

Comparing Estimates for HIV Prevalence, Incident Cases and Percent of People Living with HIV Undiagnosed Utilizing Three Estimation Methods

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Background

- In 2015, the United Nations (UN) endorsed the 90-90-90 Targets to bring upon the END of AIDS as a public health threat. In order to monitor the progress toward the 90-90-90 Targets, it is essential to have a robust methodology to estimate HIV prevalence and percent of people living with HIV (PLWH) undiagnosed.

Objective

- We examined the robustness of several popular incidence and prevalence estimation methods based on a simulated HIV epidemic with different settings on testing and treatment initiation.

Methods

- We simulated multiple HIV epidemics using a published mathematical compartmental transmission model by varying contact rate, testing rate and rate of treatment initiation, dependent on time and CD4 categories.
- We estimated annual HIV incident cases, PLWH, undiagnosed PLWH and percent of undiagnosed PLWH by different methodologies.
- We utilized the methodologies that require information on CD4 counts at diagnosis, proposed by the European Centre for Disease Prevention and Control (Netherlands Method) and by the US Centers for Disease Control and Prevention (US Method), in comparison to the one proposed by the Public Health Agency of Canada (Ottawa/Sydney Method) which does not require CD4 information.

Table 1. HIV incidence estimation models: input, output and required parameters.

	Netherlands Method	US Method	Ottawa/Sydney Method
Input	Annual HIV diagnosis by CD4 stratum; Annual HIV/AIDS diagnosis; Annual deaths of diagnosed PLWH	Date of HIV diagnosis and first CD4 test; results of the first CD4 test; Information about age, gender and risk category; Annual deaths of diagnosed PLWH	Annual HIV diagnosis; Annual AIDS diagnosis; Annual diagnosis of 'recent' HIV infections; Annual deaths of diagnosed PLWH
Parameters	Rate of CD4 depletion; Rate of AIDS diagnosis; AIDS mortality rate; Non-AIDS mortality rate	CD4 depletion rate by age, gender, risk category and first CD4 count	HIV testing hazards for recent/asymptomatic infection; HIV testing hazards for AIDS cases; Distribution of time from infection to AIDS
Output	Incidence; Undiagnosed PLWH; PLWH (derived)	Annual new infections; Undiagnosed PLWH at the beginning of the study period; PLWH (derived); Undiagnosed PLWH (derived)	Incidence; Undiagnosed PLWH; PLWH (derived)

Results

- Between 2000 and 2014, the percent error of the estimated PLWH was <12% for the Netherlands Method, <18% for the US Method, and <18% for the Ottawa/Sydney Method.
- The percent error of the estimated proportion of undiagnosed PLWH was higher in comparison to those of PLWH, which can be as high as 296% from Ottawa/Sydney Method.
- In 2014, the estimated proportion of undiagnosed PLWH was 24% by US Method if 30%-70% of CD4 counts were missing, in comparison to 21% if all CD4 counts were available.

Results (continued)

