Perspectives on the use of modelling and economic analysis to guide HIV programmes in sub-Saharan Africa

The Modelling to Inform HIV Programmes in sub-Saharan Africa (MIHPSA) Working Group*

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Summary:

HIV modelling and economic analyses have had a prominent role in guiding programmatic responses to HIV in sub-Saharan Africa. We reflect critically how the HIV modelling field might develop in future. We argue for HIV modelling to be more routinely aligned with national government and ministry of health priorities, recognizing their legitimate mandates and stewardship responsibilities, for HIV and other wider health programmes. We also place importance on an environment existing in which collaboration between modellers, and joint approaches to addressing modelling questions, becomes the norm rather than exception. Such an environment can accelerate translation of modelling analyses into policy formulation because areas where models agree can be prioritized for action, whereas areas over which uncertainty prevails can be slated for additional study, data collection and analysis. We also argue the need for HIV modelling to increasingly be integrated with the modelling of health needs beyond HIV, particularly in allocative efficiency analyses, where focusing on one disease over another may lead to worse health overall. Such integration may also enhance partnership with national governments whose mandates extend beyond HIV and to all of health care. Finally, we see a need for there to be substantial and equitable investment in capacity strengthening within African countries, so that African researchers will increasingly be leading

modelling exercises. Building a critical mass of expertise, strengthened through external collaboration and knowledge exchange, should be the ultimate goal.

Main manuscript:

HIV treatment and prevention programmes have contributed to impressive increases in national life expectancies in sub-Saharan Africa (SSA). For instance, life expectancy has increased from 45 years in 2000 to 65 years today in Malawi, from 45 to 62 years in Zimbabwe, and 56 to 64 years in South Africa.[1] Despite this significant progress, almost 1 million new HIV infections are still occurring each year in the region.[2] HIV policymakers and programme planners, particularly those working at national levels (i.e., for ministries of health and national AIDS commissions), face challenging economic choices over the allocation of limited resources across treatment and prevention interventions, including prioritization geospatially and amongst heterogeneous populations. Mathematical disease modelling can guide resource allocation and has played an important role in shaping HIV policies, such as the move towards providing ART for all people living with HIV,[3-4] the introduction of dolutegravir[5-6] and scale-up of voluntary medical male circumcision.[7-8] However, to date, there has been relatively little critical reflection on its role within the institutional arrangements that characterize HIV responses in SSA.

Funding environments for the delivery of HIV services in SSA are complex and fragmented. Commitments from country governments in SSA to sustain their own HIV response have increased over the years;[9] in all countries they usually fund health care worker and facility infrastructure costs, for instance, as well as provide managerial oversight, stewardship and coordination. Nevertheless, there is a substantial reliance on overseas development assistance (ODA) and this calls into question how modelling analyses can best be conducted and used, given the differing roles and mandates of national public authorities and their external partners. In 2019, funding from international channels accounted for 59% of total HIV spending in east and southern Africa and 64% in west Africa.[10] The two largest sources of ODA for HIV in SSA are the Global Fund to Fight AIDS, Tuberculosis and Malaria (The Global Fund) and the United States government's President's Emergency Plan for AIDS Relief (PEPFAR) programme, which together accounted for 85% of the $6.795 billion spent in 2019.[11] Other international funders (e.g. France, the United Kingdom and the Netherlands) also make substantial contributions.

The high reliance of HIV programmes in SSA on ODA comes with risks, given the interdependencies between the organizations involved in the funding and delivery of HIV services. Development assistance has plateaued since 2010 and there are signs of reduced commitments to HIV.[11] This has led to talk of an 'HIV funding transition' in which African countries would increasingly fund HIV services through domestic financing. Whether this transition happens and the speed at which it may take place are still uncertain, but it could have widespread ramifications for how HIV services are delivered, e.g., a shift away from delivery by international non-governmental organizations towards nationally-run, public

systems. Such a shift would require countries to take on increased responsibility for HIV programme delivery in the face of a myriad of other health challenges.

