For the use of EPP available retrospective prevalence data from the beginning of the HIV epidemic are required. In our case-study for the Netherlands, we have used data from prevalence surveys available since 1985. Most data sources are mentioned in Supplement 1; additional sources are listed below:

- **GGD Amsterdam. Annual report(s) of the Department of Infectious Diseases, Health Service Amsterdam, 1988-1997.**
- **GGD Amsterdam. Annual reports of the STI clinic of Health Service Amsterdam, 1990-2006.**
- **HIV en AIDS in Nederland 1999. Uitgave t.g.v. Wereld Aidsdag. Stichting Aidsfonds, Amsterdam, 1999 [in Dutch].**
Schorer Monitor 2000-2006; internet based study on Sexual Health of MSM, separately analysed for respondents of the 3 different regions.

Erasmus Medical Centre, Data STI clinic of Rotterdam, 1993-2006.


Sanquin Blood Supply Amsterdam; national data on HIV testing among blood donors, 1985-2006.


Hoek JAR van den, Mulder-Folkerts DFK, Dukers NHTM, Fennema JSA, Coutinho RA. [Surveillance of AIDS and HIV infections in Amsterdam 1997]. Ned Tijdschr Geneeskund 1998;142:2861-5.[in Dutch]


SUPPLEMENT 3. MPES HIV Model Assumptions
A number of assumptions regarding both the MPES model structure and the data informing it were required, typically in order to supplement weak (where not missing) information about some subgroup-region-gender combinations. In the absence of evidence to the contrary, epistemic uncertainty around all parameters is modelled by means of vague (typically Uniform with allowed bounds) prior distributions.

**Assumptions used for subgroup proportions**

1. Information on number of all men who have sex with men (MSM) in Rotterdam (sources: Rutgers Nisso Group, Rotterdam Health Monitor) and the rest of the Netherlands (sources: Pienter, Rutgers Nisso Group), number of injecting drug users (IDU) in Amsterdam (source: AMS Health Service) and female sex workers (FSW) in the rest of the Netherlands consists of pairs of bounding counts. Such pairs were modelled so that effective subgroup proportions are equally likely to lie within 5% (an even less conservative upper bound for either \( P_{RTD,MSM,ALL} \) and \( P_{RNL,MSM,ALL} \)) and correspondingly estimated lower bounds.

2. Due to likely over-reporting of number of IDU in the rest of the Netherlands (NL) (source: Pienter), data were assumed to actually inform an upper bound for IDU subgroup proportions.

3. Official statistics on number of migrants in Amsterdam, Rotterdam and the rest of the Netherlands (source: national bureau of statistics (CBS)) are not classified by STI clinic attendance status, nor do they include illegal immigrants. These issues are addressed first by assuming the proportions of sub-Saharan African (SSA)-born and Caribbean (CRB)-born migrants legally residing in the Netherlands (regardless of STI clinic attendance) to be equally likely to lie within 80%-90% and 95%-100% respectively; then by adjusting for the proportions of SSA-born and CRB-born STI clinic attendees.

4. The model enforces the following inequality chain:

\[
R_{AMS,MSM,ALL} \geq R_{RTD,MSM,ALL} \geq R_{RNL,MSM,ALL}
\]

Moreover it incorporates the belief that the population mix of MSM STI clinic attendees in Rotterdam lies much closer to its estimated minimum (source: Rotterdam Health Monitor) than to its conservatively estimated maximum (source: Rutgers Nisso Group).

**Assumptions used for HIV prevalences**

1. STI clinics across the Netherlands enact an opt-out policy on HIV testing, which leads to biases in the evidence (source: SOAP) reported around STI clinic attendees on HIV prevalence due to the missing information about individuals opting out of HIV testing. Opt-in and opt-out contributions to HIV prevalence, with only the former being actually observed, were modelled separately, depending on the specific region-exposure combination, in line with prior beliefs. In particular, opt-out HIV prevalences in Amsterdam and Rotterdam were assumed to be evenly distributed between opt-in HIV prevalence\(^1\) and a 50% (STI-non migrants, STI-SSA and STI-CRB) or 100% (MSM-STI) figure. In the rest of the Netherlands, where HIV testing is less encouraged than in main urban areas, such prevalence was instead assumed to lie between opt-in HIV prevalence\(^1\) (MSM-STI, STI-SSA and STI-CRB) or 0% (STI-non migrants) and a 100% (MSM-STI), 25% (STI-SSA and STI-CRB) or opt-in HIV prevalence (STI-non migrants) figures.

