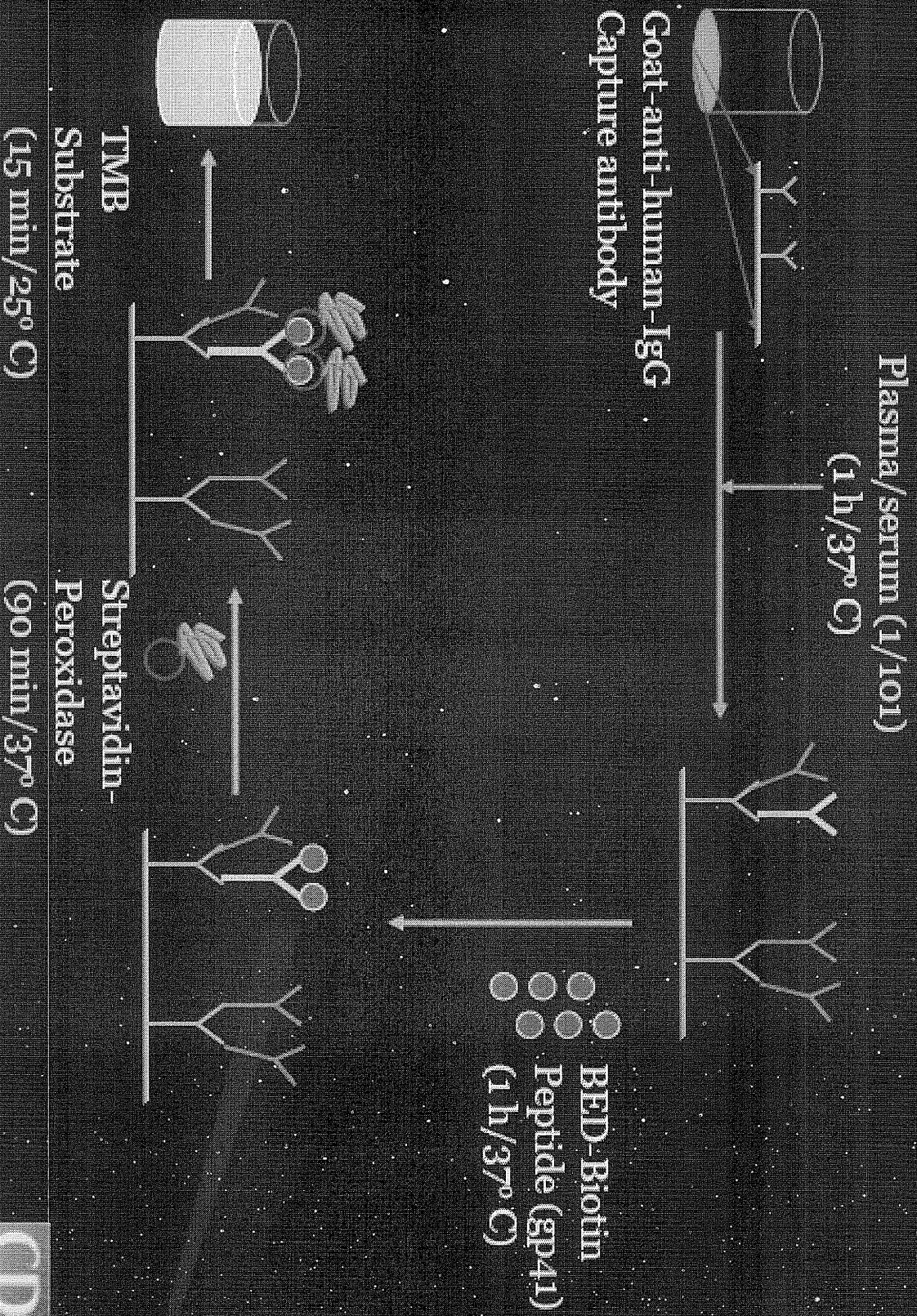
Measuring HIV incidence

- **Epidemiological methods**
 - Cohort studies (*directly observed incidence*)
 - HIV prevalence in youngest age group (15-20) (*as a proxy for recent infection*)
 - Mathematical modeling (*indirect incidence estimate*)
- **Laboratory-based methods**
(direct incidence measure from cross-sectional surveys)

