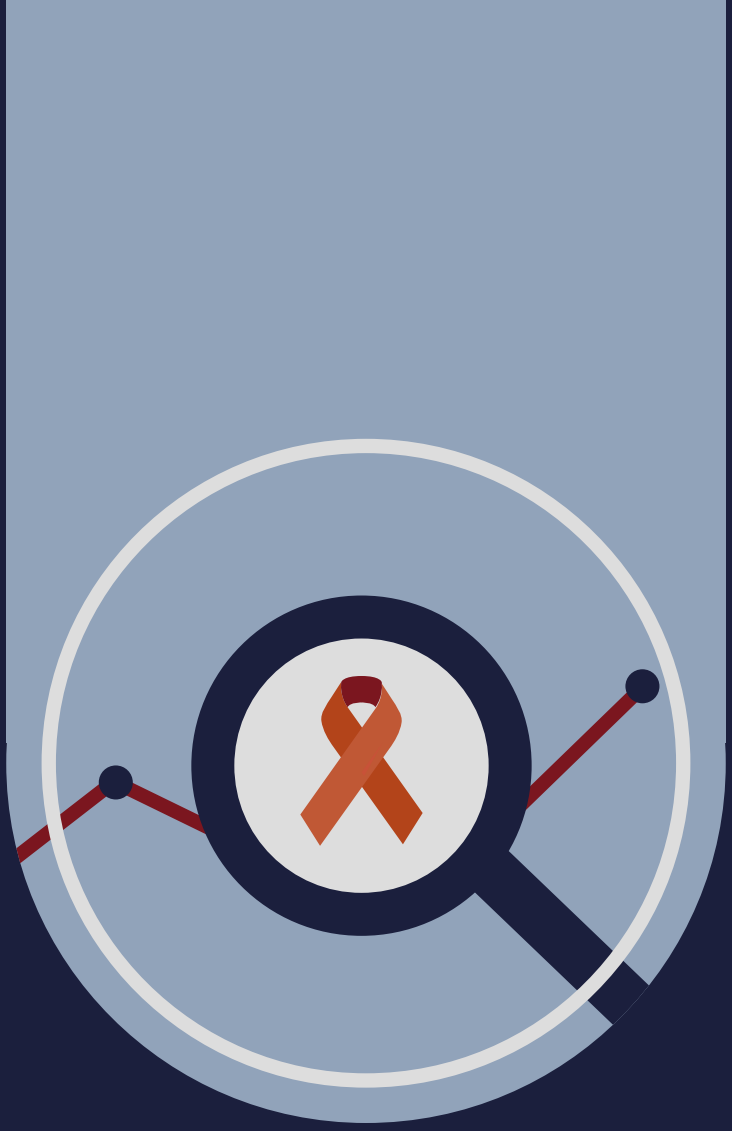

THE ECONOMIC IMPACT OF HIV

A SUMMARY OF THE EVIDENCE

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FOREWORD

How can a middle-income country's government keep financing its HIV response if donors depart? What are the returns on investment in that response in terms of deaths averted and lives saved – but also productivity gains and economic growth? How can additional funds be raised to safeguard previous investments? Which factors could potentially increase the efficiency of the HIV programme itself? And how has the Covid-19 pandemic changed the prospect for international and domestic financing of other health programmes, including HIV?

These are questions that we at the Bill & Melinda Gates Foundation encounter regularly in our work with officials from countries with a high HIV burden. The authors of the 20 briefs contained in this book, Markus Haacker of University College London and Gesine Meyer-Rath of University of the Witwatersrand, set out to answer just these questions, while also using HIV as a case in point for the financing of health programmes more generally. HIV is a useful test case because more is known about its economic impact than about that of any other disease. This is due to the relatively recent arrival of HIV compared with other chronic diseases, its high death toll if left untreated, and the severity of its impact on the most economically productive part of any country's population – working-age adults.

The authors have done a stellar job of reviewing four decades of evidence, weighing the quality of individual studies, highlighting what we know, and what we do not yet know (or not with sufficient certainty), and summarising the most important findings under 16 different aspects of the economic impact of HIV. These range from the impact of HIV on human capital (Policy Brief #4) and productivity (Policy Brief #6) to the role of external vs domestic and public vs private health funding in the HIV response (Policy Brief #14), and tools that can be used in trade-offs between health and other sectors of government planning (Policy Brief #10), between HIV and other health objectives (Policy Brief #12), and between different HIV interventions (Policy Brief #16). Given that the project took off just when the Covid-19 pandemic did, in early 2020, the authors have added a summary of the interaction between the new and the old pandemics (Policy Brief #17).

The main intended audience for these briefs is decision-makers and their advisors in low- and middle-income countries, for example, in ministries of health or finance, particularly in countries with a high HIV burden or facing discontinuation of donor support. Bearing in mind the many demands on such officials' time, the authors have summarised the most pertinent points in three 3-page summary briefs, on health and economic returns on investments in HIV (Summary Brief #1), a fiscal perspective on the HIV response (Summary Brief #2), and a health-sector perspective on the HIV response (Summary Brief #3). These briefs were added to the originally planned 17 policy briefs in response to inputs given by officials from ministries of health and finance during a set of six webinars, organised by the authors and the foundation, to discuss the content of the policy briefs before finalisation.

We are grateful for the deep engagement and rich input of these officials during the webinars, along with representatives of academic institutions and international organisations, including the main funders of the global HIV response. The briefs were made much stronger by this additional level of review. In addition to thanking the two authors of these briefs, I would like to express my gratitude to my foundation colleagues Kate Harris and Lorna Tumwebaze, and to Arjun Vasan of the US Department of the Treasury, for their leadership of this project and many direct inputs. I also thank Stefano Bertozzi of UC Berkeley for his stewardship and crucial guidance as the briefs took shape.

I hope that this collection, as well as the accompanying website, will prove a valuable resource for those faced with the task of making decisions to safeguard the future of their countries' HIV programmes well into the future – the task which the Economic Impact of HIV project set out to accomplish.

Seattle, December 3rd 2022

Prof. Geoff P. Garnett

INTRODUCTION

This book summarises the findings of the Economic Impact of HIV project funded by the Bill & Melinda Gates Foundation during 2020 to 2022. The project set out to synthesise the evidence on the economic impact of HIV in a series of policy briefs that can help decision-makers in ministries of finance and health in low- and middle-income countries (LMIC) decide on the future financing of their country's HIV programme. Our findings were detailed in 17 policy briefs, and the main points were further summarised in three summary briefs. The project incorporated a series of webinars with an audience of academics and LMIC government staff aimed at refining the content and presentation of the briefs, and the publication of the policy briefs on a website (https://hivecon.co.za/).

The overall framework defining the broader categories and topics for the individual briefs was developed by attendants of a meeting in Cascais, Portugal, in September 2018. This framework comprised two broad pillars, capturing economic and social impacts of HIV on the one hand, and economic and social trade-offs on the other. These were further sub-divided into six main categories and 15 topic areas, each of which was intended to inform one brief (see Figure 1). We refined some of the topic areas during development of the briefs, and added a brief summarizing all aspects of HIV's impact on economic growth, as well as a brief on HIV financing in the time of COVID-19, given the prominence of these concerns during the recent pandemic. The additional brief topics are shown in italics in Figure 1.

Figure 1: Framework for Economic Impact of HIV project.

ECONOMIC & SOCIAL IMPACT OF HIV	ECONOMIC & SOCIAL TRADE-OFFS
Health Impact	**Economy-Wide Trade-offs**
Services: Availability, efficiency, and quality	**Fund Generation:** Options for raising domestic public funding
Outcomes: Morbidity, mortality, life-expectancy, and their economic value	**National Budget:** Trade-offs between allocation to helath and other sectors
Growth Impact	**Within Health Sector Trade-offs**
Population: Mortality, fertility, and the dependency ratio	**Health Budget:** Trade-offs and synergies between HIV and other health objectives
Human Capital: Health and education of the labor force	**Health Budget:** Assessing cost-effectiveness across HIV and health interventions
Physical Capital: Health-related infrastructure	**Cost/Coverage:** Private and public domestic health funding
Overall Productivity: Technology, institutions, and governance	**Public/Private:** Trade-offs between public and private provision of health services
Summary of all growth impact	**Within HIV Trade-offs**
Distributional Impact	**HIV Budget:** Trade-offs currently and over time
Income: Levels of disposable income and poverty within population sub-groups	**HIV financing in a time of Covid-19**
Disease: Share of the disease burden borne by population sub-groups	

This book combines all 17 policy briefs, the three summary briefs, and a report on gaps in the current research that we identified as we reviewed the existing evidence. Together with a master slide set available from our website (https://hivecon.co.za/), we hope that these materials will make it as easy as possible for policymakers in countries with a high HIV burden, decision-makers in international organisations, and colleagues in academic organisations to engage with the evidence that we collected and bring it to bear on your daily work and, ultimately, on the planning and financing of a sustainable HIV response.

Johannesburg/Oxford, December 9th 2022

Dr Gesine Meyer-Rath

Dr Markus Haacker

POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

SUMMARY BRIEF #1

HEALTH AND ECONOMIC RETURNS ON INVESTMENTS IN HIV

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This summary brief forms part of a body of work on the Economics of HIV, funded by the Bill & Melinda Gates Foundation (INV-002382). All materials, including two other summary briefs and 17 more detailed policy briefs, can be accessed on https://hivecon.co.za. The authors acknowledge the comments of participants of a webinar in March 2022 on a previous version of this brief and the excellent work of James Baer, Carla Hauptfleisch, and Michael Obst. The findings and conclusions contained within this brief are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or of the institutions the authors represent.

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Markus Haacker, Kate L Harris, Lorna Tumwebaze, Gesine Meyer-Rath: Health and Economic Returns to Investments in HIV. Summary brief #1 of series "Economic Impact of HIV". Johannesburg, June 2022.

SUMMARY BRIEF **#1**

HEALTH AND ECONOMIC RETURNS ON INVESTMENTS IN HIV

Investments in HIV have worked to defend against the potentially destabilising effects of high AIDS-related mortality. The return on investments in the HIV response largely arises from decreased mortality and improved survival. As a result of increased access to timely HIV treatment, more people survive and contribute economically. Given that HIV impacts people in their prime working years, better health also means improved economic outcomes as treatment enables people living with HIV to avoid health-related unemployment and diminished access to education for their children. These gains carry through to the economy overall in the form of larger GDP.

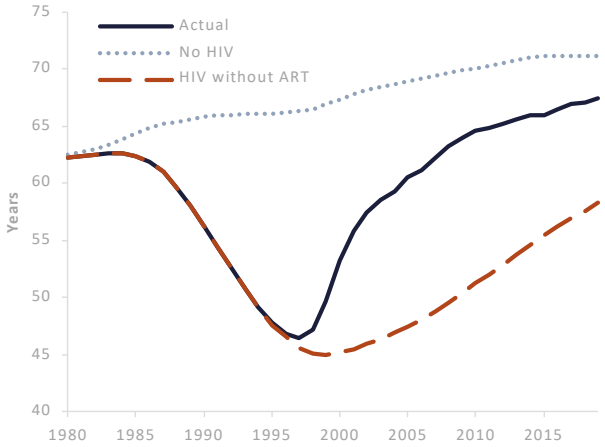
From the beginning of the HIV pandemic, it was feared that HIV would have a negative economic impact in addition to its devastating health consequences. Given that the disease affects predominantly working-age adults, there was a concern that high AIDS-related mortality and the ballooning number of orphans would destabilise societies and economies, especially in sub-Saharan Africa where HIV was most prevalent (Policy brief #4). In 2001, the United Nations General Assembly described HIV/AIDS as "a global emergency and one of the most formidable challenges to human life and dignity [...] which undermines social and economic development throughout the world" (UNGA, 2001).

Propelled by these concerns, the global partnership on HIV came together in the early 2000s to mobilise domestic efforts and an unprecedented level of international support in response to the epidemic. This investment has largely reversed the negative health and economic consequences of HIV. People living with HIV across low- and middle-income countries can now realistically have a near-normal life expectancy (Policy brief #2) and contribute fully to the economy, provided that they are diagnosed and initiate treatment sufficiently early (Johnson et al., 2013).

The most immediate effects of the HIV response are its impacts on the health and survival of people living with HIV and on the transmission of HIV (Policy brief #1). Globally, annual AIDS-related mortality among people living with HIV has declined from 5.8 percent in 2000 to 1.8 percent in 2020. The number of annual new HIV infections declined by nearly half between 2000 and 2020, from 2.9 million to 1.5 million, and even faster in Eastern and Southern Africa, where many countries with high HIV prevalence are located (UNAIDS, 2021).

The scaling-up of treatment has made significant contributions to improved global and national health outcomes overall (Policy brief #2). Declining AIDS-related mortality has contributed about one-sixth (0.9 years out of 5.5 years) of global gains in life expectancy between 2002 and 2019. The impact has been dramatic in some countries with very high HIV prevalence. In Botswana, for example, life expectancy fell below 50 years in the early 2000s – among the lowest anywhere – but has since rebounded to 68 years (and the loss in life expectancy owing to HIV/AIDS is now down to about 3½ years.

Figure 1: Life expectancy, Botswana, 1980-2019



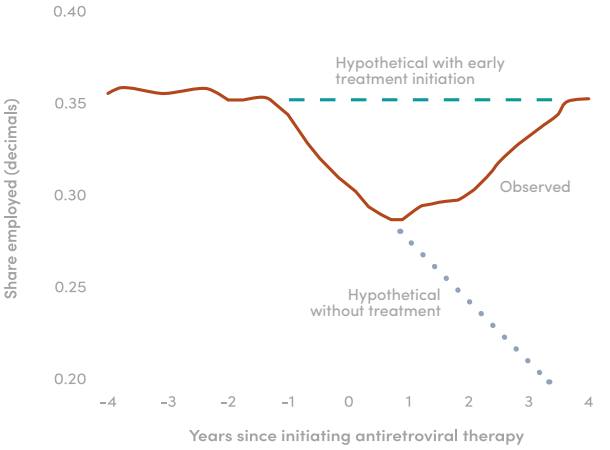
Source: UNAIDS (2020) and own calculations.

The health gains from longer survival directly translate into economic gains for people living with HIV (Policy brief #6). People living with HIV who start treatment have been shown to recover most of their productivity, in addition to surviving longer (Figure 2). People initiating treatment early – before AIDS-related symptoms become apparent – avoid such steep productivity losses and often-lengthy spells of unemployment altogether (Figure 3, see Policy brief #6).

Figure 2: Productivity loss among workers living with HIV (working days per month)

Source: Haacker (2016), adapted from Larson et al. (2013).

Figure 3: Employment trend among HIV patients receiving antiretroviral therapy



Source: Bor and others (2012).
Notes: The "observed" curve is from Bor et al. (2012); the curve for "early treatment initiation" is a hypothetical addition for our discussion.

A less immediate economic effect arises from the impacts of HIV on education (Policy brief #4). Educational attainments and school attendance have been shown to be lower for orphans and in areas where HIV prevalence is high (Beegle et al., 2010; Mishra & Bignami-van Assche, 2008; Fortson, 2011). Living with a parent who is HIV-positive also has had a negative effect on education (Evans & Miguel, 2007). The data underlying these studies are, however, from the early 2000s and thus precede the scaling-up of treatment, which has plausibly mitigated these adverse effects.

From a macroeconomic perspective, the principal consequence of these HIV-related losses in life and health is a reduced growth of the working-age population (Policy brief #3). Additionally, because of lower birth rates, or AIDS deaths among children who were infected at or around birth, cohorts affected by HIV as children and ageing into the working-age population are also smaller. Overall, in some countries with high HIV prevalence the working-age population is now about 10 percent smaller than it would have been in the absence of HIV (Policy brief #3).

Established macroeconomic "growth accounting" approaches suggest that GDP consequently is several percent smaller than it would be without the impact of AIDS by around half of the loss in the size of the working-age population (Policy brief #7). However, evidence on the impact of HIV on GDP per capita is ambiguous because HIV impacts two key factors – population growth and productivity – affect GDP per capita in opposite ways. HIV's negative impact on population growth increases GDP per capita as productive assets are divided among fewer people. Simultaneously, lower productivity of people living with HIV and lower government investment because of high HIV spending reduce it. These two effects on GDP per capita broadly offset each other.

Investment in the HIV response contributes to increased GDP growth primarily by reversing the slowdown in population growth caused by AIDS-related mortality (Policy brief #3). In fact, this investment will plausibly lead to higher economic growth than "without AIDS" over the coming years, as larger cohorts not depleted by high AIDS-related mortality replace cohorts which have suffered from high AIDS-related death rates before treatment became widely available, making population growth higher than otherwise.

The economic impacts of HIV and the returns on investments in the HIV response largely arise from decreased mortality and improved survival (Haacker, 2016; Resch et al, 2011). More people survive and contribute economically. But the response to HIV does not make the economy richer

on average, since the higher GDP is shared among a larger number of people. The survival gains are of course significant and important in their own right. Additionally, approaches to assigning a monetary value to survival gains from investments in HIV often find that this value is considerably higher than the output gains from increased survival (Policy brief #2; Lamontagne et al., 2019).

Taking a step back from interpreting these "growth accounting" exercises or valuations of health gains, it is important to recall that the global response to HIV was motivated by averting the feared catastrophic effects of unprecedentedly high mortality, especially in some of the world's poorest countries. As of 2000, it was expected that up to half of young people growing up in some countries with high HIV prevalence would eventually die because of AIDS. Because of the ubiquitous effort to fight HIV, such catastrophic impacts did not materialise anywhere; for the same reason, we never had to find out how bad the economic and social repercussions of such a health shock would have turned out. That by itself is one of the returns to investment in the global response to HIV.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

SUMMARY BRIEF #2

A FISCAL PERSPECTIVE ON THE HIV RESPONSE

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SUMMARY BRIEF **#2**

A FISCAL PERSPECTIVE ON THE HIV RESPONSE

Because HIV is an infectious disease, an effective response requires a public-health approach and hence a strong government role. Beyond the immediate health effects, investments in the HIV response achieve macroeconomic gains, reduce health and socio-economic inequities, and also yield concrete financial returns. And the big prize – shifting the trajectory of the epidemic so that HIV no longer poses a significant public-health challenge – will yield long-term health and economic gains often not captured in policy analysis.

Effectively controlling infectious diseases such as HIV (and, similarly, Covid-19) requires a public-health approach and hence a strong government role to defend against their negative health and economic costs. For both, the consequences of an individual's risk behaviour go beyond individuals to the wider community, since infected individuals can transmit the disease to others. Likewise, treating a person living with HIV also benefits more than just the individual, given that a person on treatment is far less likely to transmit HIV to another person. Thus, equitable public provision of HIV services contributes to realising the full societal benefits of HIV prevention and treatment.

The most immediate effects of investments in HIV are the improved health and survival of people living with HIV, and a decline in the number of new infections (Summary brief #1). Beyond this health perspective, investments in HIV also create macroeconomic, socio-economic and financial benefits – some accruing directly to beneficiaries, others (e.g., fiscal revenues, improved health equity) arising from a societal or fiscal perspective.

Investments in treating and preventing HIV yield well-established macroeconomic returns by restoring health and saving lives (Summary brief #1, Policy briefs #3, #6, #7). Indeed, the global response to HIV and universal access to treatment was in part motivated by the perception that the devastating health consequences would result in catastrophic social and economic impacts, both locally and globally. In some of the worst-affected countries, before treatment was widely available, AIDS had more than doubled overall mortality and caused a five-fold increase in mortality at ages 15-49 (IHME, 2020). Treatment restores the productivity of people living with HIV and extends their lives, often by decades and during their prime working age. This means that productive capacities are preserved, and GDP is consequently larger because of the treatment roll-out. For example, the working-age population of South Africa is about 7 percent larger now than it would have been without any access to treatment. Using common estimates of how increased working-age population contributes to GDP (Policy brief #3), this means that GDP could be 4-5 percent larger now as a result of treatment scale-up. In addition to improving macroeconomic outcomes and therefore contributing to government revenues, HIV investments serve various development policy objectives indirectly, notably by improving health equity and preventing poverty.

In the absence of free public provision of treatment, treatment would be unaffordable to a large share of the population in many countries. According to cost analyses summarised in the Global Health Cost Consortium's Unit Cost Repository, the average per patient year cost of adult first-line treatment ranged between $130 and $984 (in 2020 USD) across countries, sites and types of facility ownership, with a median cost of $391 (inter-quartile range, $334-489) (GHCC 2022). At the same time, coverage of any type of insurance across sub-Saharan Africa, where HIV is most prevalent, is very low (7.9 percent of the population across 36 countries where such data were available) and heavily concentrated among richer households (Barasa et al., 2021). And poverty remains widespread in the region. As of 2018, 40 percent of the population of sub-Saharan Africa were living below the poverty line of US$ 1.90 a day (Schoch & Lakner, 2020). Affordability is a key barrier to healthcare for these populations. HIV treatment costs at least US$ 100 per year to access privately, a catastrophic expenditure that many households could not afford and would cause a widening and deepening of poverty (in the sense of Wagstaff et al., 2018). Moreover, although drug prices have fallen steeply over the last decades (on the basis of generic manufacturing, bulk procurement through the public sector, and with substantial international support), these reduced prices are not normally accessible to private providers.

For these reasons, free public provision of treatment has been a key contributor to achieving high treatment coverage, which in turn is a cornerstone of the effort to "end AIDS" through early treatment not only for increased survival but also as a prevention measure (UNAIDS, 2014). High treatment coverage is also thought to be a contributor to mitigating socio-economic health inequities, as coverage rates attained in many countries indicate widespread access, and as the limited evidence available suggests that treatment coverage is fairly even across socio-economic categories, or at least no worse than the coverage of other essential health services like birth attendance (Policy briefs #8 and #9).

Free public provision of HIV treatment and prevention programmes also contributes to financial risk protection and alleviating poverty. Poor health is a key cause of poverty, and access to healthcare enables individuals to avoid illness or improve their health, thus avoiding a cause of sustained poverty. Free public provision of HIV services thus contributes to poverty reduction by avoiding HIV-related job and income losses, preserving household income and other household resources, and preventing disruptions in access to education for children living in households affected by HIV (Policy brief #4).

Second, HIV is unique in its high share of donor funding relative to domestic investments in order to make HIV programmes readily affordable to lower-income countries. As a result, policy discussions on the financing of the HIV response are atypical and frequently in part separate from the policy discourse on more general health financing. In 2017, donor funding accounted for more than half of HIV funding for the majority of people living with HIV in low- and middle-income countries (Policy brief #11). Spending decisions therefore reflect a combination of donor policies and the preferences of the domestic government, regarding both health objectives and the socio-economic objectives outlined above (Policy briefs #11 and #12).

HIV policies, however, contribute to fiscal space in other ways, too – fiscal space that can be used for HIV policies or for other government objectives. One way is through increased GDP: as a larger population sustains a larger GDP, the government's revenue base is larger, fiscal revenues are larger than otherwise, and some of this increase could be used for the HIV budget. This avenue, though, contributes little to refinancing investments in HIV from a fiscal perspective. For example, if each US dollar invested in the HIV response across low- and middle-income countries yielded US$ 2.6 in additional output (as suggested by Lamontagne et al., 2019, predominantly through increased population size; see Policy brief #2), only some 20 percent of this (and less in many developing countries), i.e., $0.5 or one-half of the amount invested, might accrue to the government in additional tax revenues. And because a larger population also requires more public services overall, only a part of these additional revenues can be utilised freely.

