

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

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

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64

65 Summary:

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

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

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85 Main manuscript:

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

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

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

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

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

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

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

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

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

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

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

208 with broader healthcare delivery systems. They could be accompanied by similar changes in  
209 other areas of health care that have been reliant on ODA, such as malaria.<sup>24</sup>

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

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

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247 **References**

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