2. The model incorporates the expectation that MSM HIV prevalence in the rest of the Netherlands should not exceed that observed in the same subgroup in Amsterdam and Rotterdam, regardless of their STI clinic attendance status.

3. Since HIV-positive IDU individuals in Amsterdam have steadily declined over time to ageing or mortality, data available this at-risk subgroup (source: anonymous unlinked HIV survey) inform an upper bound for its HIV prevalence.

4. HIV prevalence in low-risk individuals is assumed across regions not to exceed the prevalence in other at-risk subgroups with the same region-gender profile.

5. Evidence collected on HIV prevalence in SSA-born individuals in Rotterdam not attending STI clinics (source: UA survey) is limited to Cape Verdean migrants only. Since Cape Verde is an non-HIV endemic country, those data were assumed to inform a lower bound for the HIV prevalence characterising the wider SSA-born at-risk subgroup.

6. Evidence available on HIV prevalence of Caribbean migrants in Rotterdam (source: anonymous HIV survey) is thought of as informing an upper bound for such parameter which is less conservative than that instead implied by UNAIDS statistics.

7. HIV prevalences among migrant subgroups across the Netherlands not attending STI clinics and SSA-born STI clinic attendees outside Amsterdam and Rotterdam are assumed to be bounded above by corresponding UNAIDS estimates.

8. The model reflects the intuition that HIV prevalence observed in STI clinic attendees from HIV-endemic countries across the Netherlands would be expected to exceed that featured by immigrants of same background who instead do not attend a STI clinic; the same is assumed to hold within the MSM at-risk subgroup.

9. Data available on HIV prevalence in Caribbean migrants both attending STI clinics (source: SOAP) and not (source: anonymous HIV survey) in the rest of the Netherlands are assumed to inform a lower bound for such parameter.

\(^1\)Such lower bound is motivated by the assumption that individuals opting out of HIV testing are likely to be at higher risk than those instead opting in.
1. The model establishes the following ranking between cross-country HIV prevalences in MSM not attending STI clinics:

\[ \pi_{\text{AMS, MSM, NON-STI}} \geq \pi_{\text{RTD, MSM, NON-STI}} \]
\[ \geq \pi_{\text{RNL, MSM, NON-STI}} \]

11. Information available on HIV prevalence in pregnant women from either non-HIV-endemic or endemic background living in Amsterdam (source: AMS Health Service screening system) and Rotterdam (source: Rotterdam screening system) is utilised as a proxy for HIV prevalence in low-risk women. More specifically, under the assumption that pregnant and general women exhibit the same population mix — in other words, assuming similarly to Presanis et al. (2008) that pregnant women are representative of the wider women population with respect to their exposure — then HIV prevalence in pregnant women from non-HIV-endemic countries is given by a weighted average of HIV prevalences in female STI clinic attendees from non-HIV-endemic background and low-risk females, with weights given by their respective subgroup proportions. Analogously, HIV prevalence in pregnant women from HIV-endemic countries is taken to be a weighted average of HIV prevalences in female SSA-born and Caribbean-born migrants, regardless of their STI clinic attendance status.

12. To supplement weak evidence on HIV prevalence among low-risk individuals (especially outside Amsterdam and Rotterdam), male-to-female prevalence log-odds ratios were assumed to be homogeneous (that is similarly distributed) across all subgroups — albeit not across regions — excluding MSM and FSW.

13. Prevalence data available at national level on pregnant women from HIV-endemic background were assumed to be representative of pregnant women of corresponding ethnicity outside of Amsterdam and Rotterdam only (source: RIVM). Information on prevalence in blood donors (source: Sanquin), which is not made available by region nor gender, is utilised to inform minimum prevalence of low-risk individuals of either gender across the country, since blood donors are thought of as being at especially low risk of HIV infection.