The more immediate policy contribution to financing the HIV response is through effective programming and implementation, especially for lower-cost prevention efforts. Under public provision of treatment, each HIV infection requires a sustained financial commitment from the government. While the annual costs of treatment have come down immensely, high treatment coverage and early initiation of treatment mean that this financial commitment caused by each new infection has declined much less. For example, an HIV patient who initiates treatment at a CD4 count of 350 cells/microl can be projected to survive for about 33 years with HIV and receive treatment for 25 years (Haacker, 2016) and – assuming an annual cost, including applicable overheads etc., of US$ 200 – at a life-time cost of US$ 5,000.

Effective HIV prevention, by reducing the number of new HIV infections and avoiding the resulting fiscal costs, thus contributes to containing or even reducing the costs of the HIV response overall. Indeed, some HIV prevention interventions such as condoms and male circumcision are frequently considered cost-saving, resulting in financial savings in HIV spending that exceed the costs (Policy brief #16) – even before taking account of further economic returns.

A second important aspect of effective programming and implementation is speed. HIV prevention interventions are most effective when HIV transmission is still high. For example, male circumcision prevents the greatest number of HIV infections when the infection risk for males receiving it is highest. If the scaling-up of male circumcision is slow while infection risk comes down because more people living with HIV receive treatment and are virally suppressed, then (i) more people get infected before they become circumcised, and (ii) male circumcision, when it occurs, makes a smaller contribution to reducing the number of new infections.

Much of HIV programming is about getting the balance right between fast implementation, overcoming capacity constraints, and any increases in costs which might occur as a result of faster implementation. On the programme level, the gains from fast implementation often result in choices between a rapid scale-up of services, followed by a sustained decline in costs as the effects of reduced HIV incidence kick in, and a slower rate of implementation but with lower health gains and more persistent and higher costs in the medium and long terms.

Stepping back, much of HIV programming is about permanently shifting the trajectory of the epidemic and "ending AIDS" as a high-order public-health challenge, allowing countries to spend health budgets on other priorities. The permanent, longer-term gains of HIV programmes are rarely captured in conventional policy analysis, which focuses on the direct effect of policies pursued over a fairly short period. In doing so, estimates of cost-effectiveness and of economic or financial returns to investments in HIV therefore tend to understate the effectiveness and cost-effectiveness of HIV policies. Effective policy advice needs to communicate the lasting economic and health effects of shifting the trajectory of the epidemic alongside immediate health gains.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

SUMMARY BRIEF #3

HIV: A HEALTH-SECTOR PERSPECTIVE

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SUMMARY BRIEF **#3**

HIV: A HEALTH-SECTOR PERSPECTIVE

HIV has contributed to the strengthening of health systems overall, and the integration of HIV and other health services has improved the efficiency of both services and helped with managing HIV as a chronic disease. Private-sector providers appear roughly as effective in providing HIV-related services as public services, although they disproportionately serve wealthier populations. Public-private partnerships have played a role especially in capacity-building and technology transfer. Cost-effectiveness analysis can assist in health decision-making, including quantifying trade-offs between HIV and other health interventions, although its use in optimising allocative efficiency is limited by implementation and equity considerations.

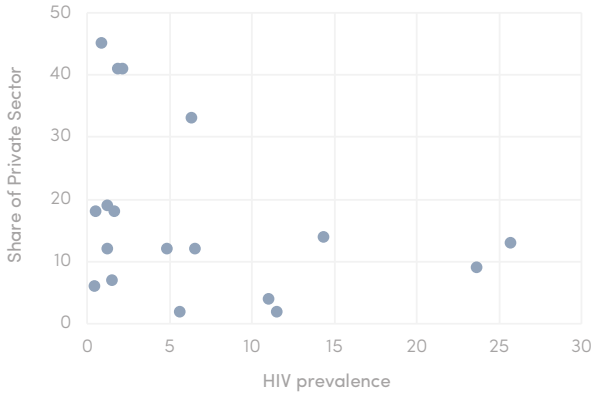
HIV services: Integration, synergies, and public vs private provision

Over the last three decades, HIV services have seen a drastic increase in funding, but this has in turn also helped fund other health services. This is particularly true where HIV services have been integrated into services such as primary healthcare, family planning and other sexual and reproductive health services, and TB services. Integration makes sense for two main reasons: HIV services share target populations both with services geared at sexually active clients, such as family planning and other sexual and reproductive health services, and with non-communicable chronic diseases, given that HIV has become a chronic disease requiring lifelong management. In contrast to the early years of the HIV response, when HIV services were often offered in specialised HIV testing and treatment clinics, they are now also often rendered by the same staff cadres as general primary healthcare services. This integration allows for the provision of more services using the same inputs (economies of scope), which can lower the combined cost of both HIV and non-HIV services.

In the early years of the HIV response, services were often pioneered and funded by private-sector providers (for-profit, not-for-profit and informal providers). They still play a role in particular in lower-prevalence settings (Fig. 1) (Policy brief #15) and in serving populations such as urban working-age men who prefer services that are open outside traditional clinic working hours.

Empirical evidence regarding the role of private-sector service provision is hampered by the great heterogeneity of private health providers. Overall, private-sector providers appear roughly as effective in providing HIV-related services as public services (Basu et al., 2012; Long et al., 2020).

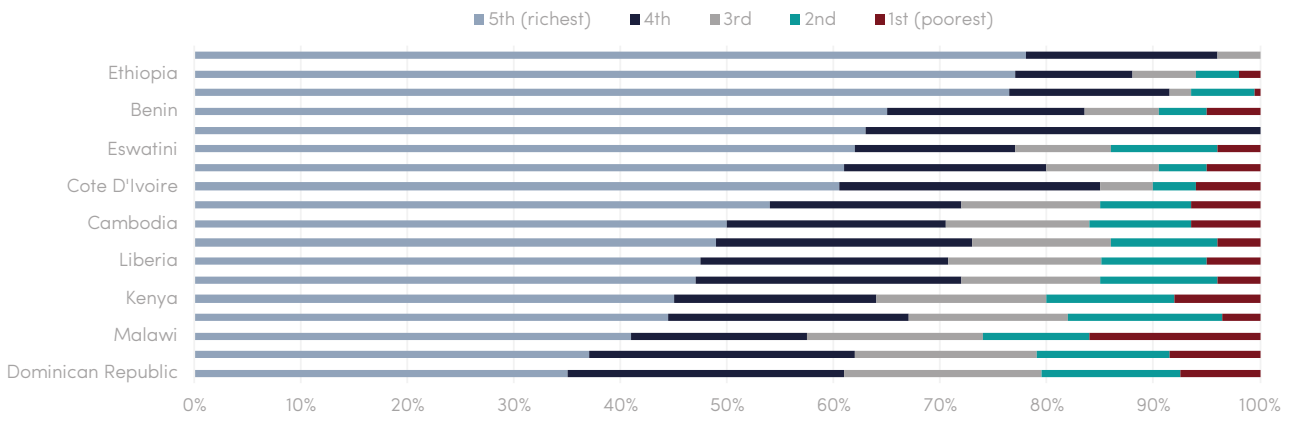
Figure 1: HIV prevalence and private sector share in HIV testing (percent)



Source: Johnson & Cheng (2014).

Additionally, private-sector entities (often non-governmental and civil-society organisations) have been instrumental in extending access to HIV services to key populations, e.g., HIV prevention and support services for sex workers or men who have sex with men, or harm reduction programmes for people who inject drugs. In these cases, non-state organisations complement public HIV services and are considered effective in overcoming barriers related to stigma and criminalisation, and in improving outcomes through peer education and support (Macdonald et al., 2019; Atuhaire et al., 2021) (Policy brief #15). On the other hand, the reach of private providers is often limited because they do not have access to the cheapest drugs (Summary brief #2) or the most recent diagnostic innovations, and for-profit private health services disproportionately serve wealthier populations (Fig. 2).

Figure 2: Users of private health services by wealth quintile



Source: Johnson & Cheng (2014).

Looking ahead, the roles of private- vs public-sector provision are likely to shift where vertical HIV programmes (dominated by the public sector and various non-profit providers) are integrated into health systems in which private providers play a larger role, for two reasons. First, models of differentiated care offer opportunities to shift some tasks from dedicated providers of HIV services to general providers – including community health workers, but also any private-sector facilities. Second, the lower costs of antiretroviral therapy (ART), reduced HIV incidence and simplified delivery of ART have lowered the bar for including ART in medical-benefit plans offered by private providers and delivered through private facilities. Thus, there is an argument for increased provision of HIV-related services through private providers for patients paying privately (typically through private insurance) for higher-quality packages of care. This might in turn increase inequity in service access, unless it is part of an overall integration of public and private healthcare sectors under universal health coverage (UHC), which can be seen as a method for "harnessing" the private sector's potential for both HIV and other health services (Policy brief #15).

Making choices between HIV interventions

Investments in the public HIV response involve choices between funding HIV or other objectives, and choices regarding which HIV interventions to fund, from what source, for which population and where. When deciding between HIV and other health objectives, as well as among different HIV interventions, it is helpful to be able to compare the outcomes of different options using a common metric. For this, planners often use some measure of survival and/or quality of life gained per unit of budget spent as a benchmark for identifying the most cost-effective interventions. The most common criteria are the loss of life years as a consequence of a disease (or gain as a result of an intervention), and the health impairment caused by the disease. These criteria are often summarised in the form of disability-adjusted life years (DALYs) or quality-adjusted life years (QALYs) (Policy brief #13). While QALYs assign weights to distinct health states, drawing on patient or population preferences elicited through large-scale surveys, DALYs measure losses in healthy life compared to an ideal state of health, and the disability weights included in DALYs were originally based on surveys of experts but have since been put on a more robust footing (Salomon et al., 2015).

Sometimes, thresholds are used to simplify the question of what is worth funding (Policy brief #13). Such thresholds can be derived from economic criteria – do the health and economic gains expected from the proposed intervention outweigh the costs? – or from the budget context – is there a threshold that divides interventions which are typically funded and those which are not? The first approach, often using income-based categories to delimit interventions worth investing in, offers little guidance on prioritisation, especially in low- and middle-income countries where recommendations based on generic thresholds often exceed available budgets (Griffiths, Legood, Pitt, 2016; Ochalek and others, 2018). The second approach allows the interpretation of findings regarding cost-effectiveness in light of the country-specific economic, fiscal, political and health context (Marseille et al., 2014; Bertram et al., 2016; Leech et al., 2018).

At high levels of HIV prevalence and HIV service coverage, cost-effectiveness can be used to identify the best use of existing HIV budgets across interventions, populations, space and time, using allocative efficiency models (Policy brief #16). The usefulness of these models is limited by implementation, fiscal space and affordability, and considerations beyond cost and effectiveness such as equitable coverage as well as the availability of data in particular for those additional considerations (Policy brief #16). The table below gives an overview of which methods might be most useful for which type of decision problem.

Even though it is tempting to think that adding more-specific optimisations to try to target interventions to specific regions, population groups or time periods, these analyses are hampered by inadequate availability of data, the lack of implementability and by the fungibility of budgets, which means that overreliance on imperfect data might be net harmful to the HIV response (Policy brief #16).

Type of analysis	Results	Setting	Data needs
a) Types of economic evaluation			
Cost analysis	Cost of intervention(s)	Any	Average cost of intervention, target population and target coverage
Cost-minimisation analysis	Cost of interventions with identical outcomes	Any	
Cost-effectiveness analysis	Cost and impact (survival/ incidence etc.)	Any	As above plus impact of intervention on survival/incidence etc.
Cost-utility analysis	Cost and impact (survival/ incidence plus quality of life/levels of disability)	Any	As above plus impact on quality of life/ levels of disability
Cost-benefit analysis	Comparison of costs and (economic and health) benefits	Any	As for cost-effectiveness analysis, plus data on the economic valuation of health outcomes, and economic and fiscal data on costs and consequences supporting a societal perspective.
Multi-criteria decision analysis	Information on how interventions perform towards additional criteria (such as equitable coverage or international targets)	Any HIV prevalence or service coverage	Identification of additional criteria, decision-makers' preferences between these criteria, and each intervention's performance under these
Extended cost-effectiveness analysis	Joint consideration of health and financial consequences	Any HIV prevalence or service coverage, in particular settings with relevant out-of-pocket spending	Data on financial risk protection and distributional consequences of interventions
b) Allocative optimisation methods			
Geospatial optimisation	Information on which regions to target which interventions to	High HIV prevalence, high service coverage	Population size, prevalence, incidence, service coverage and by region, average intervention cost and available budget
Sub-population optimisation	Information on which populations to target which interventions to	High HIV prevalence, high (average) service coverage	Population size, prevalence, incidence, service coverage by population group, average intervention cost and available budget
Temporal optimisation	Information on whether intervention coverage should be changed over time	High HIV prevalence, high service coverage	Population size, prevalence, incidence, service coverage by population group, average intervention cost, available budget by year
Optimisation under other constraints (e.g., health system capacity)	Information on how to best use limited capacity and other constraints (+/- limited budgets)	Settings with relevant health-system constraints	All of above as well as identification and quantification of relevant constraints (e.g., available healthcare staff)

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #1

THE STATE OF PROGRAMME IMPLEMENTATION TO REDUCE HIV TRANSMISSION & AIDS-RELATED MORTALITY

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POLICY BRIEF **#1**

THE STATE OF PROGRAMME IMPLEMENTATION TO REDUCE HIV TRANSMISSION & AIDS-RELATED MORTALITY

KEY POINTS

- **HIV transmission and AIDS-related mortality have been declining steeply and steadily around the world. However, because of the interplay of longer survival and lower HIV transmission, the number of people living with HIV continues to increase, and progress lags behind the targets set out in the UNAIDS strategy towards "ending AIDS" by 2030 (even before the disruptions caused by Covid-19 are factored in).**
- **Progress in reducing HIV transmission and AIDS-related mortality has tended to be faster in countries with high HIV prevalence, and has been fairly even across countries with different levels of economic development.**
- **Large discrepancies in HIV programme achievements persist across countries. If all countries had caught up with or come close to the countries with the most successful HIV programmes to date, then over one-third of AIDS-related deaths and adult HIV infections, and about 60 percent of infections through mother-to-child transmission of HIV, could have been averted in 2019.**

Progress in controlling the HIV pandemic has been remarkable, in terms both of extending the lives of people living with HIV (PLHIV) and reducing HIV incidence among adults, or through mother-to-child transmission. However, the number of PLHIV continues to increase globally as a result of reduced mortality and continuing transmission. Differences in HIV outcomes across countries suggest that a large share of AIDS-related deaths and of HIV infections occur because of a continuing lack of access to effective health and prevention services.

Increased treatment coverage and declining mortality

Expanding access to treatment is at the heart of the UNAIDS strategy to "end AIDS" as a public health threat (UNAIDS, 2015) by improving the health outlook of people living with HIV and as a key contributor to reducing HIV transmission through viral suppression.

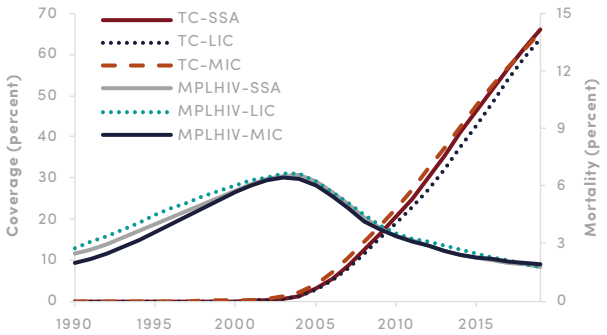
The life prospects of PLHIV have been dramatically transformed by the global effort to expand access to treatment. Remarkably, this progress has been achieved irrespective of economic context, health-systems barriers, or the burden of HIV – average rates of treatment coverage across low- and middle-income countries and for sub-Saharan Africa (the region facing the highest burden of HIV) have increased very similarly (Figure 1.1), and as of 2019 coverage reached about 65 percent of adults living with HIV.

The most direct effect of this improved treatment coverage

is reduced AIDS-related mortality among PLHIV. Indeed, provided that treatment is initiated sufficiently early, PLHIV can have a near-normal life expectancy (Johnson et al., 2013). The effects are visible in the summary data across countries – annual AIDS-related mortality among adults living with HIV declined from close to 7 percent in 2004 to 2 percent in 2018 across low-income countries and sub-Saharan Africa (Figure 1.1).

The cascade of care offers a clearer picture of barriers to access and the effectiveness of treatment (Figure 1.2). In addition to treatment coverage, it includes the proportion of PLHIV who have been diagnosed (a precondition for and potential barrier to treatment access), and the proportion of people on treatment who are virally suppressed and hence unlikely to pass on HIV. The cascade of care is at the core of the strategy of "ending AIDS" by 2030 (UNAIDS, 2015) and of the intermediate 90-90-90 goals by 2020, whereby 90 percent of PLHIV are diagnosed, 90 percent of those diagnosed receive treatment, and 90 percent of those on treatment achieve viral suppression, meaning that they cannot pass the virus on to others. Taken together, these targets are consistent with reaching a rate of 73 percent (i.e., 90% out of 90% out of 90%) of PLHIV who are diagnosed, receive treatment, and achieve viral suppression.

Figure 1.1: Treatment coverage and mortality among PLHIV, ages 15+, 1990-2019



Source: UNAIDS, 2020.
Note: TC=treatment coverage, MPLHIV=annual AIDS-related mortality among people living with HIV. LIC=low-income countries, MIC=middle-income countries, SSA=sub-Saharan Africa. Country groupings follow World Bank, 2020.

Figure 1.2: Cascade of care, 2017-2019

Figure 1.2.1: Global

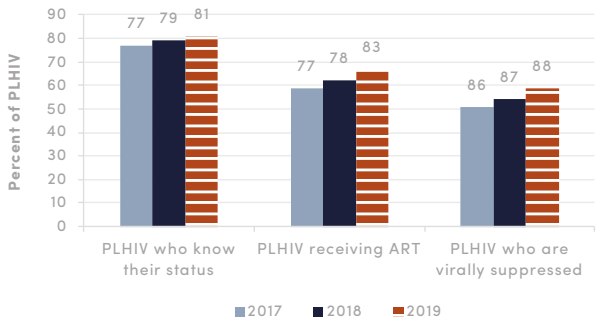
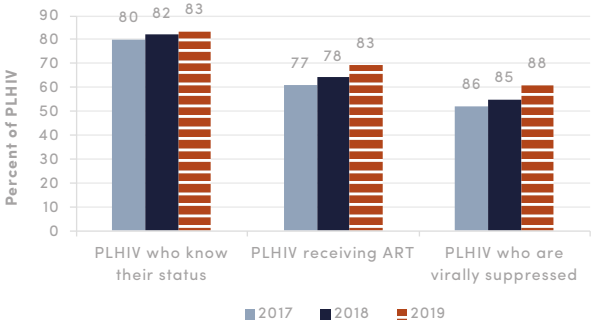


Figure 1.2.2: Sub-Saharan Africa



Source: UNAIDS, 2020. Note: ART=antiretroviral therapy.
Note: Height of bars shows values in percent of total population living with HIV. Numbers on base of bars show values in percent of the preceding category (the one to the left), consistent with the definition of the 90-90-90 targets.

Globally, there have been improvements at all stages of the cascade. Diagnosis rates improved by 3 percentage points annually (among PLHIV) between 2015 and 2019, as a result of testing but also reflecting declining incidence (resulting in fewer newly infected and undiagnosed people). Treatment access improved by 3 percentage points annually (among PLHIV who have been diagnosed), and the rate of those on treatment who achieve viral suppression increased by 1 percentage point annually (among people receiving treatment). Nonetheless, these data suggest that the global 90-90-90 targets for 2020 were missed. Extrapolation from the data through 2019 suggests that only about 65 percent of PLHIV achieved viral suppression by 2020 (against the target of 73 percent), reflecting mainly lower diagnosis rates than anticipated (accounting for more than one-half of the gap). As a consequence, UNAIDS (2020b) estimates that "accumulated from 2015 to 2020, there were 3.5 million more HIV infections and 820,000 more AIDS-related deaths than if the world was on track to meet its 2020 targets."

While the global picture suggests qualified success – steady and steep increases in treatment coverage and declining mortality among PLHIV since 2003, though progress in recent years has been slower than what was deemed feasible under the 90-90-90 targets – there is large

variation in treatment coverage across countries, ranging from less than 10 percent to close to 100 percent of adults living with HIV (Figure 1.3). As a consequence, annual AIDS-related mortality among PLHIV also remains highly unequal across countries, ranging from less than 1 percent to over 5 percent (Figure 1.4). Treatment coverage varies little with the level of economic development (represented by GDP per capita in Figure 1.3). Treatment coverage in countries with high HIV prevalence (i.e., exceeding 12 percent of the adult population) tends to be higher, ranging from about 50 percent to nearly 90 percent.

These numbers imply that in many countries, the majority of AIDS-related deaths occur as a consequence of delays in extending access to treatment, compared with the achievements of countries with similar economic capacities.

The extent to which some countries lag behind in terms of extending treatment access and reducing mortality is a significant aspect of the global picture on "ending AIDS." If all low- and middle-income countries had succeeded in bringing down annual AIDS-related mortality among PLHIV to at most 1 percent (the rate achieved in the most successful countries, see Figure 1.4), over one-third of AIDS-related deaths in 2019 across the low- and middle-income countries covered in Figures 1.3 and 1.4 would have been avoided. Looking ahead, it is important to take into account that much of this unmet need is located in countries with relatively low HIV prevalence – barriers to extending access to treatment are different from during the early stages of the global effort to extend treatment access, which focused on countries and populations with relatively high HIV prevalence.

Figure 1.3: Treatment coverage, ages 15+, and GDP per capita, 2019

Figure 1.4: Annual AIDS-related mortality, ages 15+, and GDP per capita, 2019

Source: UNAIDS, 2020 and IMF, 2020 for GDP per capita. Bubble size (area) is proportional to HIV prevalence

HIV transmission among adults

Alongside extending the life prospects of PLHIV, reduced HIV transmission has been a cornerstone of the efforts to "end AIDS" – the 2016-2021 UNAIDS strategy envisaged a global decline in the number of new HIV infections of nearly 90 percent by 2030, relative to 2010 (UNAIDS, 2015). While the dynamics of HIV incidence have been insufficient to achieve this target, incidence has declined steeply over the last years, e.g., from a peak of 0.42 percent annually across sub-Saharan Africa in 1991 to 0.11 percent by 2018 (Figure 1.5). This pattern of decline is consistent across major regions over the last two decades. To assess the effectiveness of HIV prevention efforts, however, it is usually more informative to look at the rate of transmission (the ratio of new infections to people already living with HIV), which controls for HIV prevalence and measures how fast HIV is transmitted onward. This gives clues to the implications for epidemic control measures. According to this metric, transmission of HIV has declined steadily across countries, e.g., from 0.22 in 1990 to 0.04 by 2018 across sub-Saharan Africa, and similarly across low- and middle-income countries (Figure 1.6). The decline in HIV transmission achieved so far, though, is insufficient to put HIV on a path to elimination (i.e., a trajectory where the number of PLHIV is shrinking at a rate and to a point where it no longer poses a significant health challenge). In 2000, with survival of PLHIV (without treatment) of around 10 years from the time of infection, a rate of transmission of 0.1 would have meant that an HIV epidemic was stable – i.e., the number of new infections was similar to the number of deaths among PLHIV, and the total number of PLHIV remained constant. However, with annual mortality (AIDS-related and otherwise) among PLHIV now around 3 percent due to treatment, a rate of transmission of 0.04 means that the number of PLHIV continues to increase.