HIV-1 BED incidence EIA (adapted from B. Parekh et al. 2002)

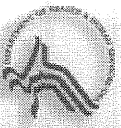


Schematic of the BED-CEIA



BED window periods at 0.8 cutoff

<u>Subtypes</u>	<u>Country</u>	<u>Window (95% CI)</u>
AD	Kenya	171 (150-199)
B	Amsterdam	127 (113-152)
B	Thailand	143 (118-170)
C	Zimbabwe	181 (165-198)
C	Ethiopia	167 (154-180)
E	Thailand	115 (106-125)
OVERALL		155 (146-165)



2005 National Household Survey

- **Study population: 2 years and older**
- **Anonymous HIV testing of dried blood spot specimens**
- **HIV prevalence and HIV incidence**
- **Final sample: 23 275 interviewed, 15 851 tested for HIV**

BED HIV-1 Incidence Estimates National HIV survey, South Africa 2005

- **BED HIV incidence CEIA applied to confirmed HIV-positive specimens**
- **BED CEIA performed at NICD, Johannesburg**
- **Adjusted BED HIV incidence estimates
(Rehle et al. S Afr Med J 2007; 97: 194-199)**

BED incidence adjustments

- **UNAIDS 2005: overestimates in cross-sectional studies**
- **BED validation meeting, CDC 2006:**
 - **Sensitivity/Specificity Adjustment (McDougal et al.)**
 - **Specificity Adjustment (Hargrove et al.)**
 - **Validated for HIV-1 subtypes B and C**
(2 532 specimens from 1 192 individuals)

BED HIV incidence calculation

$$I = \frac{F (365/w) N_{inc}}{N_{neg} + F (365/w) N_{inc}/2} \times 100$$

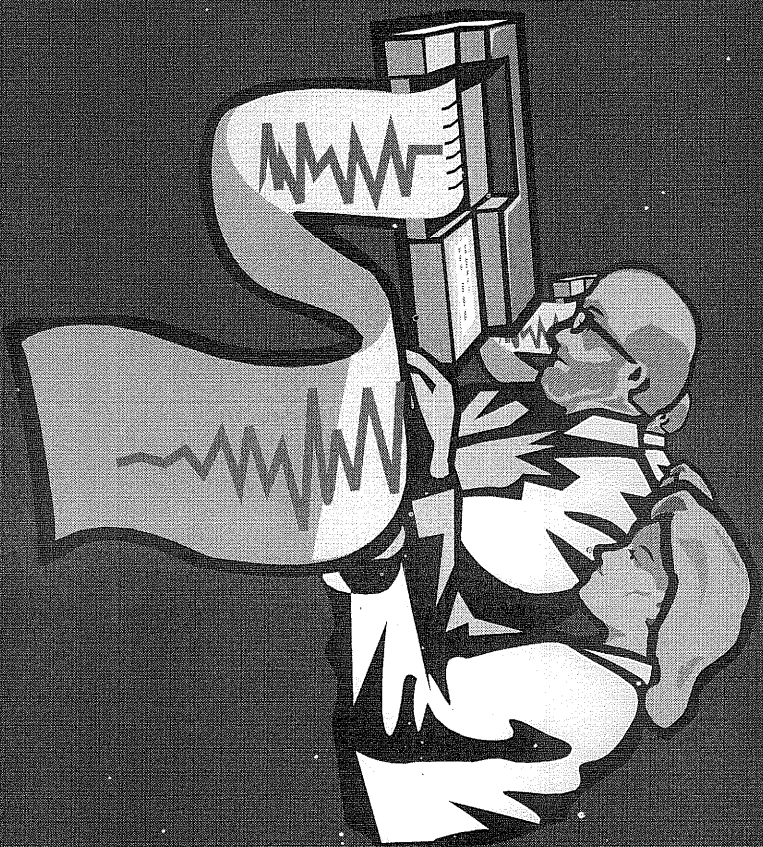
$$(R/P) + \gamma - 1$$

$$\text{Adjustment Factor} = \frac{(R/P) (\alpha - \beta + 2\gamma - 1)}{(McDougal)}$$

