Beware of using invalid transmission models to guide HIV health policy

Jeffrey Eaton and colleagues (January, p e23)\(^1\) used modelling to inform international guidelines for antiretroviral therapy for HIV. Specifically, they undertook a comparative cost–effectiveness analysis based on predictions from 12 independent transmission models: seven were used for South Africa, four for Zambia, four for India, and one for Vietnam. They concluded that all 12 models show similar results—that earlier eligibility for antiretroviral therapy is cost effective.\(^3\) They implied that their consensus finding increases confidence in the use of modelling results to guide HIV health policy.

The comparative consensus modelling approach used by Eaton and colleagues is now used frequently to justify the implementation of particular HIV interventions.\(^2,3\) However, this approach produces meaningful results only if the comparison is based on valid models. Most comparative consensus studies (including that by Eaton and colleagues) have not checked for model validity.

We checked the validity of the seven South African models that Eaton and colleagues used by reproducing some of their numerical simulations (figure). A valid model should accurately reflect the current state of the epidemic. Notably, we show that not all of the South African models agree on the present state of the epidemic; consequently, they cannot all be valid. Two models estimate that, at present, the epidemic (ie, incidence) is fairly stable, three that it is gradually decreasing, and two that it is rapidly decreasing (figure). One can only have confidence in the results from a comparative analysis if it is based on valid models. Only then can a comparative consensus approach be useful to guide health policy.

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**Figure:** Scenarios generated from seven different mathematical models used by Eaton and colleagues.\(^2\) For each model, the projected trend in incidence is based on the same assumption: that treatment conditions (ie, treatment eligibility criteria and coverage) remain the same as they are presently. Hence it can be seen that, under existing treatment conditions, two models estimate that the epidemic (ie, incidence) in South Africa is fairly stable (blue lines), three that it is gradually decreasing (green lines), and two that it is rapidly decreasing (red lines). These results were reproduced from data shown in figure 2 of Eaton and colleagues’ article.\(^3\)