Figure 1.5: HIV incidence, ages 15+, 1990-2019 (percent)

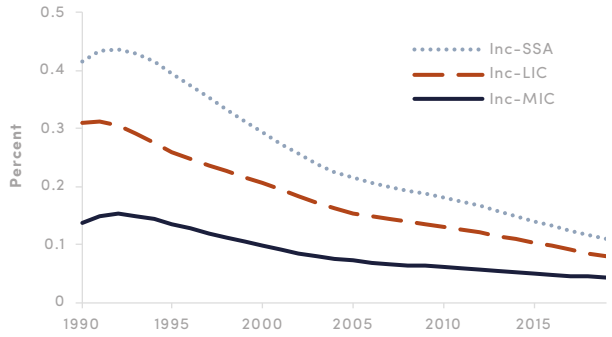
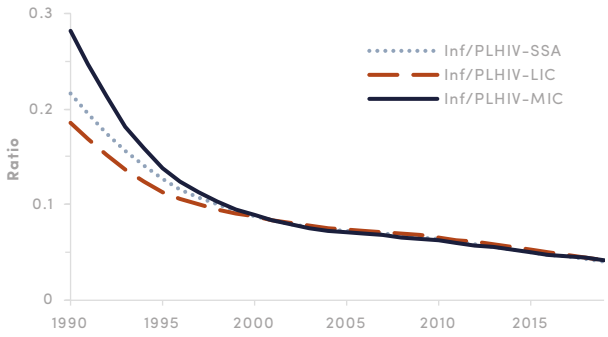


Figure 1.6: Ratio of HIV infections to people living with HIV, ages 15+, 1990-2019



Source: UNAIDS country data files (see annex).
Note: Inc=incidence, Inf=number of new infections, LIC=low-income countries, MIC=middle-income countries, SSA=sub-Saharan Africa. Country groupings follow World Bank, 2020.

As for treatment access and mortality, the rate of transmission differs substantially across individual countries (Figure 1.7). Indeed, HIV transmission and treatment coverage are highly correlated, and treatment coverage statistically explains nearly one-half of the variation in HIV transmission across countries in the data shown in Figure 1.8. This association mirrors the central role of treatment in HIV prevention, including its direct effect through viral suppression (though it could also reflect that both treatment and prevention programmes are more effective in some countries than in others). Nevertheless, there are substantial differences in HIV transmission across countries even after controlling for treatment coverage, suggesting large gains that could be attained by aligning HIV prevention policies with best practice.

Figure 1.7: Annual HIV transmission, ages 15+, and GDP per capita, 2019

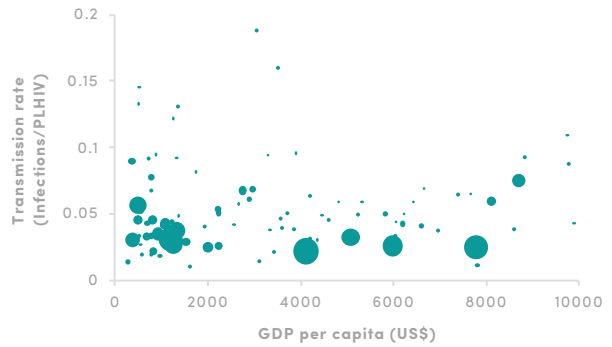
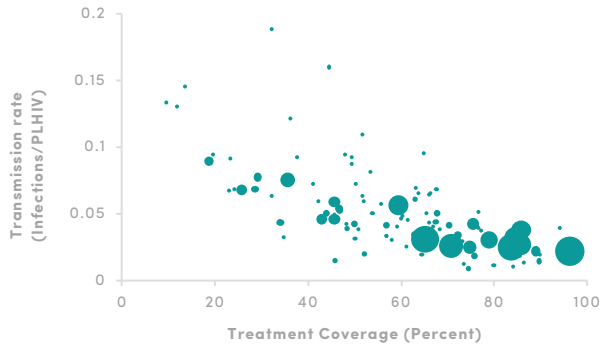


Figure 1.8: Annual HIV transmission and treatment coverage, ages 15+, 2019



Source: UNAIDS, 2020 and IMF, 2020 for GDP per capita. Bubble size (area) is proportional to HIV prevalence.

The high dispersion in the rate of transmission across countries suggests that a large share of HIV infections occurring today is avoidable, not only relative to some technically achievable ideal circumstances, but also when controlling for current country context. For example, the most successful low- and middle-income countries shown in Figure 1.7 attain a transmission rate of around 2.5 percent, with very few of them at an even lower rate. If the low- and middle-income countries captured in Figure 1.7 had all been successful in reducing the rate of HIV transmission to at most 2.5 percent (and preserving gains if the rate is already lower), then 34 percent of all new HIV infections in 2019 would have been averted.

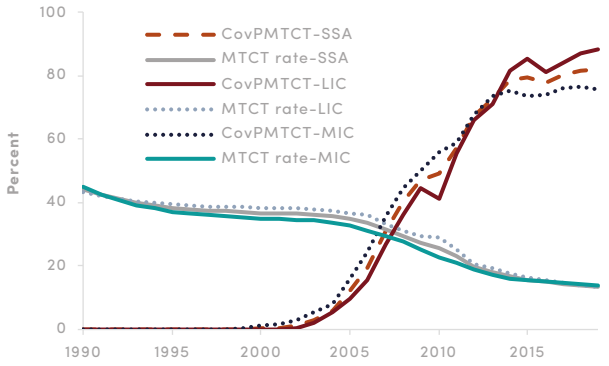
Prevention of mother-to-child transmission of HIV and child treatment

Mother-to-child transmission (MTCT) of HIV accounts for a substantial proportion of HIV infections overall. Across low- and middle-income countries where such data were available from UNAIDS (2020c), about one-quarter of all HIV infections occurred through MTCT in 2005. Prevention of mother-to-child transmission (PMTCT) of HIV has been relatively successful – the share of MTCT in overall HIV infections declined steadily to 12 percent as of 2019.

Prenatal health services also contribute to early diagnosis of women living with HIV, counselling and testing, and access to care and treatment. For this reason, diagnosis rates and treatment coverage rates tend to be considerably higher among women than among men. For example, in Eastern and Southern Africa, an estimated 91 percent of women living with HIV knew their status as of 2019 (compared with 84 percent for men), and treatment coverage stood at 78 percent for women and 64 percent for men (UNAIDS, 2020 and 2020b). The extent and impact of PMTCT are apparent from data on the scaling-up of PMTCT and the concurrent declines in the rate of MTCT (Figure 1.9). As coverage increased steeply from the early 2000s, the average rate of MTCT declined from over 30 percent of births from HIV-positive mothers in 2005 to little more than 10 percent as of 2019. Beyond these changes, there have been considerable shifts in the content and quality of PMTCT. Whereas around 2010 PMTCT typically took the form of temporary treatment during pregnancy and until the end of breastfeeding (Option A under the 2010 WHO Guidelines), most countries now endorse initiation of lifelong treatment for pregnant mothers (who are not already receiving it), and temporary treatment for infants (Option B+ under the 2013 WHO Guidelines). In 2019, an estimated 85% of 1.3 million pregnant women living with HIV globally received antiretroviral drugs for PMTCT of HIV.

As for adult treatment and incidence, the broad trends mask steep differences in rates of MTCT and access to PMTCT across countries. While in some countries nearly all mothers requiring PMTCT receive it (including most countries with high HIV prevalence), many other countries – especially low-income ones – lag far behind (Figure 1.10). Moreover, these estimates may understate differences in access to PMTCT across countries, as they do not capture factors like successful referral to and retention in care, or loss to follow-up (Gumede-Moyo et al., 2017). As a consequence, while some low- and middle-income countries reach MTCT rates similar to those in the most advanced countries, the outcomes in many countries lag far behind (Figure 1.11). This means that the majority of HIV infections through MTCT in low- and middle-income countries reflect lack of effective PMTCT services. If the MTCT rate were brought down to at most 5 percent for those countries where it remains above this level (let alone to the lower levels of 2-3 percent attained in some middle-income countries), over 60 percent of HIV infections among infants in 2019 could have been avoided. This gap is much larger than those coming out of the comparisons of AIDS-related mortality or HIV transmission across countries, above.

Figure 1.9: PMTCT coverage and MTCT rates, 1990-2019



Source: UNAIDS, 2020.
Legend: CovPMTCT=coverage of PMTCT. LIC=low-income countries, MIC=middle-income countries, SSA=sub-Saharan Africa. Country groupings follow World Bank, 2020.

Figure 1.10: Coverage of PMTCT and GDP per capita, 2019

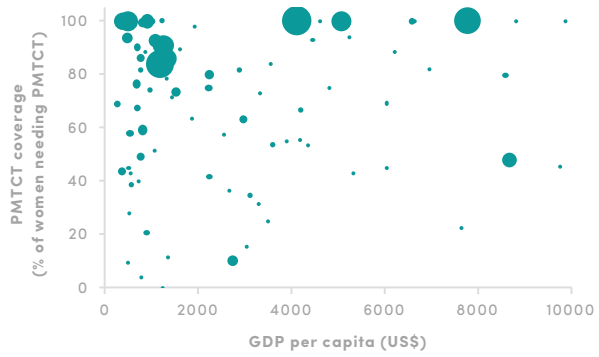
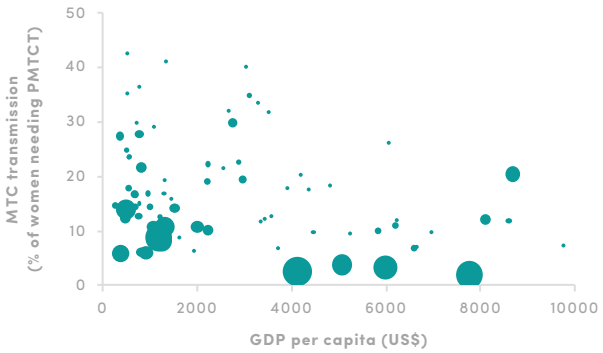


Figure 1.11: MTC transmission and GDP per capita, 2019

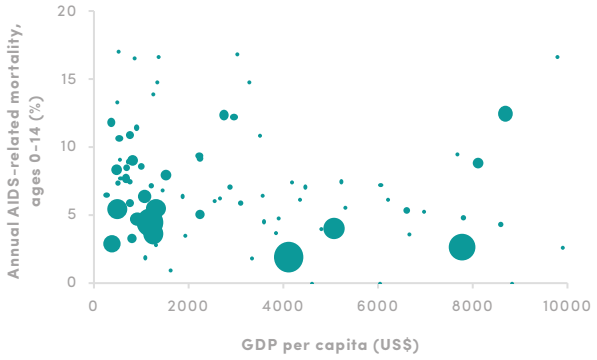


Source: UNAIDS (2020) and IMF (2020) for GDP per capita. Bubble size (area) is proportional to HIV prevalence.

Data on treatment coverage and AIDS-related mortality among children are difficult to interpret, because deaths – in the absence of treatment – often occur early. For example, low access to treatment and high *early* mortality could be consistent with relatively high treatment coverage and low AIDS-related mortality among *surviving* children living with HIV. Across countries, outcomes on extending access to treatment to children (Figure 1.12) are more varied than for adults (Figure 1.3), and treatment coverage is about 10 percentage points lower for children than for adults on average (population-weighted). AIDS-related mortality among children living with HIV remains high (6 percent on average, population-weighted; Figure 1.13), and much higher than for adults (average: 2 percent).

Figure 1.12: Treatment coverage, ages 0-14, and GDP per capita, 2019

Figure 1.13: Annual AIDS-related mortality, ages 0-14, and GDP per capita, 2019



Source: UNAIDS (2020) and IMF (2020) for GDP per capita. Bubble size (area) is proportional to HIV prevalence.

Because of the lag in scaling up treatment for children, relative to adults, people who got infected through MTCT have not benefited equally from improved treatment access. Only about one-quarter of children born in sub-Saharan Africa in 2004 – before treatment took off – and infected through MTCT of HIV are estimated to have survived to reach age 15 in 2019. Projections for infants who become infected now are unavailable, but these cohorts benefit from improved early infant diagnosis rates (up from 34 percent in 2010 to 60 percent in 2019 globally, according to UNAIDS (2020)) and the improved access to treatment (for countries where estimates are available, treatment coverage among surviving children has more than doubled between 2010 and 2019, from 26 percent to 52 percent, according to UNAIDS, 2020c).

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #2

INCREASED HEALTH & LIFE PROSPECTS & THEIR ECONOMIC VALUATION

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UCL

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POLICY BRIEF **#2**

INCREASED HEALTH & LIFE PROSPECTS & THEIR ECONOMIC VALUATION

KEY POINTS

- **Antiretroviral therapy has dramatically improved the life prospects of people living with HIV.**
- **Reduced AIDS-related mortality has been a dominant driver of improvements in life expectancy across sub-Saharan Africa and has made important contributions even in countries facing relatively low HIV prevalence.**
- **The principal economic gains arise from improved longevity through higher lifetime earnings, which can offset the costs of health investments. The longevity gains also have intrinsic value in excess of these financial impacts.**

Implications of treatment for life and health prospects of people living with HIV

Antiretroviral therapy has dramatically improved the health and life prospects of people living with HIV, and is transforming their health needs.

The scaling-up of treatment has resulted in steep declines in mortality among people living with HIV (Policy brief #1), to the point that – provided that treatment is initiated sufficiently early – life expectancy of people living with HIV (PLHIV) is approaching the corresponding levels for HIV-negative adults (Johnson et al., 2013). These changing consequences of HIV, and the impact of treatment, are illustrated in Figures 2.1 and 2.2 from the perspective of an individual adult who contracts HIV.

Morbidity and mortality outcomes for PLHIV are greatly improved if an individual starts treatment before the disease has progressed substantially. In the absence of treatment, this adult would on average survive only 12 years from the time of infection, and would have virtually no chance of reaching old age (e.g., the probability of surviving 30 years from the time of infection is only 1 percent). If the individual initiates treatment before the disease has progressed significantly and their CD4 count drops below 200 cells/microlitre, their remaining life expectancy reaches 25 years (including an expected 15 years on treatment), and the 30-year survival probability dramatically improves to 36 percent. With even earlier treatment initiation, at a CD4 cell count of 350 or above, remaining life expectancy from the time of infection surpasses 30 years, and the individual would be more likely to eventually die from other causes rather than AIDS-related conditions.

1 In what follows, we follow convention and modelling practice by using the CD4 cell count as measure of disease progression. The CD4 cell count measures the number of a type of white blood cell critical for the functioning of the immune system; these cells are gradually destroyed by HIV. A low CD4 count means that progression to AIDS-related illnesses and, ultimately, death is likely.

Figure 2.1: Survival under different treatment eligibility criteria (percent)

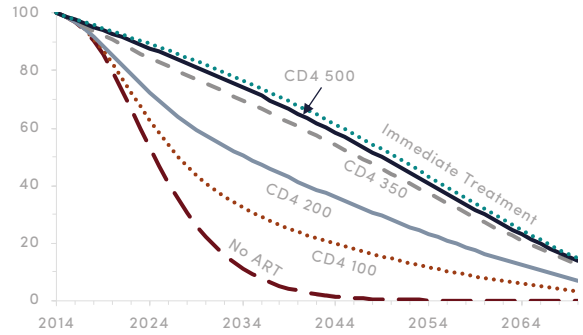
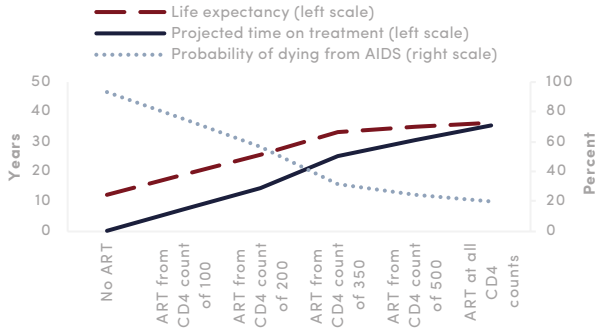


Figure 2.2: Life expectancy, projected time on treatment, and probability of dying from AIDS



Source: Haacker, 2016.
Note: The example is based on demographic and HIV-specific projections for South Africa, using Spectrum software, and shows life prospects for a person who contracts HIV as an adult (population-weighted average by sex and age at infection; average age at infection is about 30 years). ART = antiretroviral therapy.

As a consequence of earlier treatment initiation, the health needs of PLHIV are changing. AIDS-defining diseases like certain cancers have become much less common (Dryden-Peterson et al., 2015), and the incidence of diseases like tuberculosis for which HIV is a major risk factor has been declining (WHO, 2020; see also Policy brief #12). Meanwhile, the population living with HIV is ageing – the share of people at ages 50 or older among PLHIV nearly doubled over the 10 years from 2008 to 2018 (increasing from 11 percent to 20 percent globally, and from 9 percent to 16 percent over the same period in sub-Saharan Africa). Instead, PLHIV are increasingly developing diseases which become more common in old age, like cardiovascular diseases, kidney disorders or diabetes (Smit et al., 2018 and 2020; Haacker et al., 2019; see also Policy brief #12).

These changes have implications for assessing the effectiveness and cost-effectiveness of HIV policies or interventions. As PLHIV initiate treatment increasingly early, the immediate health returns to investments in the HIV response, in terms of deaths averted and life years gained, are shrinking, both for efforts to increase treatment access further and for HIV prevention interventions. At the same time, two factors become more important: first, the future costs of treatment (and by extension cost savings from reduced HIV incidence), which can be substantial when most PLHIV receive treatment for several decades, even though average costs per patient have come down (see Figure 2.2). Second, co-existing diseases such as cardiovascular diseases, diabetes or chronic kidney disease, which become more common as PLHIV grow older, need to be incorporated into any full assessment of the cost of HIV interventions. This includes synergies in service delivery (Policy brief #12A) and possible impacts of HIV or long-term treatment on the incidence of non-communicable diseases (Atun et al., 2009; Bendavid et al., 2012; Hyle et al., 2019).

Population-level effects

The response to HIV, most directly the scaling-up of treatment, has made important contributions to overall health outcomes.

Across sub-Saharan Africa, treatment coverage has improved to 69 percent of PLHIV as of 2019 (up from 24 percent in 2010; UNAIDS, 2020), and CD4 counts at treatment initiation have increased steeply (Anderegg et al., 2018; see also Policy brief #1). The resulting improvements in the life prospects of PLHIV are visible in overall health outcomes, and have made a large contribution to increases in life expectancy.

In sub-Saharan Africa, the scaling-up of treatment contributed about 3.6 years to population-wide life expectancy between 2003 (roughly when scale-up began) and 2019 (Figure 2.3) – about one-third of the overall gain in life expectancy during that period. In high-prevalence countries, it has been a dominant contributor (6.8 years, out of a total of 12.4 years), and even in countries with HIV prevalence below 3 percent, the HIV response has contributed more than 2 years to gains in life expectancy (UNAIDS, 2018).

The underlying developments are shown in more detail in

Figure 2.4, based on demographic and epidemiological estimates for Malawi. HIV resulted in a steep loss in life expectancy from the early 1980s, reaching a maximal loss of 13 years in 1999. From 2001 the impact of the HIV response becomes apparent, reflecting both reduced mother-to-child transmission (which declined by one-half between 2000 and 2012) and the scaling-up of treatment. As treatment coverage increased to 79 percent by 2010, AIDS-related mortality among PLHIV dropped from about 7 percent annually around 2003 to 2.6 percent by 2010, and 1.1 percent as of 2019. However, even in 2019, HIV still accounted for a loss in life expectancy of 2 years.

Figure 2.3: Contributors to increased life expectancy across Sub-Saharan Africa, 2003-2019

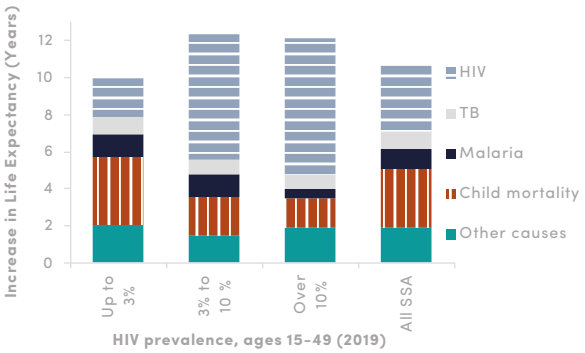
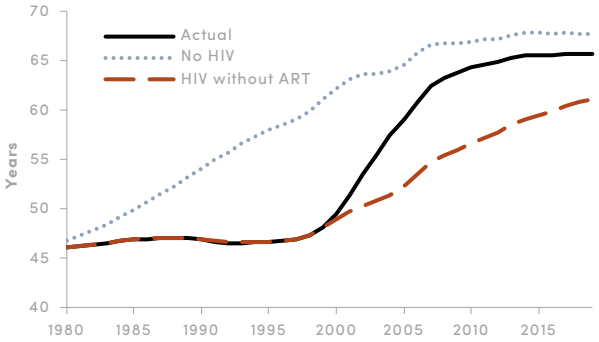


Figure 2.4: Life expectancy, Malawi, 1980-2019



Source: Authors' calculations, using data from IHME (2019) and updating an earlier analysis for UNAIDS, for Figure 2.3, which shows the contribution of reduced disease-specific mortality to the increase in life expectancy between 2003 and 2019. Figure 2.4 was created using the UNAIDS estimates file for Malawi (UNAIDS, 2020b), obtaining the "No HIV" and "HIV without ART" scenarios by switching off HIV altogether or setting treatment coverage equal to zero.

In contrast, the impacts of HIV and of the scaling-up of treatment on morbidity have been comparatively modest, because HIV infection does not cause symptoms until a long time after infection, and the symptomatic phase is relatively short. Global Burden of Disease estimates (IHME, 2019) break down the health burden into years of life lost (YLLs) and years lived with disability (YLDs), which applies disability weights to states of disease. The morbidity effects of HIV are relatively small, accounting for less than 5 percent of the years lost due to early AIDS-related mortality across low- and middle-income countries (IHME, 2019). Relatedly, HIV-related health gains following the scaling-up of treatment have predominantly been achieved as a consequence of reduced mortality (Danforth et al., 2017). As the number of AIDS-related deaths across low- and middle-income countries has declined by 50% between 2003 and 2017, years lived with disability as estimated by IHME (2019) have barely declined, accounting for less than 0.5 percent of the overall health gains.

Valuing health and life gains

Improved health and longer lives lead to higher lifetime earnings, which may offset the costs of health investments. The longevity gains also have intrinsic value in excess of these financial impacts.

Economic analyses of health policies most commonly focus on the health outcomes and the means required to attain these outcomes. For example, the policy can be assessed and ranked in terms of the health gains that can be achieved by one unit of money – e.g., disability-adjusted life years per US dollar, as used by the Disease Control Priorities project (World Bank, 2015-2018), see Policy brief #13. For other purposes – assessing the contributions of investments in health to improving living standards, exploring the extent to which the costs of investments in health are offset by economic gains that can refinance at least some of the costs, or comparing investments in policies implemented within the health care system and in other sectors – it is necessary to establish an economic valuation (i.e., assign a monetary value) to the health gains achieved by the policy.

There are three main approaches to valuing improvements in health and longevity in monetary terms: changes in gross domestic product (GDP); changes in lifetime production (human capital); and changes in individual welfare (willingness to pay). Each serves different purposes and provides different perspectives.