Window period = 180 days

Incidence = number of new infections per year per 100 persons at risk (% / year)

**Are the adjusted BED HIV
incidence estimates plausible?**



ASSA model

Antenatal data

Adjust for bias

Adult death data

Calibration

- Number infected
- New infections
- AIDS deaths

Demographic parameters
(base population, fertility, non-AIDS mortality and migration)

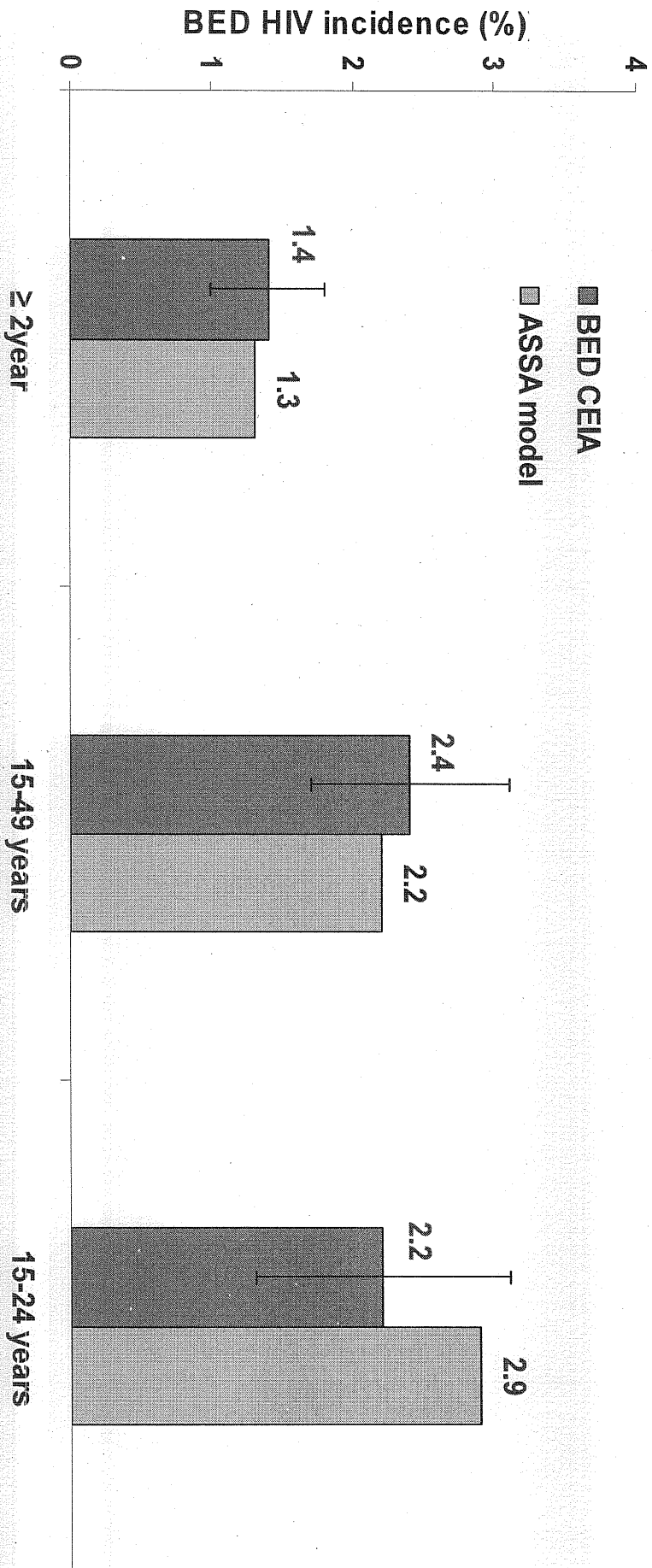
Cohort component projection model

Epi and behavioural parameters
(e.g. % in risk groups, amount of sex, probability of transmission, probability a condom used, etc)