It is necessary to consider who should be responsible for the generation and use of evidence on resource allocation, including through modelling, in this context. Stakeholders involved in funding and planning HIV programmes in SSA have a strong interest to ensure their resources are spent to generate the greatest possible beneficial impacts. Although the goals for all major organizations working on HIV in SSA appear to be broadly the same (i.e. to reduce HIV incidence and the adverse health and welfare consequences of HIV), what this means for programme planning can differ depending upon what the specific objective used in modelling is. Models can, for instance, provide evidence to minimize HIV-related deaths, minimise HIV incidence, maximize equity of access to services, minimise spending to reach a target or maximize disability-adjusted life years (DALYs) averted in a population from some given level of budget spend. Each of these objectives would be considered important to all organizations working on HIV in SSA, but not all can be met simultaneously. Ultimately the decision on prioritization between objectives which are not all attainable introduces subjective judgements that should necessarily be made through a process of deliberation amongst local stakeholders, informed by the modelling evidence. The meaningful involvement of affected populations in such deliberations is important.

Organizations that use models to inform their own planning processes do so with slightly differing purposes. The Global Fund, for instance, supports countries to develop national strategic plans (NSPs) on which to base their funding requests. It explicitly recommends that modelling is used to determine an "allocatively efficient" configuration of a country's HIV programme.[12] This can comprise health systems requirements, such as staffing and infrastructure needs, which support many interventions, as well as direct funding to treatment and prevention interventions. Funding allocations from PEPFAR are laid out annually in Country Operational Plans (COPs).[13] These are guided by a longer-term strategic plan,[14] informed by modelling, and tend to be highly specific in what interventions are funded and where. UNAIDS is leading the global effort to end AIDS as a public health threat by 2030 and facilitates inclusive processes at country-level, to estimate health burdens, track the status of programmes and monitor progress[11,15]; a new strategy emphasizes a people-centred approach and addressing of inequalities.[16] The UNAIDS intervention coverage targets are informed by modelling.[17] The World Bank is also concerned with allocative efficiency across all HIV-related spending, with bundles of interventions differing widely by country. The WHO, although it relies mainly on clinical and service delivery data in the development of its clinical guidelines, is increasingly incorporating insights from modelling studies into its global guidelines, especially in relation to cost-effectiveness.[18,19]

At the centre of these varied activities are country governments, in particular ministries of health and national AIDS commissions, that face often severe resource and human capital constraints but have to engage in grant applications and numerous planning and reporting exercises to meet the requirements of their diverse funders. They receive support from their funders and other technical partners, but as mentioned above each organization inevitably has slightly differing aims. Country government authorities are recognized through international agreements and conventions as ultimately having the mandate to make decisions on setting

policy and resource allocation. The Paris Declaration on Aid Effectiveness and Accra Agenda for Action, for instance, emphasize national ownership of policy formulation, mutual accountability between international funders and host governments, and a focus on results.[20] Most HIV models used in guiding policy in SSA have been developed by research teams based in universities or other research institutions, mostly in high-income countries. While some country governments in Africa are already increasing their capacity to use modelling for policy formulation, further development of these capabilities is necessary to fulfil the vision of the Paris Declaration.

HIV modelling needs to be grounded in the policy choices faced by countries, led by local health authorities, and directed toward issues of greatest consequence for population health and well-being. However, local health authorities currently have limited capacity to fund, commission, conduct, coordinate, and ultimately use modelling analyses. One consequence of this limited capacity has been a relatively narrow focus of modelling analyses on addressing questions set by international funders, typically on HIV programs and their HIV-specific goals, rather than addressing questions arising from country-level policymaking processes. Such questions could include how to better integrate funding and delivery mechanisms for HIV services with wider health care concerns and systems planning, as well as further exploration of the distributional and equity consequences of different resource allocations. Modelling relies upon the availability and quality of underlying data and international efforts to collate data on model inputs, such as on intervention costs, can be beneficial for constructing models. When data quality is poor, techniques such as expert elicitation to inform model parameters can be used.[21] Moreover, where there are major uncertainties due to lack of data, modelling can highlight where additional data would be most valuable to strengthen the reliability of modelling results to better inform policymaking.[22]

The Sustainable Development Goals (SDGs), set for 2030 and towards which all countries are now working, include Ending AIDS as a public health threat (SDG3.3) and also a commitment to Universal Health Coverage (SDG3.8), defined as access to a basic package of health care to which all citizens are entitled. To meet both objectives requires sustaining and expanding the successful response to HIV and also ensuring this aligns with and contributes to wider expansion of effective health services to all in need.