The **impacts on growth of GDP and GDP per capita** (discussed in more detail in Policy briefs #3 to #7) are key development indicators and show whether domestic economic gains could offset some of the costs of the health policy. Assessments of the economic impacts of HIV typically show that HIV slows down GDP growth, mainly because the working-age population grows more slowly due to AIDS-related mortality. The impact of HIV on GDP per capita, though, is more ambiguous. On one hand, AIDS-related morbidity and mortality is thought to reduce labour productivity, which also may be affected by adverse conditions in childhood and expected increased mortality risk due to HIV. On the other hand, increased mortality means that the economy's assets (accumulated capital, natural resources) are shared among fewer people, which increases GDP per capita.

The **human-capital approach** involves measuring the economic value of the health gains in terms of the effects on individuals' estimated lifetime production, providing another perspective on the extent to which economic gains may offset the costs of the policy. The theory of human capital was developed by Becker (1964) and originally applied to the increased earnings associated with investments in education. It refers to a person's contribution to overall production, which depends on their skills, knowledge, and experience. This human capital may be diminished by illness and is eliminated by death. Reduced morbidity increases individuals' ability to participate in the labour force and to be more productive when at work. A person whose death is averted may continue to contribute to the economy for the remainder of his or her productive life. Estimates based on the human capital approach tend to be larger than estimates on contemporary output gains, because they capture projected gains over a longer period – the lifetime of a cohort affected by a policy. Such total lifetime production gains can be large. For example, Lamontagne et al. (2019) estimate that the lifetime production gains among beneficiaries of working age across low- and middle-income countries from a global drive towards "ending AIDS" are on average 2.6 times higher than its costs (Figure 2.5).

The **impacts on welfare** are greater than the impacts on either GDP per capita or human capital. People value reductions in their risk of dying for reasons well beyond its net effects on income or production, including continuing to experience the joys of life itself and delaying the pain and suffering associated with dying. In **benefit-cost analysis** (Robinson et al., 2019), the monetary value of changes in both morbidity and mortality are estimated based on the affected individuals' willingness to exchange their own income for a small change in their own risks of becoming ill or dying within a defined time period, such as one year. Because this individual willingness to pay includes nonpecuniary effects as well as the effects on out-of-pocket medical and other expenditures and earnings (Robinson & Hammitt 2018, Robinson, Hammitt, & O'Keeffe 2019), it does not translate directly into money that can be taxed or otherwise used to fund a policy. It is, however, an important measure of wellbeing that is widely used when assessing the benefits and costs of government and other policies, particularly when comparing across interventions implemented within and outside of the health care system.

Economists typically convert estimates of individual willingness to pay for small changes in mortality risk into estimates of the value per statistical life (VSL). VSL is not the value that the government, or anyone else, places on saving someone's life. Rather, it reflects a person's willingness to exchange his or her own money for a small change in his or her own risk. For instance, if the average individual within a population is willing to pay $100 to reduce his or her risk of dying in the current year by 1 in 10,000, dividing this willingness to pay by the risk change leads to a population-average VSL of US$1 million. This value can then be multiplied by the number of deaths a policy is expected to avert to estimate related benefits. Individual willingness to pay is the fundamental measure – the $100 in this case. The conversion to a $1 million VSL is simply for convenience.

One challenge in applying this approach globally is lack of evidence from low- and middle-income countries where few VSL studies have been conducted so far. Economists instead often extrapolate from the values found in higher income countries. Because a person's willingness to pay is bounded by income, it is expected to decrease as income decreases. For example, in the United States, a $9 million VSL would imply that the average U.S. resident is willing to pay $900 for a 1 in 10,000 mortality risk change, or slightly less than 1.6 percent of U.S. gross national income (GNI) per capita in 2015, which was $57,900. In a lower-income country, where GNI per capita is substantially smaller, it seems implausible or impossible that the average person would be willing to spend US$900 on the same small risk reduction, given other more important needs.

Recent guidance (Robinson et al., 2019) suggests that, while VSL estimates in high income countries may be between 100 to 160 times GNI per capita, values for low- and middle-income countries are likely lower. For example, that guidance suggests that in a country with GNI per capita of $15,000, VSL may be about $1.2 million, or roughly 80 times GNI per capita (international dollars, based on

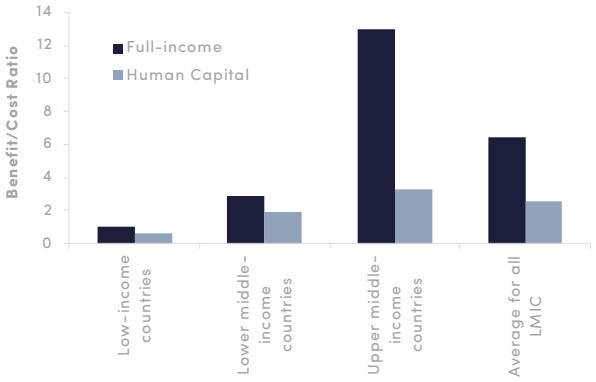
purchasing power parity) (Robinson et al. 2019, table 4.2). This implies that the average member of the population would spend about 0.8 percent of his or her income on a mortality risk reduction of 1 in 10,000. For a country with GNI per capita of $1,000, it seems unreasonable to assume that the average member of the population would devote that much of his or her resources to such a small change in risk. If GNI per capita is $1,000, that guidance recommends a VSL of about $0.02 million, roughly 20 times GNI per capita, representing willingness to pay of 0.2 percent of income for a risk reduction of 1 in 10,000 on average. More generally, the guidance suggests that analysts check the sensitivity of their results to variation in the VSL estimates, given related uncertainties.

Some analyses, such as the Lancet Commission on Investing in Health (Jamison et al., 2013) use a **full-income approach** that sums the change in GDP and the value of mortality risks reductions using VSL estimates. Following this approach, UNAIDS (2014) estimated that "fast-tracking the AIDS response between 2015 and 2030 would yield economic returns of US$15 per dollar invested". However, this approach may include some double-counting, since the contribution of labour to wellbeing is included in both the GDP and the VSL estimates. The more recent and differentiated analysis of this strategy by Lamontagne et al. (2019) estimates that "full-income" gains exceed costs by a factor of 6.4, much higher than the life-time output gains (2.6 times costs).

Regardless of the approach used to estimate the value of improved health and longevity, any such analysis must fully account for offsetting costs, which go beyond the cost of the program itself. In the context of HIV, longer survival incurs recurrent cost of treatment. More generally, added life years incur "unrelated costs" of health services (i.e., health costs over time unrelated to HIV, notably through the course of ageing; see Meltzer, 1997), fiscal costs which arise over the life cycle (Auerbach et al., 1994), and cost of living as individuals who survive longer eat and consume in other ways (Nyman, 2004). These costs must be considered in interpreting effects on GDP or GDP per capita and included in comparing human capital gains to the costs of the policy. And VSL estimates presumably include lifetime changes in costs incurred by the individual, but not the costs incurred by the government, private insurers, and donors, which are however relevant from a policy perspective.

Applying any of these approaches in global health, though, involves a tension. Changes in GDP, earnings, or willingness to pay all vary depending on the wealth of the country, as well as the wealth of those within the country whose health and longevity is improved. For example, the returns to investment for "ending AIDS" are estimated by Lamontagne et al. (2019, Figure 2.5) at 13 times cost for upper-middle-income countries, but only one times cost for low-income countries, because costs vary across countries much less than the valuations of increased longevity. Such results run against the logic of global health funding and development assistance, which prioritises disadvantaged populations. This tension is recognized by most practitioners, who recommend consideration of the distribution of both costs and benefits across advantaged and disadvantaged groups rather than solely focusing on the summary results, regardless of whether benefit-cost analysis (Robinson et al. 2019), or cost-effectiveness analysis (NICE International 2014, Wilkinson et al. 2016) is used.

Figure 2.5: Returns to investment under "full-income" and "human capital" approaches



Source: Lamontagne et al., 2019.

The preceding discussion focuses on estimating the values of gains in health and longevity in monetary terms for direct comparison to costs. In health and medicine, cost-effectiveness analysis is often instead used to compare across interventions implemented within the health care system, such as alternative drug therapies. In this case, health outcomes are evaluated based on nonmonetary measures, typically quality-adjusted life years (QALYs) or disability-adjusted life years (DALYs). At times, monetary values are used as thresholds for determining whether an intervention is cost-effective. These monetary values may be derived from VSL estimates (Robinson et al. 2017) or from estimates of health opportunity costs (Woods et al. 2016). The thresholds implied by actual decisions on health expenditures tend to be much lower than these estimates, e.g., one-half times GDP per capita for the United Kingdom (Claxton et al., 2015) or about 10 percent of GDP per capita for the South African HIV Investment Case (Meyer-Rath et al., 2017). In either case, the appropriate value per QALY or DALY is highly uncertain (also see Policy brief #13).

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #3

HIV, POPULATION DYNAMICS AND THE LABOUR FORCE

Health Economics and Epidemiology Research Office
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POLICY BRIEF **#3**

HIV, POPULATION DYNAMICS AND THE LABOUR FORCE

KEY POINTS

- **AIDS-related mortality among working-age adults reduces GDP growth but has an ambiguous effect on GDP per capita.**
- **In the short run, population size decreases due to reduced fertility and increased child mortality owing to HIV, and GDP per capita increases, but this results in lower growth of the working-age population and of GDP in the long run.**
- **A smaller elderly cohort due to HIV-related early mortality mitigates the fiscal burden of an ageing population, but as HIV treatment is scaled up, there is higher-than-normal growth of the old population.**
- **The HIV response reverses most of the demographic impacts and results in higher growth of the working-age population, but reversals in the impact on the population structure play out over decades.**

Demographic factors – such as population growth, and the share of the population at working age – are important determinants of economic growth. HIV, through increased mortality and reduced birth rates, slows the growth of the working-age population and thus of the economy's productive capacities. As a consequence, GDP grows more slowly – as do the tax base and the government's fiscal capacities – although demand for some public services (e.g., education) also grows more slowly. The effects of demographic factors on GDP per capita are less clear. If the share of the working-age population shrinks, the dependency rate increases (each working individual funds a larger number of dependents) and GDP per capita declines. However, declining fertility and the effects of AIDS on the older population could also result in a decline in the dependency rate. Whether the demographic effects alone contribute to an increase or decline in GDP per capita, it is important to bear in mind that this is an average which masks highly uneven economic impacts across households, which are important aspects of the economic fall-out of HIV/AIDS in their own right.

Increased mortality among working-age population

The most direct demographic effect of HIV is increased mortality among the working-age population, eroding the labour supply and slowing economic growth.

HIV has had significant effects on the working-age population (here approximated by the population at ages 15-64) in many countries. As annual AIDS-related mortality among people living with HIV peaked at 7 percent across low- and middle-income countries around 2004, and HIV prevalence exceeded 5 percent of the total population in 14 countries (and 20 percent in 4 countries), HIV had a large impact on overall mortality. (Note: Unless stated otherwise, HIV-related data in this brief are from UNAIDS, 2019a.)

For example, in 2004 AIDS contributed about 0.5 percentage points to mortality of the population at ages 15-64 in Mozambique, a country with an HIV prevalence of 10 percent (Figure 3.1), corresponding to about 50% of total

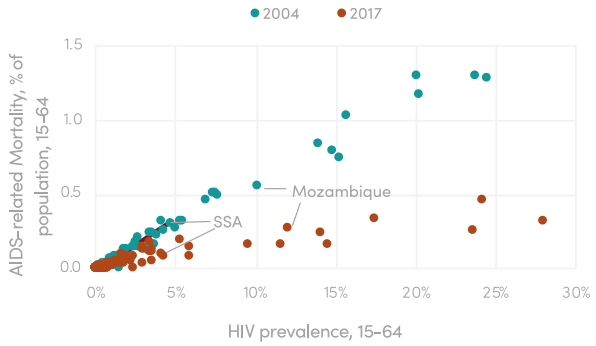
mortality in that age range. And even for a country with an HIV prevalence of 3 percent of the total population (about the average for sub-Saharan Africa), the contribution of HIV of about 0.2 percentage points (Figure 3.1) is large compared with mortality from other causes (which is typically about 0.5 percent in that age bracket across low- and middle-income countries).[1]

While AIDS-related deaths have declined owing to the scaling-up of antiretroviral treatment, HIV is still an important contributor to mortality of the working-age population. As of 2017, in a country facing an HIV prevalence of 10 percent, AIDS-related deaths still added 0.2 percentage points to mortality in the 15-64 age bracket (Figure 3.1).

The working-age population has been growing more slowly as a result of HIV – as a consequence of increased mortality among working-age adults and, with a lag, because of the impact on the young population (see next section). For example, in Botswana, by 2002 the growth of the working-age population had declined by up to 1.1 percentage points (with an HIV prevalence of 25.8 percent) compared with what it would have been without HIV (Figure 3.2). This was followed by a quick recovery during the scaling-up of treatment. Nevertheless, the working-age population as of 2018 was 12 percent smaller than it would have been without HIV. In Tanzania (where HIV prevalence peaked at 6.4 percent in 1999), the growth of the working-age population declined by 0.3 percentage points, with a slower recovery and an accumulated loss of 4 percent of the working-age population as of 2018.

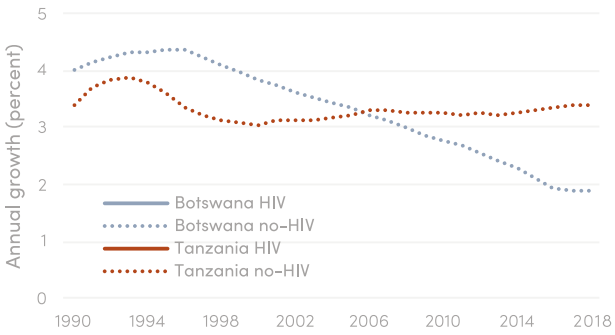
1 One important consequence of the increased mortality among the working-age population – the increased number of orphans – is addressed in Policy brief #4 on HIV and human capital.

Figure 3.1: Contribution of AIDS to mortality, ages 15-64, against HIV prevalence



Source: Country-level estimates from UNAIDS (2019a).
Note: "SSA" = sub-Saharan Africa (population-weighted average).

Figure 3.2: Growth of working-age population, with and without HIV, Botswana and Tanzania



Source: UNAIDS (2019b) and authors' calculations.

Reduced fertility and increased child mortality

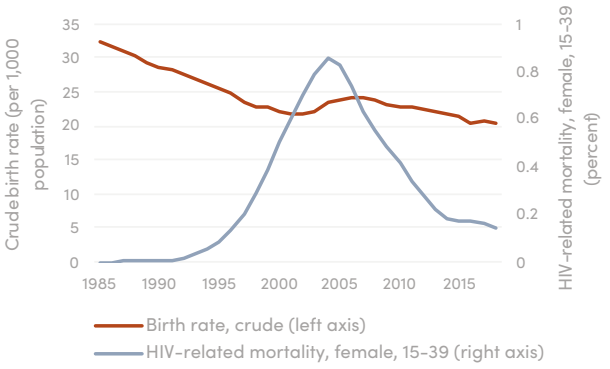
Reduced fertility among women living with HIV and increased child mortality owing to HIV lead to a smaller population below working age, making GDP per capita higher than it would otherwise be; but in the longer term they reduce population growth and the economy's productive capacities, and thus GDP.

GDP growth is linked to the rate of growth of the working-age population. HIV affects the working-age population through reduced birth rates and increased child mortality as young cohorts depleted by AIDS-related mortality eventually grow into adulthood. The effect of HIV on fertility occurs in part because of premature mortality among women living with HIV – e.g., in Zimbabwe, almost one-quarter (23 percent) of AIDS-related deaths among women occurred below age 30 as of 2018, broadly unchanged from the 21 percent estimated for 2004 (UNAIDS, 2019b). At the same time, HIV and investments in the HIV response may accelerate declines in fertility because of increased investments in family planning services and increased use of condoms. Moreover, the fertility of women living with HIV is reduced: one recent overview based on data from 49 Demographic and Health Surveys suggests that being HIV-positive reduces births per year by between 10 percent and 30 percent for most age and regional categories, and that the scaling-up of treatment has only had a small effect so far in reversing this effect (Marston et al., 2018).

Reversing the impact of HIV on children has been one of the most successful aspects of the response to HIV. The average rate of mother-to-child transmission halved across Eastern and Southern Africa between 2010 and 2018, from 18 percent to 9 percent, largely as a result of increased treatment access overall, or specifically for pregnant women. However, the much lower transmission rate of 2.4 percent as of 2018 achieved in Botswana suggests that there is great need and potential for further improvements in other countries. Nevertheless, annual AIDS-related mortality among children living with HIV in the region declined from 16 percent in 2000 to 8.7 percent in 2010, and to 4.5 percent in 2018, as coverage of treatment for children improved to 22 percent by 2010, and 62 percent in 2018 (UNAIDS, 2019b).

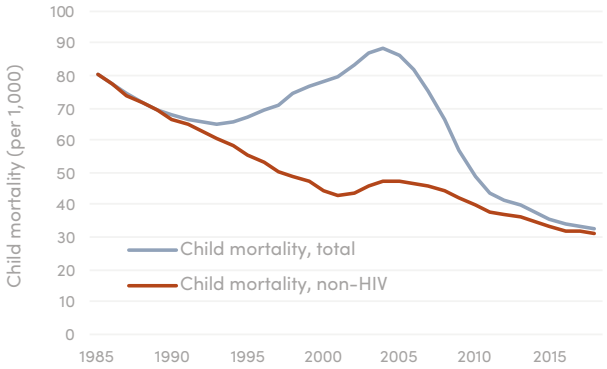
Demographic estimates for South Africa (HIV prevalence at ages 15-49: 19 percent in 2018) illustrate the implications of HIV-related changes in fertility and child mortality more specifically (Johnson & Dorrington, 2019). Between 1985 and about 2000, the impact of HIV – approximated by AIDS-related mortality among women at ages 15-39 – accelerated the long-term decline in birth rates associated with the demographic transition (Figure 3.3). The scaling-up of treatment has largely reversed this effect, with birth rates (against a downward long-term trend) increasing between 2002 and 2009. Child mortality (also against a declining long-term trend) increased steeply, from 65 per 1,000 in 1993 to 89 per 1,000 in 2003, in which year nearly half of all deaths below age 5 were AIDS-related (Figure 3.4). The steep decline in child mortality since then, by about two-thirds, reflects two factors: a decline in the rate of vertical transmission of HIV by HIV-positive mothers from 35 percent in 2000 to just 4 percent in 2018, and longer survival of HIV-positive children, for whom treatment coverage has increased from 0 percent in 2000 to 40 percent in 2010, and to over 60 percent since 2017. As a consequence of these two developments, the contribution of AIDS to child mortality has nearly disappeared, falling from 42 per 1,000 in 2004 to just 2 per 1,000 as of 2018.

Figure 3.3: South Africa, crude birth rate and HIV-related mortality among women 15-39



Source: Johnson and Dorrington, 2019.

Figure 3.4: South Africa, child mortality, total and non-HIV



Source: Johnson and Dorrington, 2019.

The demographic impacts of HIV on older adults

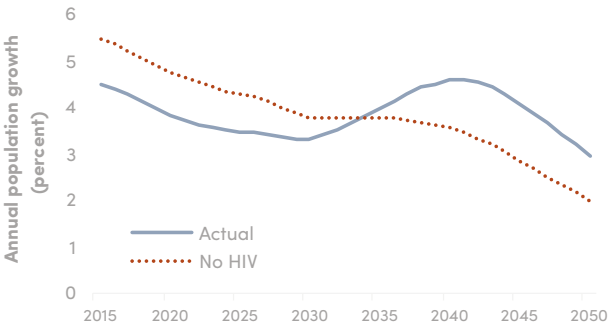
HIV can result in a smaller population share of older adults, which positively impacts GDP per capita and reduces costs associated with an elderly population, but as cohorts benefitting from treatment become older, the cohort of elderly adults grows more quickly than in the absence of HIV.

HIV affects the size of the older population in two ways: directly through AIDS-related mortality among older adults, and indirectly as the size of cohorts reaching old age is depleted by increased mortality at younger ages. This effect of HIV is significant from a macro-economic perspective because labour-force participation declines at old ages, which means that a decline in the population share of the older population is associated with an increase in GDP per capita. Additionally, fiscal and health-systems challenges associated with population ageing – such as the costs of care and old-age grants, or the increased prevalence of important non-communicable diseases at older ages – are mitigated as the older population grows more slowly.

With regard to older populations, the impact of HIV depends on the demographic context. While the countries with the

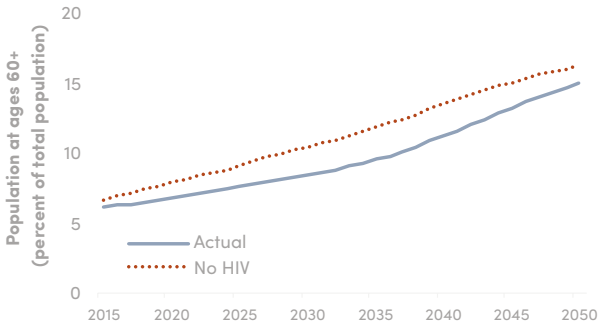
highest HIV prevalence are located in sub-Saharan Africa, the share of the population aged 60 or older in this region is relatively low, at 5 percent, compared with 12 percent in Asia, Latin America or the Caribbean, or 24 percent across high-income countries (UN Population Division, 2019). Nevertheless, HIV can have a significant impact on the growth of the older population, as illustrated by an example from Botswana (Figures 5 and 6, from Haacker et al., 2019). In this country, HIV is currently slowing the growth of the population aged 60 or older by over one percentage point, because cohorts reaching this age now were severely affected by AIDS-related mortality before treatment became accessible – about one quarter of the cohort born between 1959 and 1964 (who are at ages 55-59 as of 2018) are estimated to have died because of AIDS. As later cohorts benefitting from treatment early on reach old age, this effect is reversed, and the growth of the older population accelerates to a level that is higher than in the absence of HIV, by more than one percentage point.

Figure 3.5: Botswana, growth of population 60+, HIV and no HIV



Source: Haacker, Bärnighausen, and Atun, 2019.

Figure 3.6: Botswana, share of population 60+, HIV and no HIV



Source: Haacker, Bärnighausen, and Atun, 2019.

From demographic impacts of HIV to economic growth

HIV, through increased mortality and reduced birth rates, diminishes the growth of the working-age population and thus of the economy's productive capacities. Consequently, GDP growth declines. The implications of these demographic changes for GDP per capita are less clear. The most important effect runs through the dependency rate. If the mortality effects are concentrated among the working-age population, and each working individual has (on average) to sustain a larger number of dependents, this will have a negative effect on GDP per capita. If, however, the young population (pre-working age) shrinks more (e.g., because of fewer births or higher mortality), or the old population declines more than the working-age population, GDP per capita could increase.

Among other factors of production (see Brief 7), GDP depends on the size of the working-age population. The effect of increased mortality on the size of the working population accumulates over time and is not reversed as a result of the HIV response. The magnitude can be substantial – for countries like Botswana or Malawi, the size of the working-age population had been reduced by about 10 percent by 2018 relative to estimates excluding the impact of AIDS (Table 1).

Table 3.1: Impact of HIV on working age population, 2018

	Adult HIV prevalence (15-49)	Effect on size of working age population	Effect on share of working age population	Change in dependency rate
	(percent)	(percent)	(percentage point)	(decimal)
Botswana	20.3	-11.7	-0.7	0.010
Haiti	2.0	-2.5	-0.2	0.003
Malawi	9.2	-8.6	-0.6	0.011
Namibia	11.8	-6.5	-0.5	0.008
Uganda	5.7	-7.3	-0.7	0.014

Source: UNAIDS (2019b) and authors' calculations.
Note: Working-age population is defined as population at ages 15-64. Effects and changes are calculated relative to scenarios excluding the impact of HIV.