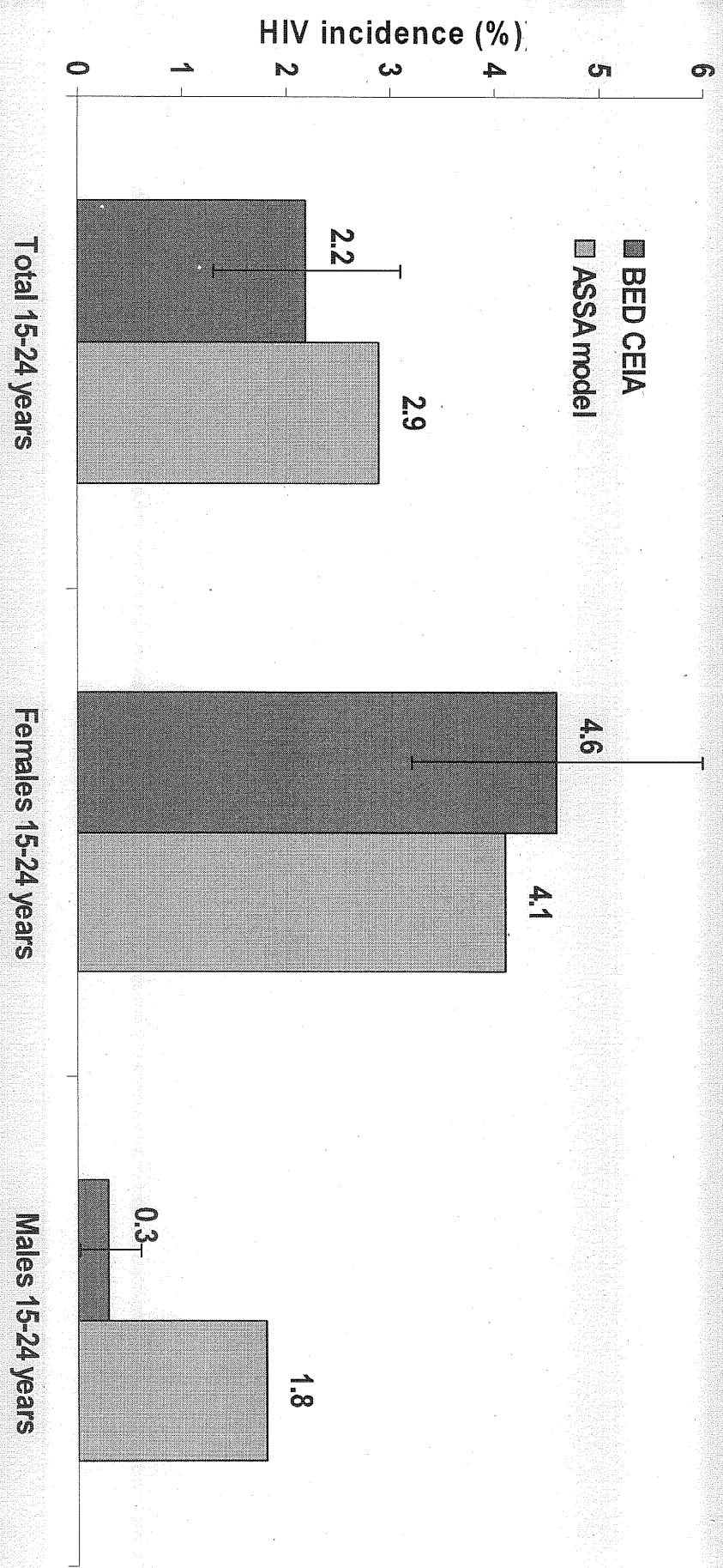
Epidemiological behavioural intervention model

Interventions

BED HIV incidence vs ASSA model (estimates for 2005)