The 2021 Political Declaration on HIV and AIDS includes commitments to accelerate integration of HIV services into universal health coverage (UHC) and strong and resilient health and social protection systems, synergistic with other SDGs.[23] The Global Fund and PEPFAR have also developed policies to support these efforts and their funding for health systems strengthening (HSS) has more than doubled between 2010 and 2017.[9] The goals of UHC and Ending AIDS must be met in tandem – bringing HIV epidemics under control helps to limit budgetary demands, freeing up resources for investments towards UHC, and ensure the long-term financial sustainability of HIV spending. Modelling can play an increasingly prominent role in HIV programme design, but this also needs to be done in cognizance of other health needs. If the right decisions are made, this could lead to HIV services becoming more efficient and better integrated with other health services, supporting patient-centred care and reducing inequalities. Steps in this direction must be evidence-based and careful to ensure that the successes seen in HIV programmes to date are not compromised in the process of integration

with broader healthcare delivery systems. They could be accompanied by similar changes in other areas of health care that have been reliant on ODA, such as malaria.[24]

For modelling to contribute most effectively to HIV programme design and UHC in future, in our view, requires four things. First, that HIV modelling is more routinely aligned with and ideally emerges from national government and ministry of health priorities, recognizing their legitimate mandates, and based on an understanding of country needs. This should be conducted according to established best practices[25] and use recognized taxonomies of interventions.[26] Even if modelling continues to be predominantly commissioned and funded internationally, in the short term, it is imperative that it is focused on issues emanating from the country perspective. Second, that an environment exists in which collaboration between modellers and joint approaches to addressing modelling questions becomes the norm rather than exception. Such an environment can accelerate translation of modelling analyses into policy formulation because areas where models agree can be prioritized for action, whereas areas over which uncertainty prevails can be slated for additional study, data collection and analysis. Third, that HIV modelling is integrated with the modelling of health needs beyond HIV, particularly in allocative efficiency analyses, where focusing on one disease over another may lead to worse health overall. This integration may also enhance partnership with national governments whose mandates extend beyond HIV and to all of health care, as reflected in national health sector strategic plans, other national policies and the international commitment to UHC. There is also potential for strengthened regional partnerships within SSA. Fourth, there needs to be substantial and equitable investment in capacity strengthening *within* African countries, so that African researchers will increasingly be leading modelling exercises. In addition to being better aligned to local health challenges, African-led studies are also likely to resonate more and lead to better uptake by local policymakers.[27] This can only happen with the commitment of all key stakeholders and, crucially, large and sustained funding. Building a critical mass of expertise, strengthened through external collaboration and knowledge exchange, should be the ultimate goal.

HIV programmes and policy needs are best understood locally, and evidence-informed policy formulation needs to be a continuous endeavour led by local actors. We believe our suggestions, if implemented, would represent a step-change in efforts to attain improvements in population health and well-being in countries most adversely affected by HIV. Similar approaches could also be adopted in and have been advocated for other areas of health care, especially those that are reliant on ODA, such as malaria.[22] This Viewpoint has been developed collaboratively between leading practitioners of HIV modelling and those working on HIV policy focused on SSA, but the balance of authorship is heavily balanced towards northern institutions. This is indicative of the challenges faced but also the willingness of key actors to work in better ways. It is in the interest of all that, in future, leadership of analysis and policy decisions that respond to the challenges posed by HIV are increasingly centred in Africa.

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