For GDP per capita, the most directly relevant demographic determinant is the change in the share of the working-age population. If the working-age population declines relative to the size of the young and old populations (i.e., the dependency rate increases), each income needs to sustain a larger number of people, and GDP per capita is correspondingly lower. Estimates of the impacts of HIV on the share of the working-age population are small – even for countries with high HIV prevalence, it declines by less than one percentage point by 2018 (Table 1), and dependency rates increase by about up to one percentage point. Considering that these effects have gradually developed over a period of several decades, this means that the demographic impacts of HIV alone have had a minuscule direct effect on the annual growth of GDP per capita over this period.

Summary table: Demographic impacts of HIV and their macroeconomic implications

Demographic impacts of HIV	Macroeconomic implications	Impact of HIV response
Slower growth or declines in working-age population because of increased mortality among adults (especially young ones).	Labour supply increases more slowly or declines, reducing GDP growth. Increased mortality among the working-age population lowers GDP but also the population size; the net effect on GDP per capita is therefore unclear.	The effects of HIV on population size and structure are cumulative and not directly reversed by HIV response. In the longer run (decades), a reversal of the effects of HIV on the population age structure. Growth of labour supply higher than otherwise as younger cohorts are less depleted by impacts of HIV.
Lower birth rates (because of increased mortality and reduced fertility rates among women living with HIV) and increased child mortality reduce size of young cohorts.	GDP per capita higher than otherwise in short run (smaller not-yet-productive young population). In the longer run smaller cohorts of young people contribute to lower growth of labour supply.	Reverses lower fertility rates and elevated child mortality, increases growth of labour supply in long run.

Demographic impacts of HIV	Macroeconomic implications	Impact of HIV response
Fewer adults reach old age due to AIDS-related early mortality	GDP per capita higher than otherwise (because of smaller size of old population). Mitigates fiscal and health-systems burden associated with population ageing	Following scaling-up of treatment, higher-than-normal growth of the old population, as cohorts reaching old age are increasingly less depleted by AIDS-related mortality.
The impact of HIV on the dependency rate (DR) is ambiguous and depends on the interplay of (1) reduced mortality of working-age adults (increases DR), (2) reduced birth rates and increased child mortality (reduces DR), and (3) the age profile of adult mortality (role of deaths among older adults and depleted cohorts reaching old age, reducing DR).	The dependency rate (size of old and young population, relative to size of working age population) is an important determinant of GDP per capita. The overall impact on GDP per capita is negligible.	HIV response reverses causes of changes in dependency rates, but reversals in impacts on population structure take decades.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #4

HUMAN CAPITAL

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This brief forms part of a body of work on the Economics of HIV, funded by the Bill & Melinda Gates Foundation (INV-002382). The authors acknowledge the contributions of the participants of the 'Economics of HIV' meeting in Cascais, Portugal, in September 2018 for general direction on this work. The brief was reviewed in-depth by Arjun Vasan from the US Treasury and Katharina Hauck from Imperial College London. We are grateful for the excellent work of James Baer in proofreading the briefs, and Carla Hauptfleisch in designing them. The findings and conclusions contained within this brief are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or of the institutions the authors represent.

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POLICY BRIEF **#4**

HUMAN CAPITAL

KEY POINTS

- **AIDS-related mortality among young adults results in an increase in the number of orphans, and orphanhood is associated with impaired access to education.**
- **Early mortality among working-age adults causes a loss of skills and experience and a drop in returns to investment in education.**
- **Educational outcomes have weakened in regions with higher HIV prevalence but investments in the HIV response are effectively mitigating HIV's negative impact on human capital.**

HIV/AIDS destroys human capital through early mortality among adults, but also affects the creation of new human capital.[1] Orphanhood is associated with worse educational outcomes. HIV also discourages investment in education through an increase in mortality among working adults, before the income benefits of education have been fully realised. Overall, education outcomes have weakened in regions where HIV prevalence has been high. Declining orphanhood rates, and a weakening of the link between HIV and education outcomes, suggest that the HIV response has mitigated the effects of HIV on human capital.

1 Moreover HIV affects the ability to use human capital because of ill health. In this brief we focus on the accumulation of human capital in the form of education and other skills. The consequences of increased morbidity, or of changes in the composition of the population if the impact of HIV differs across skill categories, are addressed in Policy brief #6.

Orphans

HIV/AIDS has resulted in a steep increase in the number of orphans in high-burden regions. Among other adverse consequences, orphanhood affects economic growth by impairing access to education and the ability to benefit from it.

One of the effects of HIV/AIDS is the increase in the number of orphans resulting from increased mortality among young adults. The number of AIDS orphans increased steadily as the impact of the epidemic escalated (UNAIDS, 2019). By 2006, about 3 percent of children were orphaned by AIDS across sub-Saharan Africa (average HIV prevalence: 4.5 percent in that year), but the share of children who were AIDS orphans reached up to 10 percent in countries like Zambia (HIV prevalence: 13.8 percent in 2006), and 16 percent in Botswana (HIV prevalence: 24.3 percent) (Figure 4.1). Of these children orphaned by AIDS, a disproportionate number were double orphans: UNICEF (2013) estimated that 31 percent of children orphaned by HIV were double orphans in 2006, compared with 9 percent of children orphaned for other causes. Since then, orphanhood rates have declined by nearly one-third across sub-Saharan Africa, largely as a consequence of improved survival owing to treatment scale-up, and by more than one-half in those countries (Botswana, Namibia, Zambia) that were most successful in extending treatment access (Figure 4.2).

Figure 4.1: Children orphaned by AIDS (percent of population, ages 0-17)

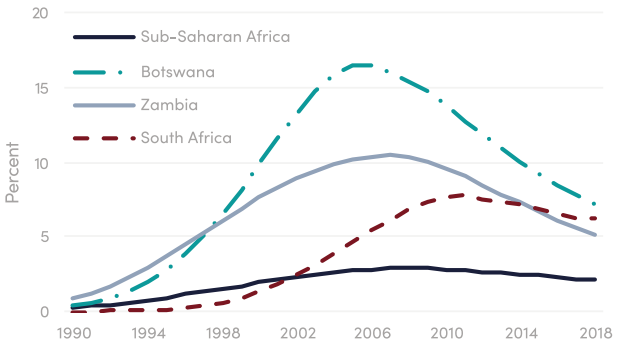
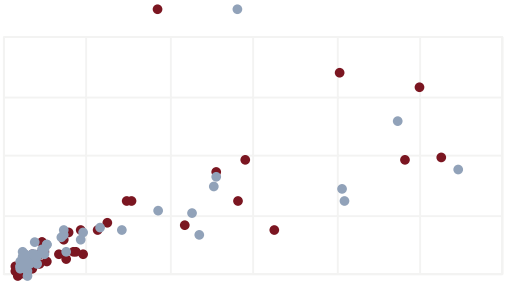


Figure 4.2: Share of AIDS orphans and HIV prevalence across countries



Source: UNAIDS (2019). Orphans are defined as all children who have lost at least one parent.

The increase in the number of children orphaned by AIDS gave rise to concerns about catastrophic social consequences as a result of parental loss and lack of childhood nurturing, such as reduced access to health and education on the one hand, and increased juvenile delinquency and a "crime time bomb" (Schönteich, 1999) on the other. In addition, there was concern about economic decline in countries most affected by HIV, notably through disruptions to the accumulation of human capital (Bell et al., 2006).

Orphanhood has consistently been shown to result in lower educational attainment. One study found a one-year loss in years of schooling for children who have lost their mother (maternal orphans) and a weaker effect for paternal orphans (Beegle et al., 2010). Mishra & Bignami-Van Assche (2008) showed that school attendance for adolescent orphans (ages 15-17) is 11 percentage points lower than the average. Additionally, living with a parent who is HIV-positive has been shown to have a negative effect on education, although the effect is smaller than the consequences of orphanhood (Evans and Miguel, 2007; Mishra & Bignami-Van Assche, 2008). This finding, though, precedes the scaling-up of treatment, which plausibly has mitigated such adverse effects.

Notably, not all concerns about some of the consequences of orphanhood have been realised. The number of child-headed households has not obviously increased because of AIDS (Hosegood et al., 2007), suggesting that societies have coped in terms of looking after orphaned children, for example by incorporating them into extended families. Also, there is little evidence suggesting that orphans are disadvantaged in terms of health or nutrition outcomes, or household wealth (Mishra and Bignami-Van Assche, 2008), let alone some of the more dramatic projections of the impact of high rates of orphanhood on society.

Mortality and experience

Early mortality among adults results in losses of human capital in the form of experience and education, and diminishes the incentives to invest in education.

HIV resulted in a steep increase in early mortality among adults in the early 2000s, but much of this increase has been reversed by the scaling-up of treatment. The probability of a 15-year-old dying before reaching the age of 50 rose to 45 percent in Zambia (HIV prevalence at ages 15-49 of 14.1 percent in 2005) from 21 percent in the 1980s, to 36 percent in Kenya (HIV prevalence of 6.6 percent in 2005) compared with just 16 percent in 1980-85), and to over 50 percent in some countries with very high HIV prevalence (Eswatini, Lesotho and Zimbabwe) (Figure 4.3). These trends of course mirror the escalation of the HIV epidemic and the subsequent scaling-up of treatment over time, against an underlying trend of health improvements in other areas.

Figure 4.3: Probaility of dying before reaching age 50 for a 15-year old

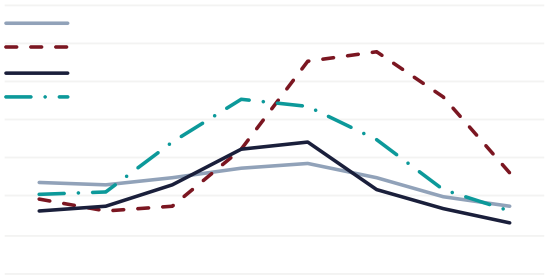
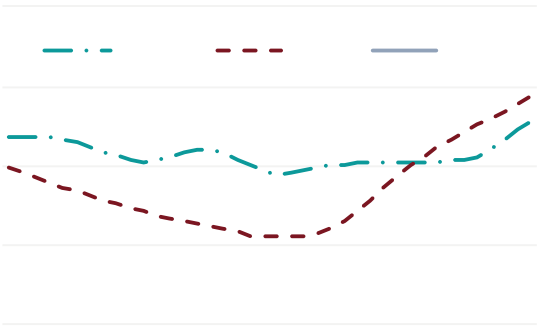


Figure 4.4: Average age of working-age population (ages 15-64)



Source: UNPD (2019).

In addition to education, another dimension of human capital is experience – skills acquired through professional experience and learning on the job. Age and years of work experience have been found to play an important role in explaining labour productivity (Heckman et al., 2006; Bigsten et al., 2000). On the macroeconomic level, early mortality – by destroying experience – could thus reduce the average labour productivity of the workforce overall, a factor that has been incorporated in some macroeconomic analyses of the impact of HIV (e.g., BIDPA, 2000).

At the population level, the evidence regarding such a loss in experience and skills is mixed. Figure 4.4 illustrates the experience of some countries facing severe HIV epidemics, where the average age – and thus experience – of the working-age population declined as AIDS-related mortality escalated, followed by a rebound during the period in which treatment became increasingly available. With regard to skills and education, the evidence is less clear. While increased mortality destroys skills, the epidemic may result in increases or decreases in the average education level, depending on the socio-economic gradient of HIV and of access to treatment. Data from Demographic and Health Surveys do not give a consistent picture on this: Asiedu et al. (2012) observe that the link between HIV prevalence and education differs between countries, and Hargreaves et al. (2013) suggest that the burden of HIV is shifting to populations with lower educational attainment.

The average age of the working-age population declined by about 1 year in Kenya and Zambia between 1980 and about 2000, but by much less in Eswatini (Figure 4.4). These discrepancies between countries likely reflect demographic factors in addition to HIV. In each country, average working-population age rebounded after 2000 – closely associated with the scaling-up of treatment.

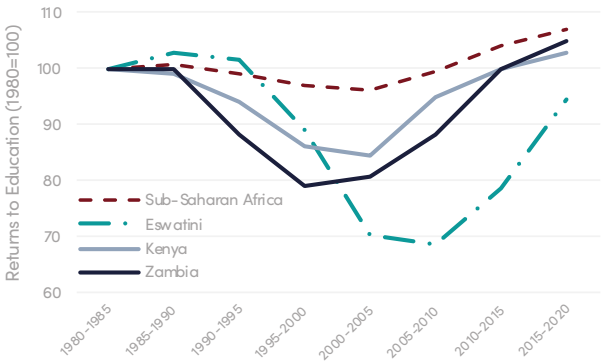
Investment in human capital

The risk of dying early reduces public and private incentives to invest in human capital. Empirical evidence suggests that HIV has been associated with a decline in educational outcomes.

Increased mortality among young adults not only destroys human capital directly – including a reduction in the available teaching workforce – but also affects the incentives of both governments and individuals to invest in education and skills for the future. To the extent that these reduced incentives result in lower investment in human capital (schooling, training), this would compound the direct losses in human capital through increased mortality.

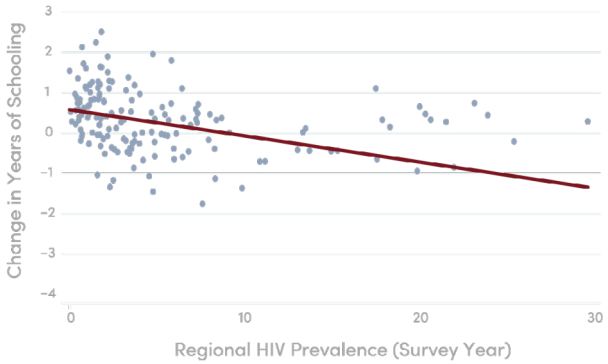
In countries facing high AIDS-related mortality, the economic returns to education may decline steeply. According to our simple illustration (Figure 4.5), in which the return to education is measured by the value of a lifetime income stream, these returns have declined by up to one-sixth in Kenya, one-fifth in Zambia, and one-third in Eswatini.

Figure 4.5: Effect of changing mortality on returns to education



Source: Authors' calculations, based on UNPD (2019). Figure shows returns to education estimated based on age-specific mortality prevailing in the respective period, relative to the level that would have been attained if mortality patterns had remained the same as in 1980-85. Calculation assumes returns to education are proportional to present discounted value of lifetime income (i.e., from age 15 to 64), assuming a discount rate of 3 percent and annual growth of individual income of 5 percent.

Figure 4.6: HIV prevalence and change in years of schooling



Source: Fortson (2011, reprinted with permission). For regressions underlying trend line, data points were weighted by underlying number of observations.

To the extent that these changes in actual mortality are realised and reflected in expected life prospects, such declines in the returns on investment in human capital could affect decisions on schooling and other forms of investment in human capital. This capital could have large implications for economic outcomes. One study calibrating the economic impacts of HIV through this channel projects that "the most [HIV] affected countries in Sub-Saharan Africa will be in future, on average, 20 percent poorer," and that "schooling will decline in some cases [...] by more than 40 percent" because of higher mortality (Ferreira, 2013). This projection, though, did not yet factor in the steep increase in access to treatment and the associated reversals of the negative impacts of HIV on the returns on human capital.

Such modelled projections of the effects of HIV on the accumulation of human capital, however, assume that individuals' subjective expectations of life expectancy align with the actual changes caused by HIV/AIDS. If the impact of HIV on subjective expectations regarding life expectancy is tempered by lags in the perception of the impacts of the epidemic, or by a mis-appreciation of the individual risk of contracting HIV, then the link between increased population-level mortality and individual decisions to invest in human capital is weakened or broken.

Empirical evidence suggests that HIV has been associated with a decline in educational outcomes, beyond the effects on orphans discussed earlier. Fortson (2011), comparing cohorts born before and after 1980 (i.e., passing through school before or while the impacts of HIV escalated) across 15 African countries finds that there were fewer completed years of education where HIV prevalence was high: "relative to areas without HIV, post-1980 birth cohorts in areas with HIV prevalence of 10% (today) completed about 0.5 fewer years of schooling than pre-1980 cohorts." These findings were reaffirmed by Chicoine et al. (2019), but their larger and more recent dataset also found that this adverse effect may be fraying as a consequence of treatment scale-up. This finding is consistent with evidence showing that treatment initiation is associated with an improvement in school attendance of children in households of adults living with HIV (Graff Zivin et al., 2009; d'Adda et al., 2009). Baranov & Kohler (2018) suggest that household expenditures on education and children's schooling have improved in areas where antiretroviral therapy has become available, including among households not affected by HIV, suggesting that expectations of mortality are an important channel through which HIV and the HIV response affect educational outcomes and thus human capital accumulation and growth.

Conclusion: Impact of HIV on human capital

Overall, the evidence suggests that HIV has affected human capital in several ways. Most directly, HIV destroys human capital through early mortality – and as a consequence, the economy benefits less from investments in education. At the same time, HIV affects the accumulation of new human capital. Orphanhood results in lower educational attainments, and anticipated early mortality also reduces individuals' incentives to invest in acquiring skills and education. Empirical evidence suggests that educational outcomes have deteriorated relatively in areas with high HIV prevalence, suggesting that the effects of HIV have extended beyond households directly affected. The scaling-up of treatment has obviously mitigated the destruction of human capital through early mortality, and appears to have an effect in terms of mitigating the adverse consequences of HIV on education outcomes.

Summary table: HIV/AIDS and the accumulation (and destruction) of human capital

Direct impact	Macroeconomic implications	Impact of HIV response
Early mortality among adults.	Destroys human capital and reduces the economic benefits of past public and private investments in education.	Directly mitigates the adverse impacts by reducing AIDS-related mortality.
Anticipated early mortality among adults.	Reduces the expected returns to current public and private investments in education, and may therefore reduce such investments.	Not yet known. This effect of AIDS and the HIV response works through perceptions, and thus depends on the extent to which increased mortality has been a factor in decisions on education, and to what extent this belief has been changed through the HIV response.
AIDS causes orphanhood, which is associated with impaired access to education.	Reduces the supply of more educated workers once cohorts affected by high rates of orphanhood enter and age through the working-age population.	Directly mitigates the adverse impacts by reducing AIDS-related mortality. However, the impact on education outcomes among working-age adults occurs with long lag.
Increased mortality among teachers.	Disruptions in the supply of education, reducing educational attainments.	Directly mitigates the adverse impacts by reducing AIDS-related mortality.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #5

CAPITAL AND INVESTMENT

Health Economics and Epidemiology Research Office
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Wits Health Consortium
University of the Witwatersrand

WITS UNIVERSITY

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POLICY BRIEF **#5**

CAPITAL AND INVESTMENT

KEY POINTS

- **The direct effects of health-related productivity shocks on economic output are magnified by their negative impact on investment.** Poorer health decreases productivity, which results in lower economic output and consequently lower investment, which again reduces productivity and output over time.
- **Higher mortality reduces incentives for saving and investment.** Empirical studies (not HIV-specific) suggest that this could be an important link between HIV and growth, but there is no clear evidence on such drops in savings and investment in countries facing a large HIV burden.
- **Some HIV-related spending may "crowd out" capital investment which would occur if the funds were used differently.** However, to the extent that spending on the HIV response contains investment, the net effect on investment and capital accumulation is mitigated and could even be reversed.

HIV may affect investment and capital accumulation both directly and indirectly. First, spending on the HIV response replaces spending for other purposes, including investment. Second, lower investment means that less capital is accumulated over time, resulting in lower GDP per capita.

Capital accumulation magnifies impacts of health shocks on growth

Lower productivity caused by a health shock such as HIV results in lower output and consequently lower investment, which again reduces output over time. This effect on investment approximately doubles the direct effects of health-related productivity shocks on output.

In standard neoclassical models of economic growth (e.g., Mankiw, 2018; Jones & Vollrath, 2013),[1] a drop in output due to lower productivity sets off a gradual macroeconomic adjustment characterised by lower investment and a gradual decline in the capital-labour ratio, resulting in a period of lower economic growth until the economy reaches a new equilibrium at a lower level of output. The magnitude of such an indirect effect can be significant. Under common assumptions regarding the shape of the production function in developing countries, the reduced accumulation of capital roughly doubles the overall effect of lower productivity on output (see Annex describing the model used in this brief for calibrating the economic effects of HIV). This adjustment process, however, operates slowly: it typically takes about one decade for half of the adjustment to be completed.

Concretely, this means that a productivity shock that immediately reduces GDP per capita by 1 percent can result in an *additional* loss in GDP per capita of about 0.5 percent after 10 years, and subsequent slower declines until the full effect of 2 percent of GDP per capita is realised.

1 See the Annex to this brief for an illustration of the model.

Through a similar mechanism, the neoclassical models also estimate how investment and capital accumulation modify the macroeconomic effects of increased mortality and changes in population growth. For example, if a health shock results in a loss of 1 percent of the population (setting aside any other disruptions which might be associated with this), GDP declines by between about 0.5 percent and 0.67 percent.[2] GDP per capita increases accordingly by about 0.33–0.5 percent. However, the lower level of GDP is not sufficient to sustain the previous level of capital, and the capital stock declines until GDP drops by 1 percent (the same change as the loss in the population size) and the temporary increase in GDP per capita is nullified.

These two effects – the direct effect of a change in population size and the changes in investment it triggers – are also present when a health shock results in a permanent decline in the rate of population growth. Here the repeated declines in population have a cumulative positive effect on GDP per capita, but these effects are partly offset through lower investment. Following an adjustment period, the economy settles at a new equilibrium. For example, if population growth declines by one percentage point, GDP growth eventually also declines by one percent, but with a level of GDP per capita that is about 5–10 percent higher than otherwise (see Annex).

2 Here and further below, the ranges in economic effects reflect differences in how responsive output is to changes in capital or labour, summarised by the parameter γ in the model described in the Annex. If output responds little to changes in labour, then a loss in the size of the population has little effect on output, and therefore translates into a relatively large effect on output per capita.

Increased mortality results in lower savings

Economic models and empirical evidence suggest that higher adult mortality results in lower savings. In the long run, however, higher mortality changes the age structure of the population, resulting in a more ambiguous link between mortality and the aggregate savings rate. In any case, countries facing high AIDS-related mortality did not experience the large effects on savings predicted by some models.

The savings rate is a key determinant of economic growth and GDP per capita. A higher savings rate results in a higher capital-labour ratio and higher GDP per capita. This link is quantitatively important, as a 10 percent increase in the savings rate would eventually increase GDP per capita by 5–10 percent. This increase in GDP per capita, which works through a gradual increase in the capital-labour ratio, would occur slowly – one-half of the adjustment would take about 10 years.

The potential impact of HIV on savings behaviour is therefore an important aspect of the appraisal of the economic impact of HIV. One important channel through which HIV may affect savings is increased mortality and reduced life expectancy for the working-age population.

Increased life expectancy – specifically, increased remaining life expectancy – creates an incentive to save more, in order to secure one's standard of living in old age. But this increased incentive does not necessarily result in a higher savings rate out of an individual's current income. Individuals could also retire later, especially if longer life expectancy is associated with an improved age-specific state of health (Bloom et al., 2010).