Assumptions used for Proportions Diagnosed

1. Lack of knowledge on actual number of infections among STI clinic attendees across the Netherlands (due to some of them opting out of HIV testing) required the utilisation of number of infections predicted elsewhere within the model for estimating proportions in the corresponding at-risk subgroups diagnosed with HIV. Moreover the model takes into account the belief that correspondingly estimated proportions diagnosed are all expected to exceed 20%.

2. Since HIV-positive IDU individuals in Amsterdam have steadily declined over time to ageing or mortality, data available this at-risk subgroup in Amsterdam (source: anonymous unlinked HIV survey) inform a lower bound for corresponding proportion diagnosed with HIV.

3. Because of their intrinsic design characteristics, evidence collected on IDU across regions in the Netherlands (sources: anonymous HIV surveys) and on all STI clinic attendees in Amsterdam (source: DWAR) was assumed to inform a lower bound for corresponding subgroup proportions diagnosed with HIV.

4. The model encodes the intuition that proportions of STI clinic attendees from HIV-endemic countries diagnosed with HIV should be greater than those featured by immigrants of same background instead not attending a STI clinic; the same is assumed to hold within the MSM at-risk subgroup. This is also thought to be generally connected to cultural profiling, because of generally better integration of immigrants of Caribbean origin into the Netherlands compared to SSA-born migrants: in other words, proportions of Caribbean migrants diagnosed with HIV would be expected to be larger than those featured by those of SSA background irrespective of STI clinic attendance status. This consideration too is accounted for by the model.

5. To corroborate weak evidence on proportions diagnosed with HIV among low-risk individuals (especially outside Amsterdam and Rotterdam), male-to-female log-odds ratios of these parameters were assumed to be homogeneous across all subgroups — albeit not across regions — excluding MSM and FSW.

6. Data available on proportions of pregnant women diagnosed with HIV from either migrant or non-migrant origin living in Amsterdam (source: AMS Health Service screening system) was assumed to be representative of low-risk women. More specifically, under the assumption that pregnant and general women exhibit the same population mix (analogously to what already assumed for the estimation of HIV prevalences in low-risk women) then proportions of pregnant women from non-HIV-endemic countries diagnosed with HIV are given by a weighted average of diagnosed HIV prevalences among female STI clinic attendees from non-HIV-endemic background and low-risk females, with weights given by their respective subgroup proportions. Analogously, proportions of pregnant women from HIV-endemic countries diagnosed with HIV are taken to be a weighted average of diagnosed HIV prevalences among female SSA-born and Caribbean-born migrants, regardless of their STI clinic attendance status.

7. Due to their higher level of health consciousness and access to health-care facilities across the Netherlands, MSM not attending STI clinics are expected to be diagnosed in higher proportions than SSA- and Caribbean-born males likewise not attending a STI clinic.
Assumptions used for Diagnosed HIV Prevalences

1. Due to separate evidence about HIV infection among low risk individuals, data on MSM attending STI clinics in the rest of the Netherlands (source: Pienter) are assumed to inform a lower bound for HIV prevalence diagnosed.

Assumptions used for Diagnosed HIV Infections

1. Since not all individuals diagnosed with HIV are actually in care, under-reporting biases affect region-specific records (source: SHM) notably in relation to all MSM across the Netherlands and IDU in Amsterdam. Resulting predicted numbers of diagnosed HIV infections were adjusted upwards in the light of information available (source: Schorer Monitor) around corresponding proportions not in care.

2. Due to differences between the observed and modelled classifications of exposures in number of diagnosed HIV infections, the ‘SSA/Caribbean migrants (heterosexual)’ class was assumed to comprise immigrants irrespective of STI clinic attendance status; on the other hand, ‘heterosexual men/women other than SSA and Caribbean (including Dutch)’ were taken to consist of IDU, FSW (women only), STI clinic attendees from non-HIV-endemic countries and low-risk individuals.

3. Information available on newly diagnosed infections by place of diagnosis in 2007 among migrants in the rest of the Netherlands (source: RIVM) was utilised to inform an upper bound for the fraction of such infections which were diagnosed in STI clinics. This in turn was utilised to distinguish from migrants in care those diagnosed with HIV in a STI clinic.

References