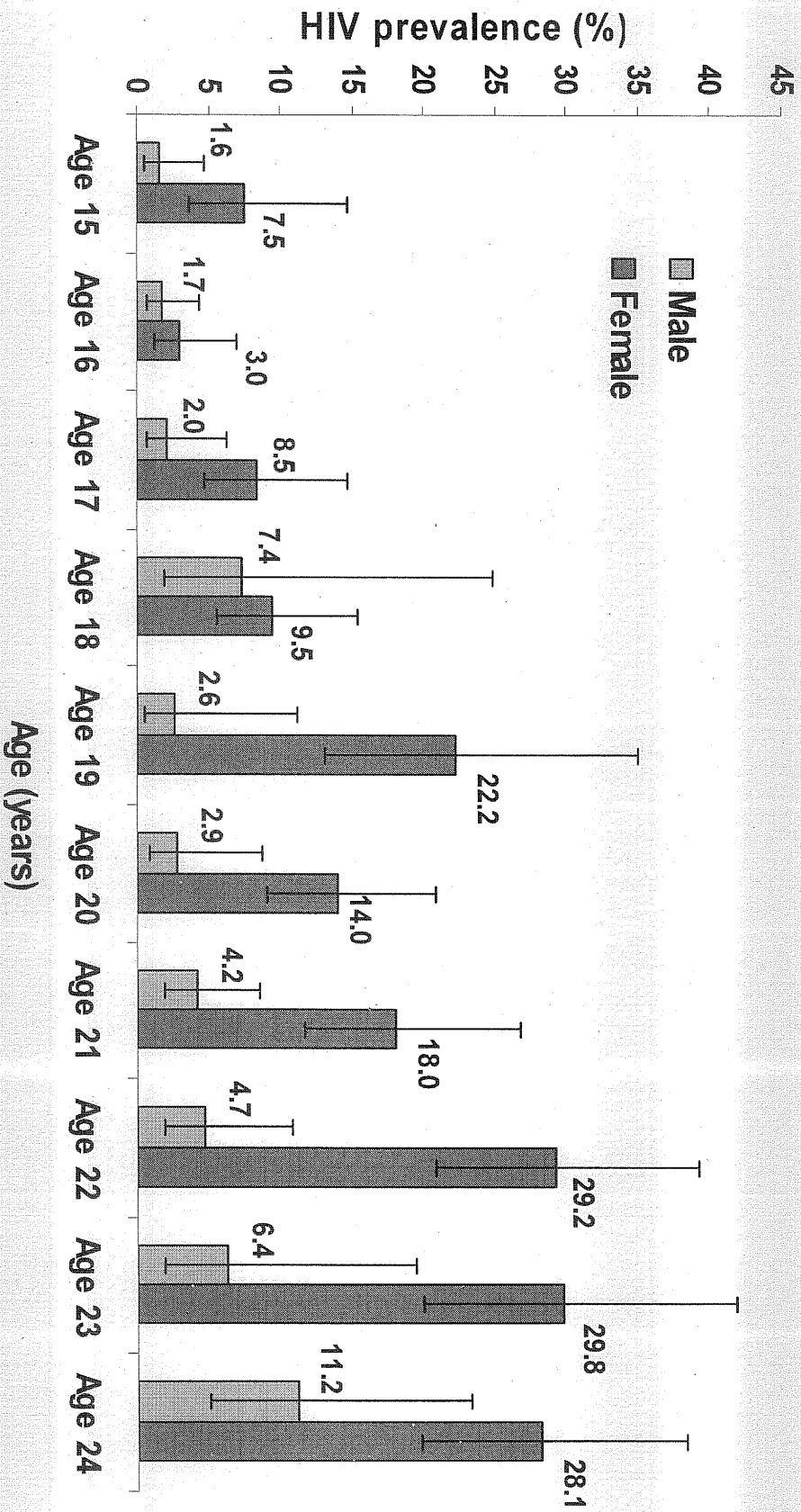


BED HIV incidence vs ASSA model: male and female youth 15-24 years



HIV prevalence in youth by single year of age

HSRC 2005



HIV incidence and behaviour

HSRC 2005 (age group 15 – 49 years)

Variable	HIV incidence (% per year)
Marital status	
Single	3.0
Married	1.3
Widowed	5.8
Sexual history	
Sexually active in the past 12 months	2.4
Current pregnancy	5.2
Condom use at last sex (15-24 yrs)	
Yes	2.9
No	6.1

Conclusion

- **The adjusted BED HIV incidence estimates provide valid national HIV incidence estimates for South Africa**
- **Laboratory-based HIV incidence testing method of choice to measure impact of national HIV prevention efforts**
- **Measuring main goal of NSP**
 - **national HIV incidence data 2005, 2008, 2011**