In addition to these individual effects, it is necessary to take into consideration the composition of the population, and specifically the distinction between the working-age population, who are saving for retirement, and the population at later stages of their lives, who are drawing down savings. Population ageing per se thus tends to lower the savings rate, and it is conceivable that the positive effects of improved life expectancy on savings are offset over time as – owing to reduced mortality – an increasing share of the population reaches old age and starts dis-saving (Bloom et al., 2003). Such a demographic adjustment takes decades, however. For the appraisal of the macroeconomic consequences of HIV and of the HIV response, it is therefore sensible to focus on the immediate effects of changes in mortality or life expectancy on the savings rate.

Empirical studies addressing the link between savings and life expectancy or mortality in general, not specifically addressing HIV, suggest that the impact of increased life expectancy on savings is positive and potentially important. Bloom et al. (2003) estimate that one additional year of life expectancy is associated with an increase in the savings rate of about 0.4 percentage points (with some variation across specifications). This is a large effect with regard to the potential economic impacts of HIV. For example, with an underlying savings rate of 15 percent, a loss in life expectancy of 10 years would reduce the savings rate by 4 percentage points, and eventually lower GDP per capita by 13–27 percent. Similarly, Lorentzen et al. (2008) suggest that an increase in adult mortality (ages 15–60) of 0.1 percentage points (i.e. 1 death per 1,000 people per year), compared with a mean of 0.3 percent, would reduce the

savings rate by 1.9 percentage points. A sustained increase in HIV-related mortality could therefore have a severe effect on the savings rate. For example, adult mortality at ages 15-60 in Botswana increased by up to 1.3 percentage points because of HIV (as of 2003), which would reduce the savings rate by 25 percentage points – a decline almost as high as the total level of savings. As of 2018, HIV-related mortality in Botswana had declined to 0.25 percent at ages 15-60, which would still result in a decline in savings of 4.75 percentage points, and – if mortality remained at this level –would reduce GDP by about 6-12 percent in the longer run.

Such a steep drop in the savings rate, however, has not happened in Botswana, nor in other countries facing a severe HIV epidemic. One possible explanation is the issue of "out-of-sample projection" – the mortality shocks encountered in countries facing high HIV prevalence are outliers compared to those in the empirical studies discussed above. While the models may work well for typical changes in mortality, the results may not extrapolate well to larger shocks. Second, the effect operates through reduced expected life expectancy. In other words, it requires that individuals be aware of changes in projected mortality and fully factor these into their outlook on life. It is not clear if this requirement has been met because of the stigma attached to HIV and the fact that accessing and appraising relevant information is a slow process. While there is microeconomic evidence that HIV has had some impact on savings behaviour at the household level (Baranov & Kohler, 2018), the macroeconomic data suggest that any such changes in expectations did not have a forceful effect on aggregate outcomes.

HIV-related spending may crowd out investment

Public or private spending on HIV is not available for other purposes, including investment. To the extent that HIV spending "crowds out" investment, it reduces capital accumulation and, gradually, output. However, spending on the HIV response may itself represent investment.

The best-documented impacts of HIV on savings and investment involve households affected by HIV, which experience drops in income when an income earner becomes sick or other household members have to take time off to care for a sick household member, while health-related expenditures crowd out other types of household spending. As a consequence, households affected by HIV frequently sell assets or borrow. (This is discussed in more detail in Policy brief #8, on the economic consequences of HIV across households.) From a macroeconomic perspective, this household response contributes to a decline in the savings rate. However, the magnitude and macroeconomic relevance of these household-level effects is not well established. Some of the negative income effects in households affected by HIV are – from a macroeconomic perspective – offset by gains in other households, e.g., if a sick person loses an employment and a person from a different household gains it. The contributions of households affected by HIV to aggregate private investment (their weights in relation to other private households, and the breakdown in household vs. corporate investment) are also not well understood.

Because of these challenges in assessing the consequences of HIV for investment using a bottom-up approach, building on microeconomic data, most assessments of the link between HIV spending and investment follow a top-down approach, assessing effects on investment based on estimates of the cost of the HIV response (and assumptions about how much of these costs result in low investment). In some countries, the HIV response absorbs a significant amount of resources (Figure 5.1; most data relate to 2017 or 2018). Total (domestic and foreign-financed) HIV spending across all countries covered by UNAIDS (2019) amounts to up to 4 percent of GDP, with the highest level attained in Lesotho, a country with low GDP per capita and very high HIV prevalence (Figure 5.2). In the countries which face the most severe financial burden, however, external financing accounts for a substantial share of the expenditure on the HIV response. For instance, in countries where expenditure on the HIV response exceeds 1 percent of GDP, external financing ranges from about 40 percent of total HIV spending (in Botswana and Namibia) to about 97 percent of total HIV expenditure (in Haiti, Malawi and Mozambique).

Figure 5.1: Total and domestic public HIV spending (percent of GDP, latest year)

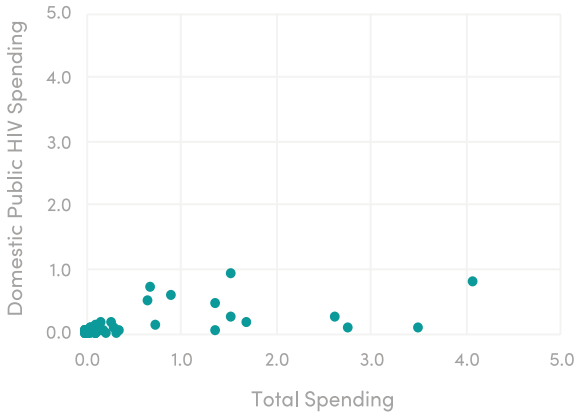
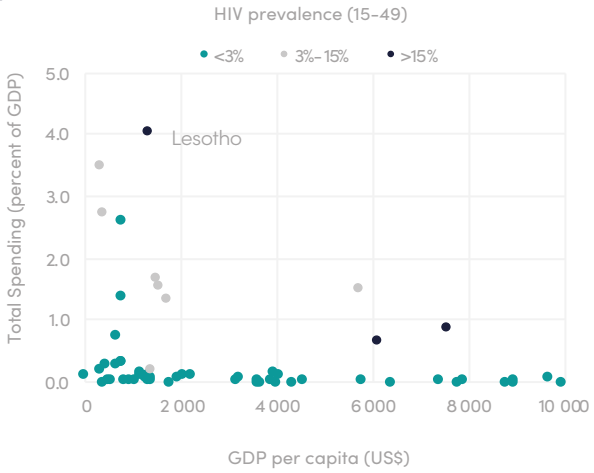


Figure 5.2: Total HIV spending vs. GDP per capita (latest year)



Source: UNAIDS (2019).
Note: Figures cover all countries with a level of GDP per capita lower than US$ 10,000 covered by UNAIDS.

An assessment of the crowding out of public investment by spending on the HIV response thus needs to differentiate between externally financed spending and domestically financed spending. If external financing of the HIV response were to crowd out external financing of other projects, this could have an important impact on public investment which is often partly funded externally. In Malawi, for example, external financing of government development spending (which consists largely of investment) amounted to 3.5 percent of GDP, and over 60 percent of total government development spending. Such crowding out could happen if HIV funding and other development assistance are funded out of a donor's fixed budget for development assistance. It is, however, implausible that external financing of the HIV response crowds out external financing for other purposes in any specific aid-receiving country, because external funding for HIV comes predominantly from HIV-specific funding instruments rather than country-specific allocations of general aid by donors.

Expenditure on domestic financing of HIV exceeds 0.1 percent of GDP in only 12 of the 80 countries for which HIV spending data are available from UNAIDS (2019). On this count, the highest burden tends to fall on middle-income countries with very high HIV prevalence (Botswana, Lesotho, Namibia, South Africa), where domestically financed HIV spending exceeds 0.5 percent of GDP. The consequences of such domestic spending in terms of capital accumulation depend on how much investment is displaced by the expenditure on HIV. For example, in a country where domestic HIV spending is among the highest, where total investment amounts to 20 percent of GDP, HIV spending amounts to 0.5 percent of GDP, investment accounts for 15 percent of domestic government spending, HIV spending displaces government investment and consumption proportionally, and no HIV spending represents an investment, then investment is 0.4 percent lower than otherwise because of HIV spending.[3]

Eventually, through the process of capital accumulation described in the first section, this lower investment would result in a level of GDP per capita which is 0.5-0.8 percent lower than otherwise (using the model described in the annex). This output loss, however, could turn out to be smaller, depending on two factors: first, if domestic HIV spending is more than proportionately or entirely financed from current spending, and second, to the extent that HIV spending also contains investment. (If HIV spending contains more investment than alternative spending, then the impact of HIV spending on investment and capital accumulation could even be positive.) This eventual output loss occurs through a gradual slowdown that is spread over more than a decade (as described in the first section). Relative to annual effect on GDP growth (averaging about 4 percent annually across sub-Saharan Africa in 2009 to 2019), the growth effect is thus very small, even in countries with relatively high levels of domestic HIV spending.

3 The calculation is as follows: reallocation of government spending of 0.5 percent of GDP, 15 percent of this crowds out investment, so investment declines by 0.075 percent of GDP, which is about 0.4 percent of total investment of 20 percent of GDP.

Limitations

Our calibrations on the impacts of HIV on economic growth through investment and capital accumulation do not include two aspects which might play a role. First, owing to data limitations we do not account for investment expenditure in non-health areas (e.g. construction) that is financed by the HIV response. Especially where investment is low otherwise, such HIV-related investment could mitigate and even reverse the adverse macroeconomic effects of a crowding-out of investment in other sectors by HIV spending. Second, we do not distinguish between investment by households, businesses or government. This reflects that the bulk of identified HIV spending occurs through governments, and a broad-brush focus on total or public investment is a good approximation. This macroeconomic perspective misses aspects of the impact of HIV across the economy, such as the impacts of ill health or specifically HIV on affected households (Alam & Mahal, 2014; Murphy et al., 2019), or different effects across sectors.

Summary table: HIV, investment and capital accumulation

Direct impact	Macroeconomic implications	Impact of HIV response
Reduced productivity and human capital (Policy briefs #4 and #6)	A shock to output is augmented through reduced investment and – over time – a reduced capital stock.	The effects of direct impacts in reversing losses in productivity or human capital are similarly augmented through investment and capital accumulation.
Increased mortality and reduced life expectancy	High mortality discourages private saving and investment. Reduced investment erodes capital stock and gradually results in lower GDP per capita.	The response reverses impacts on health, and gradually – following recovery of investment – on capital stock and GDP per capita.
		Domestically financed spending on the HIV response crowds out government spending on other purposes, including investment, potentially leading to a gradual reduction in GDP per capita.

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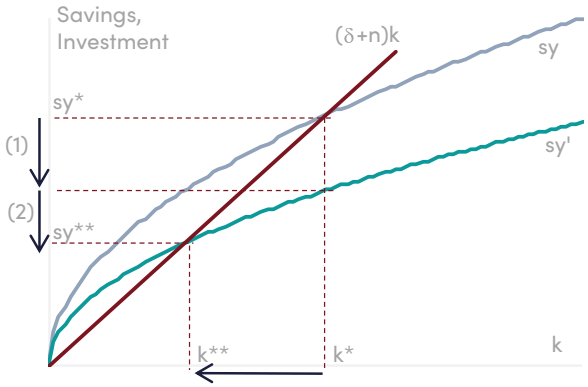
Annex

This annex describes the basic neoclassical growth framework which underlies the discussion on how investment and capital accumulation magnify the direct macroeconomic effects of health-related productivity shocks. The model is discussed in more detail in standard macroeconomics textbooks like Mankiw (2018) or Jones & Vollrath (2013).

In this model, output per capita y depends on the capital-labour ratio k, often expressed as y=f(k) (Figure 5.A1). Each year, the capital-labour ratio is augmented by new investment, but depleted by capital depreciation (at an annual rate δ) and population growth *n* (the latter because the capital stock is spread over a larger number of workers).

Figure 5.A.1: Output per capita and the capital-labour ratio

Figure 5.A.2: Consequences of a productivity shock



Notes: In Figure 5.A.2, (1) represents the immediate adjustment to lower output per capita (y) and thus savings (sy) following a productivity shock, while the capital-labour ratio (k) is unchanged at that moment. (2) Because investment is lower than what would be required to compensate for depreciation and to accommodate population growth, the capital-labour ratio starts declining at that point, and the economy gradually adjusts to a lower level of output per capita that can be sustained by a lower capital-labour ratio.

This economy attains an equilibrium (with capital labour ratio at k* in Figure 5.A2) in which the amount saved and invested (*sy*, where s is the savings rate) annually is just equal to the losses from depreciation and population growth:

$$sy^*=(\delta+n)k^* \quad (1)$$

If output declines owing to a productivity shock, then *y* and consequently *sy* decline, and ongoing investment is no longer sufficient to offset the annual losses in the capital-labour ratio from depreciation and population growth. This is the beginning of a process through which the capital-labour ratio shrinks until the economy eventually reaches a new equilibrium, at k**.

To quantify this effect, a more concrete specification of the link between y and k is needed. One common form is

$$y=Ak^{\gamma} \quad (2)$$

Using this specification, the equilibrium capital stock (from Eq. 1) can be expressed as

$$k^*=(sA/(\delta+n))^{(1/(1-\gamma))} \quad (3)$$

and

$$y^*=A^{(1/(1-\gamma))}(s/(\delta+n))^{(\gamma/(1-\gamma))} \quad (4)$$

This implies that a productivity shock (a decline in A) by 1 percent reduces output immediately by 1 percent (following Eq. 2), but – when the impact on the capital-labour ratio is taken into account – causes a decline in output by $1/(1-\gamma)$ percent in the longer run, which exceeds the immediate impact by $\gamma/(1-\gamma)$ percentage points.

With typical estimates of the parameter γ in developing countries at about one-third to one-half (Feenstra et al., 2015), the long-term impacts of a productivity shock on output per capita are thus 1.5 to 2 times higher than the immediate effects.

The impacts of a change in population growth on output per capita are obtained by taking the derivative of y* with respect to the population growth rate *n*, i.e.,

$$dy^*/dn=(-\gamma/(1-\gamma))y^*/(\delta+n) \quad (5)$$

For common estimates of n (see above), a depreciation rate of 8 percent, and evaluated at a rate of population growth of 2 percent, this implies that a permanent 1 percent decline in population growth increases GDP per capita by between 5 percent and 10 percent.

POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #6

PRODUCTIVITY AND EMPLOYMENT OF PEOPLE LIVING WITH HIV

Health Economics and Epidemiology Research Office
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Wits Health Consortium
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WITS UNIVERSITY

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UCL

This brief forms part of a body of work on the Economics of HIV, funded by the Bill & Melinda Gates Foundation (INV-002382). The authors acknowledge the contributions of the participants of the 'Economics of HIV' meeting in Cascais, Portugal, in September 2018 for general direction on this work. The brief was reviewed in-depth by Arjun Vasan from the US Treasury and by Jacob Bor from Boston University. We are grateful for the excellent work of James Baer in proofreading the briefs, and Carla Hauptfleisch in designing them. The findings and conclusions contained within this brief are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or of the institutions the authors represent.

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POLICY BRIEF **#6**

PRODUCTIVITY AND EMPLOYMENT OF PEOPLE LIVING WITH HIV

KEY POINTS

- **Early on, there were concerns that AIDS-related mortality would erode state governance and institutions and thus compromise economic development, but there is little evidence to suggest that such effects have been significant.**
- **HIV – especially at late stages of disease progression – results in reduced productivity and lower employment of people living with HIV, though the economy-wide effects are unclear.**
- **Treatment has been effective in restoring the productivity and – with some delay – employment of people living with HIV.**
- **Early access to treatment plausibly prevents spells of unemployment, which are an important cause of the adverse economic consequences of HIV.**

HIV potentially affects productivity in both a very general and a concrete sense. Especially during the escalation of the epidemic, there were concerns that steeply increased mortality would hollow out the functioning of the state and institutions, affecting the productivity of the economy overall.

More concretely, there is substantial evidence on the adverse effects of HIV on the economic activity of people living with HIV – through reduced employment and, if employed, lower productivity on the job or absenteeism – and the role of treatment in reversing some of these effects.

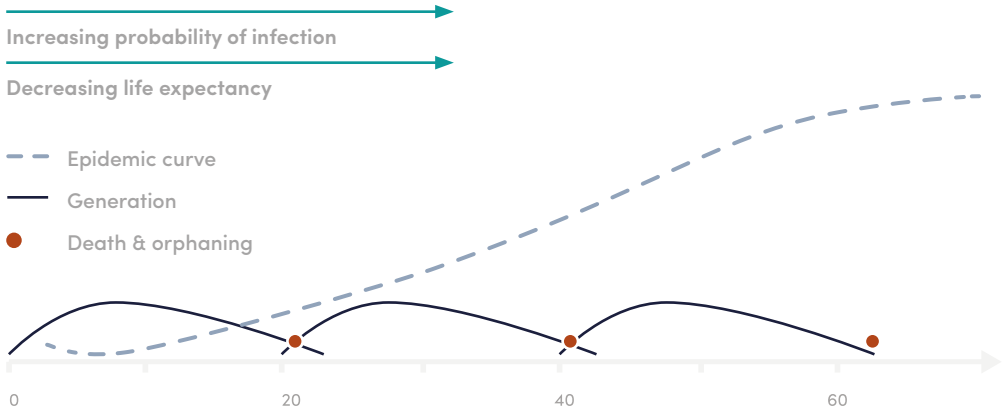
Governance and institutions

Governance and institutions create an enabling environment for economic development. High observed and anticipated mortality among public servants initially fuelled concerns about a potential collapse of state functions, but such dramatic effects have not materialised.

One of the concerns about the potential economic impacts of HIV regarded social cohesion and good governance – crucial factors in attaining sustainable growth (World Bank, 2017). The absence of such factors impedes economic growth directly by driving up the costs of doing business, but also by increasing uncertainty and discouraging investment (World Bank, 2020).

With regard to social cohesion and institutional development, there was a fear that owing to increased mortality the future would carry less weight in individuals' decision-making, and this in turn could discourage forward-looking behaviour and increase corruption, which has quicker pay-offs (de Waal, 2003). Second, and more generally, it was feared that HIV could result in a destabilising cycle, through reduced life expectancy, high rates of orphanhood and inadequate socialisation of orphans and vulnerable children, which might in turn contribute to the spread of HIV (Figure 6.1; Barnett 2006). The force of any such processes, though, has been radically weakened by the decline in AIDS-related mortality owing to widespread access to treatment.

Figure 6.1: Evolution of HIV epidemic and intergenerational impacts

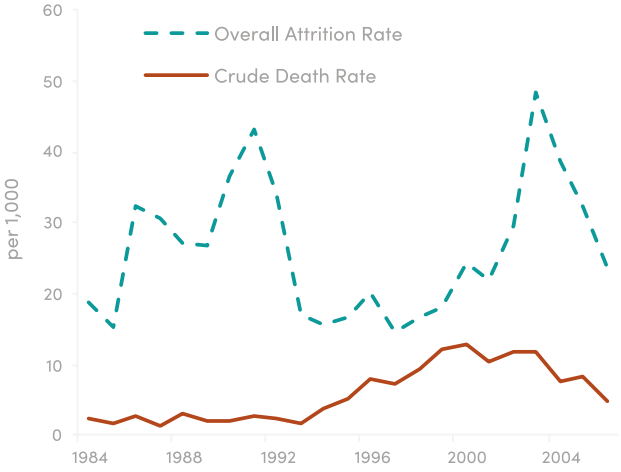


Source: Adapted from Barnett (2006), with the author's permission.

More concretely, HIV has eroded the capacities of the civil service through increased mortality among public servants. This process has been well documented, e.g., in Botswana, where mortality among police and prison officers increased about 5-fold from 0.3 percent in 1992 to 1.3 percent in 2002 (Figure 6.2; Gossett, 2010), and in Swaziland, where mortality among civil servants in 2001-2009 was highest at age 36-40 for men, and age 31-35 for women – the age brackets with the highest HIV prevalence (Haacker and Lule, 2012).

The implications of this increased mortality for the functioning of the state, however, are less clear. Deaths are only one of several causes of attrition from employment, and typically play a smaller role than resignations or retirement. In Botswana, for example, the contribution of deaths to overall attrition in the police and prison service between 1984-1995 and 1996-2005 (the period in which AIDS-related deaths in Botswana peaked) increased from 11 percent to 36 percent (Gossett (2010). Nevertheless, overall attrition barely changed, and was actually somewhat lower in 1996-2005 (averaging 26.6 percent) than in 1984-1995 (average of 27.2 percent). For Botswana, Gossett (2010) states that "one cannot conclude that the prevalence of HIV/AIDS has yet led to a 'hollowing out' of the state", and the subsequent decline in mortality (barely captured in this study) has plausibly ameliorated any adverse effects since. Similar observations on the mortality effects of HIV have been made for the education sector in Botswana (Bennell, 2005), or public servants overall in Swaziland (Haacker and Lule, 2012) and Malawi (UNDP, 2002).

Figure 6.2: Death and attrition rates in the Botswana police and prison services, 1984-2006



Source: Gossett (2010).

This finding may not carry over to other countries – the scale of the impact of HIV in Botswana was among the highest anywhere, scaling-up of treatment in the public sector occurred early and very comprehensively, and state capacities may have been relatively robust to start with. However, one lesson that applies generally is the need to place AIDS-related deaths in the context of attrition overall.

Productivity – evidence from company-level data

Company-level data show a steep decline in the productivity of workers living with HIV with failing health, and a strong recovery following initiation of treatment, but these data may not be representative for the impacts of HIV across the population.

The adverse impacts of HIV on employees have been documented in several studies based on company-level data. Drawing on company employment data (absenteeism, attrition and sometimes output), they are considered more precise than self-reported data.

The impact of HIV per se (before the introduction of antiretroviral therapy) has been documented for a sample of South African gold miners by Sonnenberg and others (2011). Absences for HIV-positive workers increased by about 2 percent of total working time following infection, largely on account of higher sick leave. This effect likely reflects health-seeking behaviour, as this is a sample of workers who know their HIV status, and would not be representative for HIV-positive people who do not. The adverse effects escalate only in the penultimate and final year preceding death, when the effect on absenteeism increases to 4 percent and 19 percent, respectively. In a rural community in Uganda, HIV-positive people not on treatment and with a CD4 count below 200 (an indication of advanced HIV disease) worked 7 days less per month than those with a CD4 count above 500 (Thirumurthy et al., 2013).

One of the best-known studies focuses on the impacts of HIV – and treatment – on tea pluckers in Kenya, covering not only absenteeism but also productivity, around treatment initiation (Larson et al., 2013). The data show a steep decline in working days in the year preceding treatment initiation, and an even steeper decline in the amount harvested, commencing earlier. Thus for this population, declining productivity on the job is an issue, exacerbating the effects of increased absenteeism (Figure 6.3). Following treatment initiation, the loss in working days is reduced to just 1-2 days per month (Figure 6.3). The recovery in output appears less complete (especially for women), but reflects in part that some employees are shifted to less physically demanding tasks (Figure 6.4). For the macroeconomic interpretation, it is important to note that while treatment improves workers' daily and monthly productivity, much of the treatment gains reflect longer survival rather than improved productivity of people living with HIV, i.e., the workers receiving treatment would have died otherwise (Habyarimana et al., 2010).