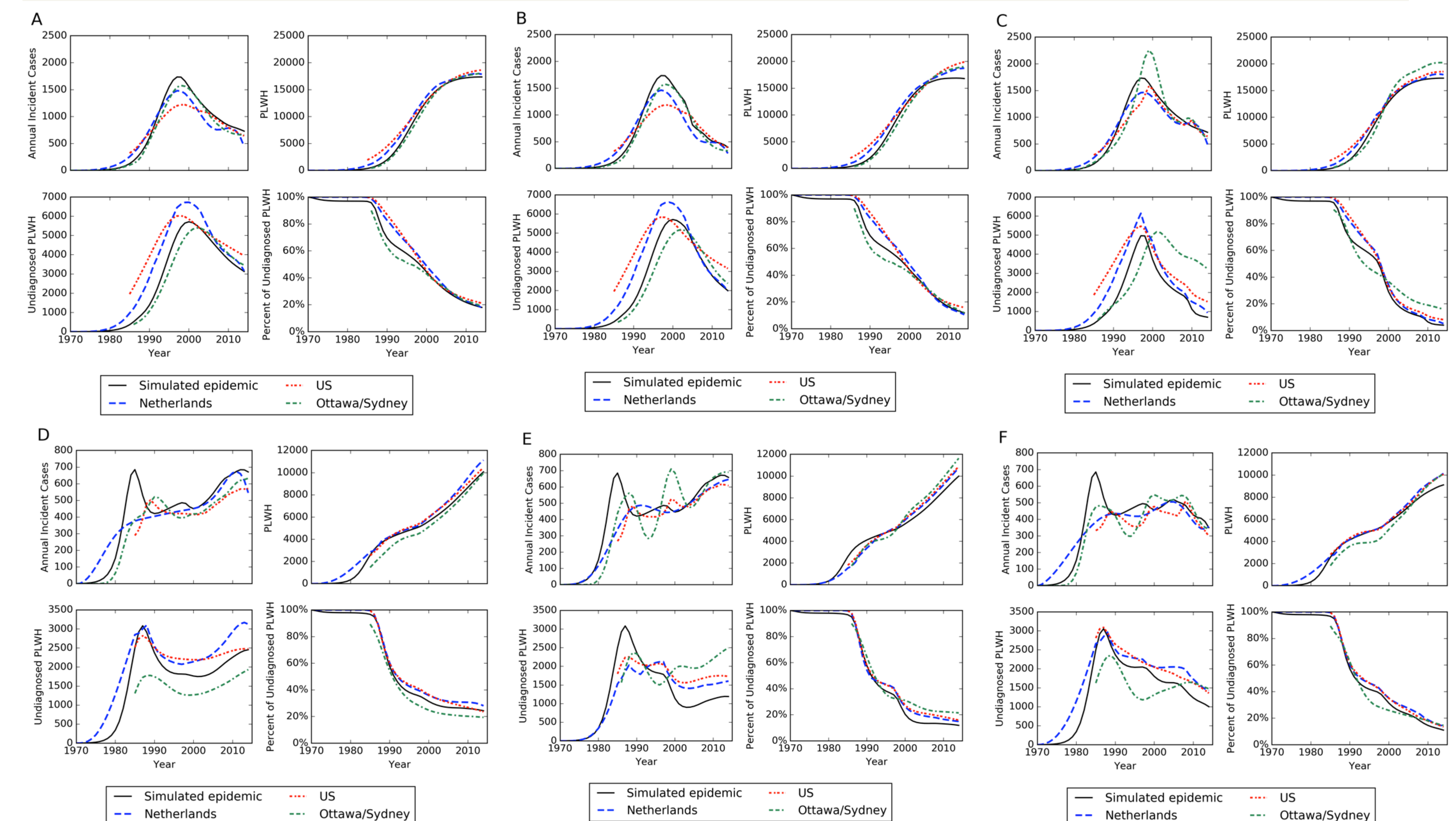


Figure 1. Estimated HIV incident cases, PLWH, undiagnosed PLWH and percent of undiagnosed PLWH based on different simulated surveillance data.

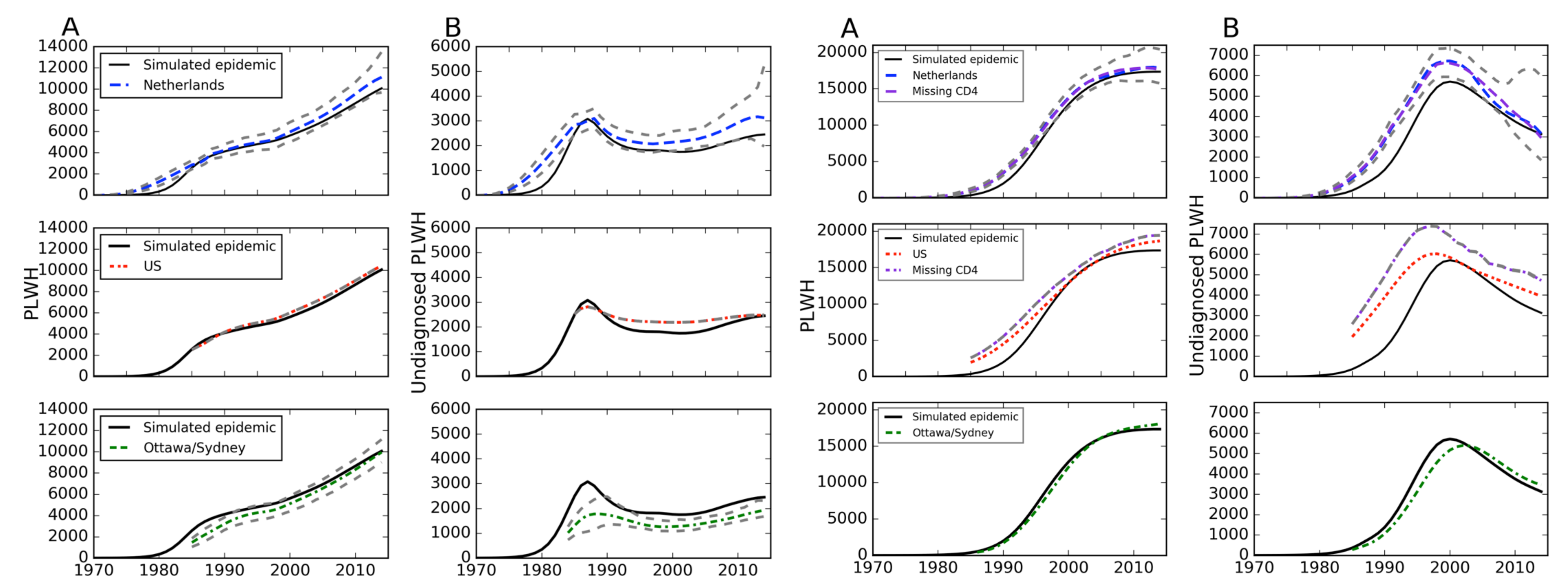


Figure 2. Estimates of PLWH and undiagnosed PLWH for the simulated epidemic (scenario from Figure 1D). Grey dashed lines represent the confidence interval of each estimate.

Figure 3. Estimates of PLWH and undiagnosed PLWH for the simulated epidemic (scenario from Figure 1A), with 30%-70% of CD4 counts missing.

Discussion

- None of the methods had optimal estimates for HIV incident cases, PLWH, undiagnosed PLWH and the percent of undiagnosed PLWH. However, we did observe consistent trends on recent estimates of all measures among the three methods.
- The percent error on the undiagnosed PLWH and the proportion of undiagnosed PLWH were relatively large for all three methods.
- The Ottawa/Sydney Method is particularly sensitive to abrupt changes of testing rate in the past.
- Estimates by the US Method highly depend on the completeness of first CD4 counts close to diagnosis.

Conflict of Interest Disclosure: We have no conflicts of interest.