Figure 6.3: Productivity loss in days working per month (days)

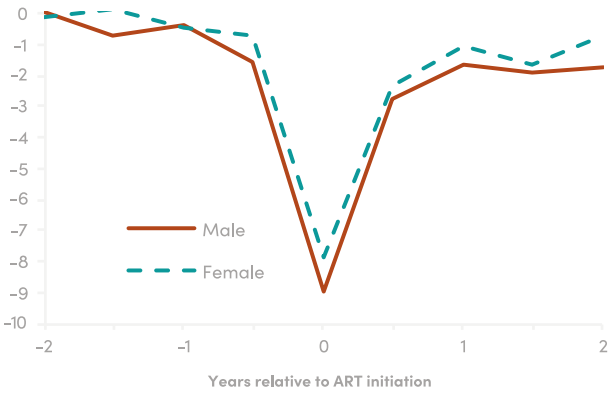
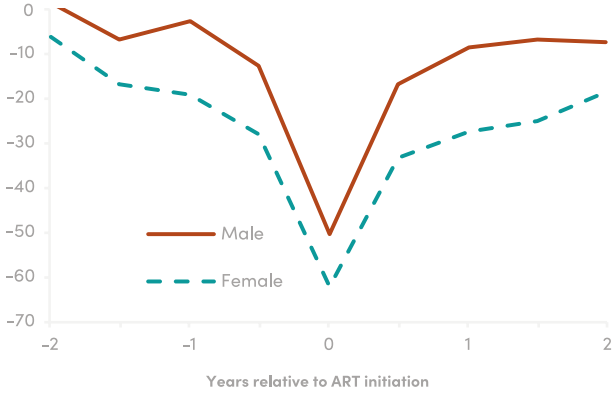


Figure 6.4: Loss in kilograms harvested per month (percent)



Source: Haacker (2016), adapted from Larson et al. (2013).

French et al. (2019), in a study of South African coal miners in 2009-2017, extend this literature to the era of comprehensive access to treatment, and treatment initiation at much earlier stages of disease progression than previously. For individuals initiating treatment earlier (above a CD4 count of 200), attrition (including deaths, but also other causes like retirement and separations for medical and other reasons) is reduced from 23 percent to 17-18 percent over a 4-year period. Absenteeism before treatment initiation is 8 percent lower if treatment is initiated above a CD4 count of 200, and 14 (or 20) percent lower following treatment initiation at a CD4 count of 200-350 (or above 350), all compared with treatment initiation below a CD4 count of 200.

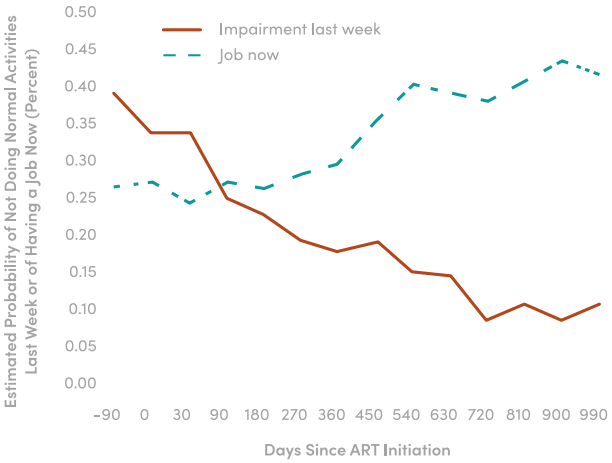
Productivity and employment – evidence from patient or population data

HIV results in steep losses of productivity and employment at late stages of disease progression. Treatment has been effective in improving health and – very gradually – employment.

While company-level data may offer precise measures of aspects of the productivity impacts of HIV, they are not representative, since they concern specific populations and occupations and do not capture important aspects of the labour-market impacts of HIV, e.g., a potential return to (any) employment enabled by treatment.

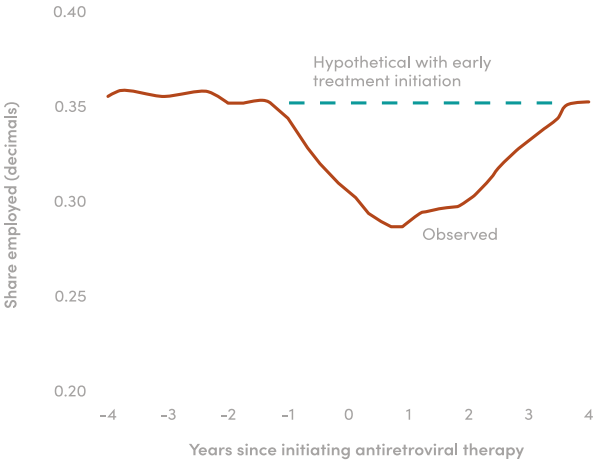
The impacts of treatment on employment outcomes have been documented in a number of studies tracking patients shortly before and after treatment initiation. The findings by Rosen et al. (2010) are typical. For a sample of South African patients receiving antiretroviral therapy, there was a rapid improvement in health status (from 40 percent reporting health impairments to just 10 percent) and a recovery in the employment rate (from 25 percent to about 40 percent) over the two years following treatment initiation (Figure 6.5). According to Bor et al. (2012), the employment loss escalated over the 1½ years before treatment initiation, followed by a slow but eventually nearly full recovery over 3-4 years (Figure 6.6).

Figure 6.5: Antiretroviral therapy, employment and impairment



Source: Rosen and others, 2010

Figure 6.6: Employment trend among HIV patients receiving antiretroviral therapy



Source: Bor and others (2012).
Notes: The "observed" curve is from Bor et al. (2012); the curve for "early treatment initiation" is a hypothetical addition for our discussion.

The slow recovery in employment – in a context of high unemployment overall – illustrates the role of the labour market in shaping the employment effects of HIV. Indeed, Booysen & Geldenhuys (2016) show that labour-market participation (being employed or seeking a job) recovers quickly following treatment initiation, but that patients find new jobs only very slowly. This factor is common among both HIV-positive people receiving treatment and HIV-negative job seekers. According to Bor et al. (2012), the median duration of unemployment following a job loss for HIV-positive people on treatment is 3.7 years, close to the median duration of 3.3 years for an HIV-negative control group.

The effects of HIV on the productivity and employment of people living with HIV are compounded by effects on members of their households. While the quantitative evidence is weaker than for the effects on people living with HIV, several studies show that caregiving family members must take time off work, so that caregiving erodes the economy's productive capacities (Heymann 2007; Rajaraman et al., 2008). In addition, caregiving or lack of resources affect children's access to education, with adverse effects on human capital in the longer run (see Policy brief #4).

These empirical studies were all conducted during a period when treatment was initiated relatively late, once patients

were already severely sick, but they also offer insights into the economic implications of early treatment initiation. Because the employment loss typically occurred within about a year before treatment initiation, and expanded treatment eligibility is associated with earlier treatment initiation, it is plausible that the ongoing expansion of treatment removes a major source of economic hardship for people living with HIV – health-related employment loss often followed by years of unemployment irrespective of improved health following treatment initiation (Figure 6.6, "hypothetical" curve). At the same time, the measured productivity effects of treatment (observed when treatment is initiated very late) are diminished. Looking ahead, the productivity effects of long-term treatment (which may be small but extend over long periods), the interactions of HIV and HIV treatment with other diseases, and the effectiveness of different drugs to mitigate such adverse effects become more important (Haacker et al., 2019).

While patient-level studies provide important insights into the improvements in health and economic outcomes associated with treatment, they are subject to two shortcomings: they may not capture impacts of HIV before the escalation of adverse health effects at a late stage of disease progression, and the sample may not be representative of the population as a whole. In both regards, Levinsohn et al. (2013) provide an important addition, studying employment effects of HIV in a nationally representative sample for South Africa. Controlling for other factors, they show that HIV has been associated with an increase of 6-7 percent in the probability of being unemployed. This effect is concentrated among less-educated individuals, where the employment rate was about 10-11 percent lower.

Some of the negative employment effects of HIV are plausibly reversed by the scaling-up of treatment. The effects of HIV programmes, though, may extend well beyond patients and households affected by HIV, because the programmes also create employment directly. Such effects are illustrated from a macroeconomic perspective by Wagner et al. (2015), pointing to employment gains in countries receiving support from PEPFAR (the U.S. President's Emergency Plan for AIDS Relief), and attributing them not only to health gains, but also to the effects of PEPFAR spending (accounting for about 6 percent of GDP in 10 PEPFAR focus countries). However, the statistical power of their analysis is relatively weak, as it relies on comparison between 10 PEPFAR focus countries and 11 control countries and offers no direct evidence on how HIV spending may affect employment.

Evidence on the localised effects of HIV treatment offers more insights into how HIV may affect employment. Wilson (2020) finds that local introduction of antiretroviral therapy increased employment by 8 percentage points among people living with HIV in Zambia. McLaren et al. (2019) provide estimates of the effects of introducing treatment in rural South Africa, not only on people living with HIV but also on the population not directly affected by HIV. They estimate that employment has increased by 8.5 percentage points for people living with HIV living close to antiretroviral therapy clinics, and that it has improved by nearly as much (6.3 percentage points) for people not affected by HIV in the same vicinity. They attribute these general employment effects to increased demand for labour, either directly through employment generated by the clinics, or through an expectation of reduced labour costs in the area.

Summing up

In summary, the adverse impacts of HIV on productivity and employment have been documented in numerous studies, predominantly based on data on patients initiating and continuing treatment. However, our understanding of the economic repercussions of HIV in this area is limited, for at least two reasons. First, the bulk of the published evidence regards South Africa, and the focus has been on the formal sector (through use of company data, or a focus on formal employment). These findings may not travel well across countries, nor apply to the informal sector, i.e., where the bulk of adults in many countries work (Thomas et al., 2019).

Second, the macroeconomic implications of reduced employment among people living with HIV are unclear – to what extent does this reflect a distributional effect (i.e., HIV-negative people benefiting from employment losses among people living with HIV) or an aggregate employment effect (with HIV-related health and employment losses resulting in lower employment overall)?

Summary table: Implications of HIV for productivity and employment

Impact	Macroeconomic implications	Impact of HIV response
Erosion of state capacities through increased mortality among public servants.	State dysfunctions increase the cost of doing business and undermine sustainable development.	Early concerns on state erosion have not obviously materialised. Reduced mortality owing to treatment would have further mitigated any effects.
Loss of productivity among people living with HIV, concentrated at late stage of disease progression.	Loss in average productivity. However, empirical evidence is employment- and sector-specific, and may not apply across economy.	Treatment results in reversal in productivity losses among people living with HIV, but main effect of treatment is increased survival.
Employment loss among people living with HIV.	Employment loss contributes to adverse economic effects on people living with HIV. However, effect on aggregate unemployment unclear, as employment losses among people living with HIV may be offset by employment gains by others.	Treatment initiation is followed by slow recovery in employment. Early initiation of treatment may prevent employment loss altogether.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #7

ECONOMIC GROWTH – OVERVIEW

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This brief forms part of a body of work on the Economics of HIV, funded by the Bill & Melinda Gates Foundation (INV-002382). The authors acknowledge the contributions of the participants of the 'Economics of HIV' meeting in Cascais, Portugal, in September 2018 for general direction on this work. The brief was reviewed in-depth by Arjun Vasan from the US Treasury. We are grateful for the excellent work of James Baer in proofreading the briefs, and Carla Hauptfleisch in designing them. The findings and conclusions contained within this brief are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or of the institutions the authors represent.

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POLICY BRIEF **#7**

ECONOMIC GROWTH – OVERVIEW

KEY POINTS

- **HIV has increased mortality and slowed population growth. As a consequence, GDP is lower and will remain lower than it would have been without the impact of HIV.**
- **Economic modelling suggests that the short- to medium-term impacts of HIV on GDP per capita are unclear, with important effects working in opposite directions. In the longer run, the effects are likely dominated by adverse impacts on education and skills.**
- **The empirical evidence on the link between HIV and growth of GDP per capita is also unclear. Studies linking growth of GDP per capita and direct measures of the impact of HIV tend to find very small effects.**
- **The evidence is strongest with regard to the impact of HIV on the accumulation of human capital, which however affects economic growth only very gradually.**

The impact of HIV on the overall capacity of an economy occurs through different channels. HIV-related mortality cumulatively reduces the size of the working-age population (see Brief 3), destroys human capital, and reduces returns to investments in education (see Brief 4). Increased morbidity or the disruptions associated with increased mortality reduce productivity (see Brief 6). The negative impacts of HIV on GDP are dominated by reduced population growth. The impact on GDP per capita is less clear, as HIV exerts a negative effect on productivity, reducing GDP per capita; but increased mortality means that the economy's assets are shared among fewer people, thereby increasing GDP per capita. Empirical studies suggest that the impact of HIV on GDP per capita has so far been small. In the long run, the impact of HIV on the accumulation of human capital is likely to be the dominant factor that affects GDP per capita.

Lower population means lower GDP

HIV-related mortality cumulatively reduces the size of the working-age population. In countries with high HIV prevalence, the magnitude of this effect is large. For example, in Botswana, the population aged 15-64 is now 12 percent smaller than it would have been without the impact of HIV (UNAIDS 2019). Likewise, the size of the young population, born largely during the scaling-up of treatment, is 9 percent smaller than it would have been without the impact of HIV, suggesting that the impact of HIV on population size persists across generations.

Economic modelling suggests that a population loss results in a drop in GDP that is about one-half to two-thirds the size of the population loss (see Brief 5). This effect is magnified as the immediate loss of GDP induces lower investment, decreases the capital stock, and lowers GDP further until the total loss is proportional to the size of the underlying population loss. This effect on GDP could be mitigated somewhat in economies that rely largely on natural resource extraction if the value of resource extraction is largely independent of the availability of domestic capital and labour resources. In such cases, GDP would decline less than proportionally to the drop in population.

Ambiguous effect on GDP per capita

Economic modelling suggests that HIV has both positive and negative effects on GDP per capita. The overall effect is ambiguous, especially in the short run, when increased mortality improves employment opportunities for survivors. In the longer run, the effects are largely negative, owing to the effects of HIV on the accumulation of physical and human capital.

Productivity losses owing to HIV-related morbidity or AIDS-related mortality (increased staff turnover, attendance at funerals) reduce GDP per capita (see Brief 6). Increased mortality also destroys human capital (skills accumulated by education, training or experience, see Brief 4). The average loss in human capital across the population owing to increased mortality is ambiguous, since it depends on the distribution of HIV-related mortality across population groups, e.g., according to educational attainment, which is uneven across countries (Hajizadeh et al., 2014).

Looking further ahead, the impact of HIV on human capital is one of the most important aspects of predicting the long-term impacts of HIV on GDP per capita. In some models, economic growth depends directly on ongoing investment in human capital. In these models, the impacts of HIV on human capital accumulate over time, and HIV has a persistent impact on the growth of human capital. For example, according to Corrigan et al. (2005), an HIV prevalence (ages 15-49) of about 10 percent (which would result in an increased risk of premature AIDS-related mortality of 20 percent in the absence of treatment) would reduce GDP per capita growth by about 0.2 percent annually through dis-investments in education. Other models of this kind predict cumulative losses in GDP per capita eventually growing to over 40 percent (Ferreira et al., 2011) or one-half (Bell et al., 2006) in high-prevalence countries.

Through investment and capital accumulation, HIV affects economic growth and GDP per capita in several ways (see Brief 5). First, owing to increased mortality, the capital stock is shared among fewer people. This opens better employment opportunities for survivors, partly reversing the negative effects of HIV (e.g., on productivity) or even increasing GDP per capita in the short run (see also Brief 3). Second, to the extent that the costs of HIV and the HIV response result in a reduced investment rate, the capital stock, and thus GDP per capita, eventually decline. Third, levels of investment and capital accumulation reinforce any direct shocks on GDP per capita. For example, if GDP per capita declines because of a productivity shock, any resulting drop in investment eventually diminishes the capital stock and thus employment opportunities.

The HIV response mitigates the direct effects of HIV on GDP per capita by improving productivity. It also reverses the effects of HIV on human capital, both in the short run, by reducing premature mortality, and in the long run, by restoring the incentives to invest in education that were eroded by perceptions of mortality risks (Baranov & Kohler, 2018). However, the HIV response may absorb considerable resources, and some of this expenditure may result in lower investment in other sectors.

Empirical evidence on the link between HIV and economic growth

The empirical evidence on the links between HIV and the HIV response on the one hand, and economic growth on the other, is weak. Some early studies followed an indirect approach, linking economic growth to a number of variables, including health indicators such as life expectancy or mortality; estimating or calibrating the impact of HIV on those health indicators; and obtaining the impacts of HIV by stacking up the two effects. For example, McDonald & Roberts (2006) linked the growth of GDP per capita to variables such as investment, school enrolment and infant mortality, of which the latter was linked to HIV prevalence. According to their findings, an HIV prevalence of 10 percent results in a gradual loss in GDP per capita amounting to 6 percent.

This research mirrors the literature on health and growth in general, in which life expectancy is one of the most robust variables that explains economic growth (Barro & Sala-i-Martin, 2003). However, such estimates tend to yield estimates of the impact of HIV that are implausibly large, when compared to actual data on economic growth during the period in which the mortality impacts of HIV were escalating and in the subsequent recovery period that saw the scaling-up of treatment (Haacker 2016). This disconnect may arise for a number of reasons. If the empirical link between health and growth reflects health conditions in early life and their contributions to acquisition of skills and education in childhood and adolescence, then such findings do not carry through to the consequences of an adult

mortality shock like HIV. More fundamentally, the correlation between growth and life expectancy could reflect third factors, such as the quality of institutions or public services (Deaton, 2006), rather than a causal link.

For these reasons, it is important to also consider evidence linking economic growth directly to measures of the health impact of HIV. For example, Papageorgiou & Stoytcheva (2009) link GDP per capita and the number of reported AIDS cases across 89 countries between 1986 and 2000, arriving at a minuscule effect of HIV and growth (e.g., a loss in GDP per capita of 0.2 percent for Botswana). Similarly, Werker et al. (2009) do not find "any measurable impact [of HIV] on economic growth or savings in African nations" through 2005. These studies primarily regard the impact of HIV per se, as the underlying data largely precede the scaling-up of treatment. In contrast, Tompsett (2020) focuses on growth experience during the expansion of antiretroviral therapy (until the end of 2014), finding that growth in countries with high HIV prevalence accelerated relative to other countries during the scaling-up of treatment – "the estimated effect on growth in GDP per capita in the main sample is 1.40 percentage points [...] for a 1 percentage point increase in ARV therapy coverage" (where coverage means the share of the total population receiving antiretroviral therapy, not only of people living with HIV). This estimate, however, is likely mis-specified: at the high end, with up to 10 percent of the total population (in Botswana) receiving antiretroviral therapy in 2014, Tompsett's estimates suggest an increase in the growth of GDP per capita of up to 14 percentage points, which is quite unlike anything experienced in countries facing high HIV prevalence.

Conclusions

HIV did not result in the catastrophic economic effects feared as the epidemic escalated. In part this is a result of the scaling-up of treatment, which has reversed much of the adverse health effects of the epidemic since about 2003. Careful empirical analyses focusing on the period preceding the scaling-up of treatment find an insignificant or negligible effect of HIV on growth of GDP per capita.

Perhaps the most important effect of HIV with regard to economic growth is the impact on the accumulation of human capital. A perception of high mortality risk reduces incentives to invest in education, and empirical evidence suggests that HIV has had an important impact on educational outcomes (Fortson, 2008). Conversely, following the roll-out of antiretroviral therapy, investments in education and schooling outcomes recovered (Baranov & Kohler, 2008). The human-capital factor, however, affects economic growth only with a lag and very gradually, as cohorts whose education was affected age into and through the working-age population. For this reason, this effect is not captured in conventional empirical assessments of economic growth.

With regard to HIV policy, our review suggests that the economic returns to investments in HIV (in terms of gains in GDP or GDP per capita) play a minor role in the evaluation of HIV policies. Reduced AIDS-related mortality results in a larger population and larger GDP. However, results on the effects of HIV on GDP per capita are ambiguous. Notably, much of the empirical evidence and economic modelling focuses on the role of AIDS-related mortality (or, relatedly, life expectancy). These effects are now much diminished because the scaling-up of treatment is well advanced in most countries.

Summary table: impacts of HIV and of the HIV response on economic growth

Direct impact	Macroeconomic implications	Impact of HIV response
Loss of population owing to increased mortality. AIDS-related morbidity.	Reduced economic capacities, reduced GDP. Reduced productivity associated with morbidity and mortality-related shocks.	Reduces ongoing mortality, but demographic impacts of HIV persist.

Direct impact	Macroeconomic implications	Impact of HIV response
Reduced lifespan owing to HIV.	Loss of skills and experience owing to increased mortality. Composition of working-age popu¬lation changes, depending on the socioeconomic gradient of HIV. Reduced investment in human capital, e.g., worse schooling outcomes.	Reduces ongoing mortality. Reverses effect on incentives to invest in human capital and losses in schooling outcomes.
Impact of HIV absorbs public and private resources.	Some of the resources absorbed result in lower investment, eventually reducing the capital stock. The remainder results in reduced spending on other purposes, reducing living standards.	Public health spending on HIV response highly persistent because of long-term treatment costs, but HIV-related costs to households are reduced.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #8

INTERACTIONS BETWEEN HIV AND POVERTY

Health Economics and Epidemiology Research Office
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Wits Health Consortium
University of the Witwatersrand

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POLICY BRIEF **#8**

INTERACTIONS BETWEEN HIV AND POVERTY

KEY POINTS

- **Poverty can increase vulnerability to HIV, but so does social opportunity. Overall, the picture on socio-economic correlates of HIV is not consistent across countries.**
- **HIV contributes to poverty through income loss and the increased costs of accessing care. But some employment losses among people affected by HIV result in employment gains by other individuals, so the macroeconomic impact is smaller than the direct effects on households affected by HIV.**
- **Poverty appears to act as a barrier to treatment access. Treatment adherence tends to be higher for patients with higher socio-economic status.**

The link between HIV, poverty and other socio-economic factors has played an important role in positioning HIV as a major development challenge. For example, the 2011 United Nations "Political Declaration on HIV and AIDS" declared that the spread of HIV/AIDS was often both a cause and consequence of poverty (UN General Assembly, 2011). Such concerns have been supported by data on the impacts of HIV on the household level, and data on socio-economic determinants of vulnerability to HIV, as well as the association across countries between HIV and factors like poverty, income inequality or gender inequality. However, there is no consistent picture regarding the link between HIV and socio-economic factors within or across countries, and HIV has not obviously contributed to poverty or inequality in the population overall.

Poverty and inequality as contributors to HIV

HIV prevalence is correlated with some types of inequality (income, gender) across countries. Empirical analyses based on national survey data suggest links between poverty and some HIV risk behaviour, but the evidence on the socio-economic gradient of HIV is uneven overall.

Concerns about the links between HIV and poverty played an important role in positioning HIV as a global development challenge at the beginning of the global HIV response. For example, UNAIDS (1998) highlighted the fact that "89% of people with HIV live in sub-Saharan Africa and the developing countries of Asia, which between them account for less than 10% of global gross national product". This perception gave way to a more differentiated view. It was noted that at least across sub-Saharan Africa, HIV was concentrated in some of the most advanced countries (Halperin, 2001), and that HIV was more strongly associated with high rates of inequality (Piot et al., 2007).

These correlations are illustrated with more recent data across sub-Saharan Africa in Figures 8.1 and 8.2. HIV prevalence is indeed high in some of the most advanced countries in the region (Botswana, South Africa) where poverty rates tend to be lowest, and low in some of the least developed ones (Burundi, Liberia, Madagascar) with high rates of poverty. The association between HIV prevalence

and income inequality is even stronger – the eight countries with a Gini index exceeding 50 include the six countries with the highest rates of HIV prevalence anywhere. Interpreting the correlations between HIV prevalence on one hand, and poverty or inequality on the other, is not straightforward. First, the correlation is predominantly driven by five geographically adjacent countries in Southern Africa (Botswana, Eswatini, Lesotho, Namibia and South Africa) with very high levels of HIV prevalence, and could reflect other factors specific to that region. Second, the correlations are not robust if additional variables like GDP per capita are included in a regression (Haacker, 2016).

Figure 8.1: HIV prevalence and poverty across sub-Saharan Africa

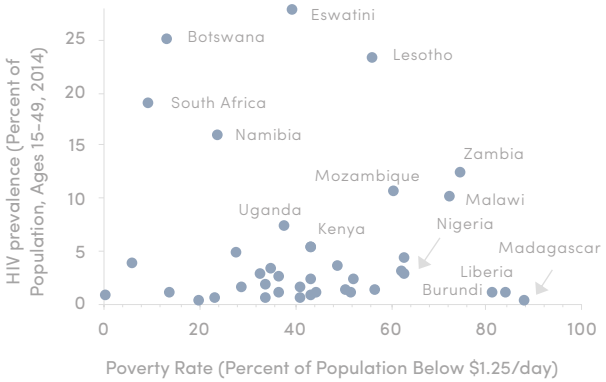
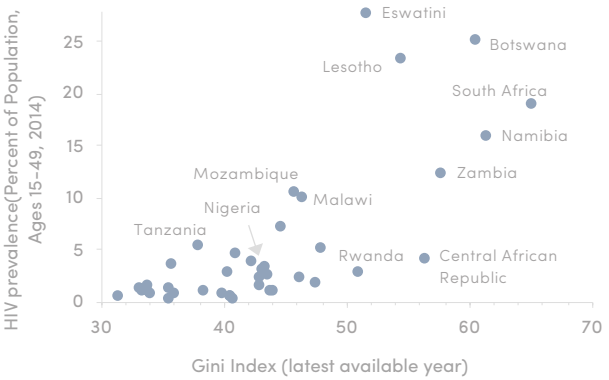


Figure 8.2: HIV prevalence and inequality across sub-Saharan Africa



Source: Haacker (2016)
Note: Figures show HIV prevalence for 2014 and the latest available year for estimates of poverty and inequality.

Because HIV is a sexually transmitted disease, and women are disproportionately affected, gender inequality is considered an important driver of HIV, "depriv[ing] women and girls of basic rights and opportunities and their ability to prevent HIV and access the services they need" (UNAIDS, 2020). One important driver of gender disparity in the impact of HIV is the higher risk for women of contracting HIV through vaginal sexual transmission. Another key factor – important especially for disparities in HIV prevalence at early ages – is the lower age at first sex for women (Sia et al., 2016). However, there is no clear link between HIV and summary measures of gender inequality (as measured by various indices with a focus on socio-economic aspects and participation) across countries – HIV prevalence tends to be lower in countries with higher levels of gender inequality (Kenyon & Buyze, 2015), and the association between HIV prevalence and gender inequality becomes statistically insignificant when other socio-economic variables are also considered (Kenyon & Buyze, 2015).

Data from Demographic and Health Surveys (DHS) offer an opportunity to assess socio-economic aspects of HIV both within and across countries (as estimates including an HIV component are available for numerous countries). According to two studies pooling a large number of such survey data (Hajizadeh et al., 2014; Gaumer et al., 2021), greater wealth and urban residence were associated with a higher probability of being HIV positive. Parkhurst (2010) found that HIV prevalence tended to be higher in wealthier households in low-income countries, but not in middle-income countries. Magadi & Desta (2011) found that HIV prevalence was higher for women who had completed at least primary education. Effects of educational attainment on men were smaller and not significant. The link between education and HIV prevalence, though, may vary across countries (Fortson, 2008; Asiedu et al., 2012) and over time. In five out of seven countries studied by Hargreaves et al. (2015) where more than one DHS survey had been available, HIV prevalence among the population with secondary education declined relative to the population with no completed education, but this trend was not significant in a pooled regression.

Overall, these findings are consistent with a link between HIV and social opportunity, rather than a narrative on poverty and inequality as principal drivers of HIV. However, important gaps remain in our understanding of the socio-economic determinants of HIV. Some of the reviews discussed are more than five years old, and the underlying data are even older (especially considering that estimated HIV prevalence is a result of infections that may have occurred many years earlier). As a consequence, the data do not capture many of the changes which have occurred over the last 10 years, as populations have continued to adapt to HIV and treatment coverage has increased steeply.

HIV as a contributor to poverty

In addition to its health consequences, HIV poses an economic burden on households affected, and frequently is a cause of poverty. The aggregate effects of HIV on poverty rates and economic inequality, however, are less clear, as some such losses are offset by gains elsewhere, e.g., as other individuals take up employment lost by people affected by HIV.

The direct effects of HIV on household members and surviving dependents are compounded by its economic consequences. HIV results in income losses to those living with HIV through reduced productivity and loss of employment due to ill health (see Policy brief #6), and to household members who have to devote time to care and treatment. Costs of accessing treatment can be substantial, even when antiretroviral therapy is provided free of charge. The costs of accessing care for people receiving antiretroviral therapy have been estimated at 9 percent of average household income in South Africa (Cleary et al., 2013), and at about 5 percent of average household income in Malawi, where each clinic visit absorbed seven hours of a patient's time on average (Pinto et al., 2013). However, innovations to reduce supply-side costs of providing access to care (such as task-shifting and differentiated care, with less frequent interactions with health services for stable patients) also bring down these household costs of accessing care. HIV also negatively affected school attendance and nutritional status of children in affected households, because of reduced economic circumstances or – especially for older children – caregiving responsibilities (Alkenbrack Batteh et al., 2008; Heymann & Kidman, 2009). Treatment has been shown to be effective in reversing or preventing losses of productivity and employment (Policy brief #6) and in mitigating the adverse effects on young dependents (Goldstein et al., 2010).

Deaths can further impoverish households through income losses (if the deceased has been an income earner) and funeral costs, which can amount to the equivalent of an annual income in some countries (e.g., South Africa; see Case et al., 2013). However, these effects dissipate over time as households recover or re-form. For Kenya, Beegle et al. (2008) estimate that household consumption per capita drops by 7 percent in the five years following a death, but that this effect subsequently becomes smaller and statistically insignificant. Other effects can be more persistent – orphanhood negatively affects child development and educational attainment, and consequently the economic prospects of children affected (Beegle et al., 2010).

To gauge the macroeconomic implications of these household-level effects, it is important to consider that not all the losses experienced by households affected by HIV are net losses from a macroeconomic perspective. For example, an employment loss by a person who dies or becomes too sick to work is often offset – from a macroeconomic perspective – by the gain of another individual who takes over the employment. Such effects operating through the labour market can offset much of the direct effects of HIV on incomes (Salinas & Haacker, 2006; Jefferis et al., 2008). In line with these findings based on economic modelling, high HIV prevalence has not been associated with increases in poverty or inequality (Figures 8.3 and 8.4).

Figure 8.3: HIV prevalence and changes in poverty

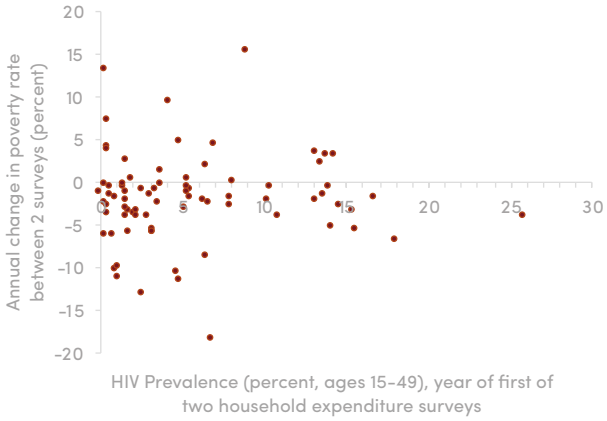
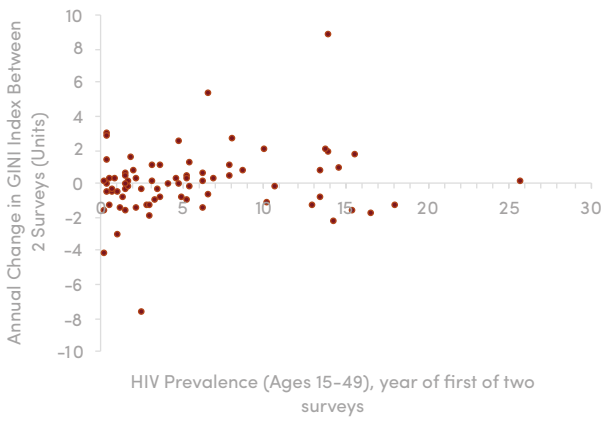


Figure 8.4: Changes in inequality and HIV prevalence



Source: Haacker (2016), using data from the World Bank's World Development Indicators (in turn based on national surveys) and HIV prevalence data from UNAIDS.

In summary, the adverse economic impacts on households affected by HIV are well documented, and effective mitigation requires tackling both the health and economic consequences. However, much of the economic losses of individuals affected by HIV are offset by gains elsewhere, so that the aggregate economic effects of HIV on households are smaller than the direct effects. Judging from trends in poverty and inequality across countries, HIV appears to have had no noticeable impact on poverty rates or the degree of income inequality.

Poverty as a barrier to treatment access

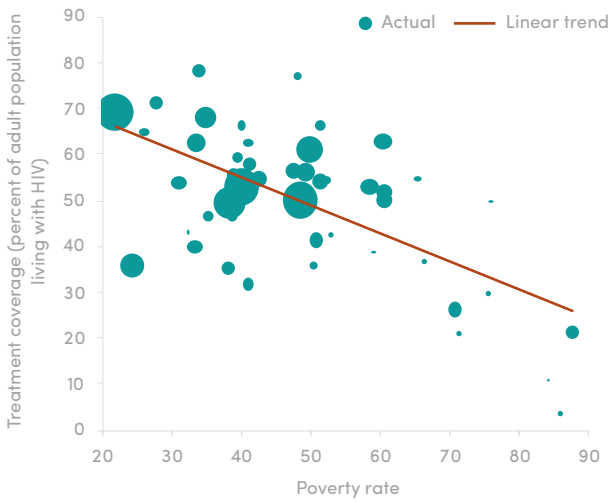
Although antiretroviral therapy is usually delivered free of charge, costs of accessing treatment and care can be substantial for affected households. The impact of poverty-related barriers in access is not well understood, although it could have important consequences for effective HIV control and impact mitigation.

The presence of socio-economic barriers to access to treatment is important for an economic assessment of the impacts of HIV, and for effective policies to combat the disease, for at least three reasons. First, differential access to treatment results in selective-mortality bias in cross-sectional surveys; data on the socio-economic gradient of HIV prevalence could therefore yield a misleading picture of the distribution of the burden. Second, if barriers to access to treatment mirror socio-economic disadvantages (e.g., poverty), poverty-related indicators at the national level could improve because of higher mortality among the poor, but mask a deterioration in the consequences of poverty. Third, understanding barriers to access and identifying underserved populations is important for designing effective policies to expand treatment access.

The evidence on economic barriers for households accessing HIV services is consistent with the (sparse) evidence on the socio-economic differences in treatment coverage and effectiveness. In South Africa, treatment access gradually expanded from "richer more urban regions where hospitals resided" to "clinics, which are [also] located in poorer and less densely populated regions" (Burger et al., 2017). Haacker & Birungi (2018) studied the determinants of treatment access across Kenyan counties and found that poverty is the statistically and substantially most important predictor of treatment coverage (Figure 8.5).

This picture is reinforced by evidence on treatment adherence – an important aspect of the effectiveness of treatment. A review by Peltzer & Pengpid (2013) across 25 low- and middle-income countries found that adherence is generally positively correlated with socio-economic status. This is especially true for income, for which 14 studies (out of 36) found a significant positive relationship, and only one study a negative one. A review by Heestermans et al. (2016) documents that cost barriers to treatment, poverty and food insecurity were important determinants of non-adherence.

Figure 8.5: Treatment coverage and poverty across Kenyan counties, 2015



Source: Haacker and Birungi (2018).
Notes: Size (area) of circles represents number of people living with HIV in respective county.

Discussion

In summary, the empirical evidence on the links between HIV, poverty and inequality is weak and inconsistent. The adverse impacts of HIV on affected households, including the economic repercussions and the risk of impoverishment, are well documented. However, poverty or inequality overall have not been associated with higher HIV prevalence, and high HIV prevalence has not resulted in higher rates of poverty or inequality. The absence of obvious aggregate effects, though, does not invalidate concerns about poverty- or gender-related risks of contracting HIV and lack of choice, HIV as a cause of poverty, and the specific difficulties encountered by poor households in coping with the health and economic consequences of HIV. Even though some macroeconomic effects mitigate the aggregate effects of HIV on poverty, the economic consequences compound the direct health impacts with regard to the welfare of households affected by HIV, and exacerbate health-related economic risks, especially in the absence of universal health coverage.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #9

DISEASE BURDEN ACROSS POPULATION SUB-GROUPS

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POLICY BRIEF **#9**

DISEASE BURDEN ACROSS POPULATION SUB-GROUPS

KEY POINTS

- **The population living with HIV is ageing – owing to the scaling-up of treatment and hence longer survival (especially for women), success in reducing mother-to-child transmission of HIV, and (in most countries) a decline in HIV incidence.**
- **HIV prevalence has been higher among women, mainly because of higher incidence. The share of women among people living with HIV is increasing in the region, driven by higher treatment coverage and hence longer survival among women.**
- **Within countries, the epidemic is often distributed unevenly. Understanding the distribution of HIV and of gaps in service coverage is crucial for devising effective and cost-effective prevention and treatment strategies.**
- **HIV prevalence and transmission are higher among key populations (such as sex workers, people who inject drugs, and men who have sex with men). HIV prevention measures targeting key populations are among the most effective HIV prevention interventions, but their effectiveness and reach is often hampered by stigma and criminalisation.**

Prevalence and incidence of HIV are distributed highly unevenly across the population. To identify the most effective and cost-effective approaches to extending treatment access and HIV prevention efforts, it is essential to understand this distribution. In which age groups is HIV transmission most concentrated, and how does the effectiveness of HIV prevention interventions differ by age? Where are the "hotspots" where the epidemic is most intense, and which areas feature the most pervasive gaps in service coverage? And what is the role of "key populations" at high risk of contracting HIV, who often also face barriers in access to effective HIV services?

Changing age structure of population living with HIV

The age structure of the population living with HIV is changing, owing to longer survival and a shift in HIV incidence to older age brackets.

The composition of the population living with HIV is changing, with implications for the needs of people living with HIV (PLHIV) and HIV prevention. The best-known aspect is the "greying of AIDS" – the ageing of the population living with HIV owing to longer survival, following the scale-up of treatment. As a consequence, the share of people at ages 50 or higher among PLHIV is increasing, e.g., in sub-Saharan Africa from 10 percent in 2008 to 17 percent in 2018 (Figure 9.1), and this share continues to increase at a rate of about one percentage point annually.

A less well-known aspect of the changing composition of the population living with HIV is the declining share of young adults. This trend is not only a mirror image of the longer survival, but also reflects two factors specific to the young population.

First, the "youth bulge" is receding. The "youth bulge" occurred because of the demographic transition, as steep increases in child survival and ongoing high birth rates result in large cohorts of young people. However, birth rates (number of births/total population) in countries facing high HIV prevalence have been declining for a long time, e.g., from 4.7 percent in 1980 to 4.2 percent in 2000 and 3.5 percent in 2019 for sub-Saharan Africa overall. Because of these developments, the young population, and the cohorts becoming sexually active and susceptible to sexual transmission of HIV, now grow more slowly than the population overall.

Figure 9.1. State of HIV across sub-Saharan Africa, by sex and age group, 1990-2019

Figure 9.1.1: Women living with HIV

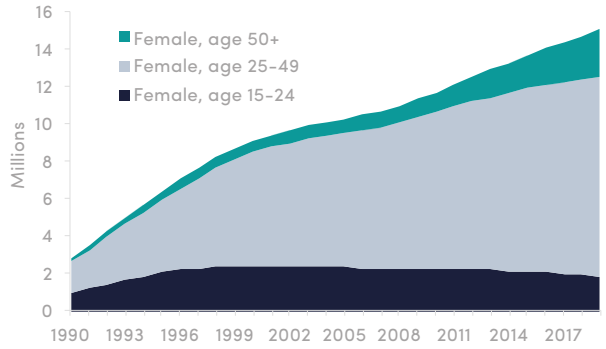


Figure 9.1.2: Men living with HIV

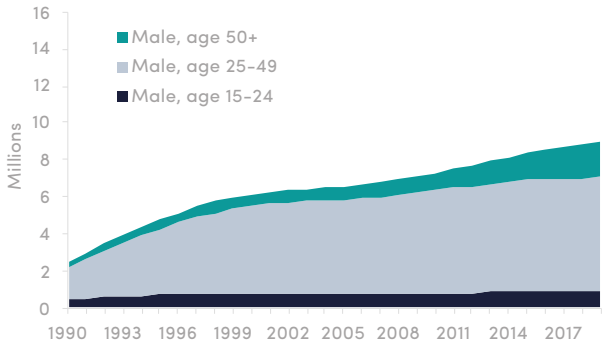


Figure 9.1.3: New HIV infections among women

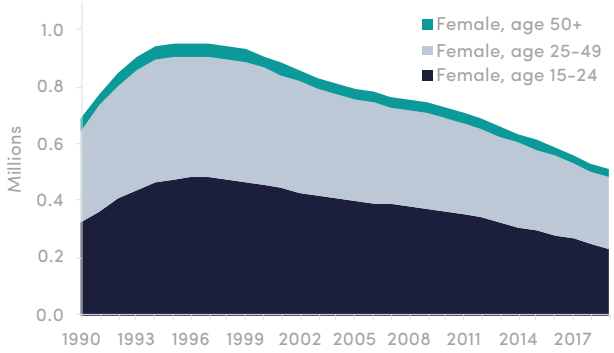
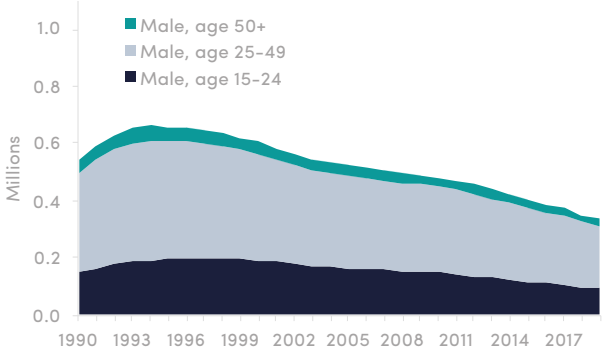


Figure 9.1.4: New HIV infections among men



Source: UNAIDS (2020).

Second, while ongoing high HIV transmission rates among the young population, and especially among young women, have been and remain a major concern, the picture is slowly evolving. Since 2008, efforts to reduce HIV incidence have been more effective for young adults. For example, between 2008 and 2018, HIV incidence across sub-Saharan Africa declined by 45 percent among young adults (ages 15-24), and by 41 percent among adults aged 25 and above.

Reflecting these differences in population growth and HIV incidence by age group, the number of HIV infections among young adults (ages 15-24) across sub-Saharan Africa declined by 28 percent between 2008 and 2018 (for both women and men), much faster than the number of HIV infections among adults aged 25 and above, which declined by 19 percent.

Gender differences in HIV prevalence and incidence

As is well known, HIV affects women disproportionately across sub-Saharan Africa, reflecting the predominantly heterosexual transmission of HIV in the region, the higher risk for women than for men of contracting HIV from heterosexual intercourse, and differences in the age profile of sexual activity, with women on average initiating sexual activity earlier. The share of women among adults (ages 15+) living with HIV in sub-Saharan Africa has been increasing steadily, from 60.0 percent in 2000 to 62.7 percent in 2019.

Over this period, HIV incidence has declined by nearly the same rate (about two-thirds) for both men and women – from 11.6/1,000 annually to 3.8/1,000 annually for women, and from 7.9/1,000 annually to 2.5/1,000 annually for men (Figure 9.2.1). Consequently, the contribution of the risk of contracting HIV to differences in the health outlook between women and men has been greatly diminished, as the excess risk of contracting HIV for women (i.e., the difference in incidence between men and women) is now (as of 2019) down to 1.3/1,000.

Figure 9.2. HIV Incidence and AIDS-related mortality across sub-Saharan Africa, by sex

Figure 9.2.1: HIV incidence, ages 15+

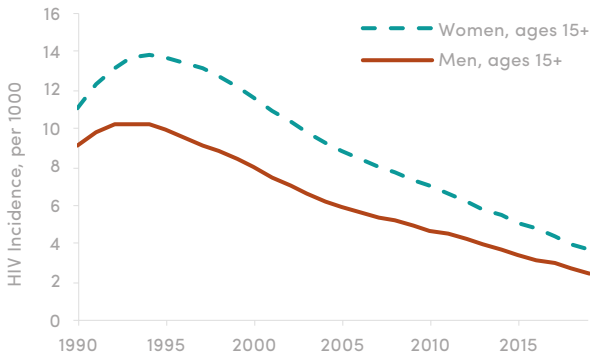
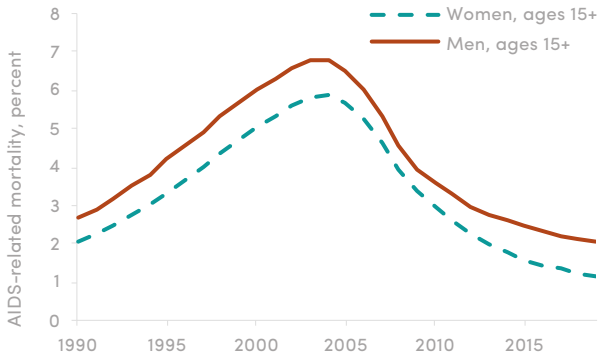


Figure 9.2.2: AIDS-related mortality among people living with HIV, ages 15+



Source: UNAIDS (2020).

Meanwhile, AIDS-related mortality across sub-Saharan Africa has declined steeply for both women and men (Figure 9.2.2), a well-known consequence of the scaling-up of treatment. For women, it dropped from its peak of 5.8 percent annually (2004) to 1.2 percent annually in 2019, a relative decline of 80 percent. Men have experienced higher AIDS-related mortality, peaking at 6.9 percent in 2004, and this declined to 2.0 percent annually by 2019, a relative decline of 70 percent. This steeper relative decline in mortality among women is consistent with higher coverage for women across stages of the treatment cascade, especially in the awareness of HIV status (Green et al., 2020). Estimated treatment coverage reached 76 percent of women living with HIV as of 2019, but only 62 percent for men.

This means that the role of HIV as a cause of gender differences in health and life prospects has diminished greatly across sub-Saharan Africa. The excess risk of contracting HIV is at its lowest for 30 years, and the current increase in the share of women among people living with HIV in sub-Saharan Africa is a consequence of higher treatment coverage and therefore an improved health and life outlook for women living with HIV.

These population-level modelled estimates complement and build on direct empirical evidence on the distribution of HIV across the population and gender differences as a contributor to HIV. A systematic review by Birdthistle et al. (2019) of studies on HIV incidence across Africa concludes that HIV incidence among women and girls declined in most locations, but that the relative risk (compared to HIV incidence among men) persisted.

In light of very high HIV incidence observed among young women, one important channel of HIV transmission is the presence of age-disparate sexual relationships between young women and older men. Population surveys show

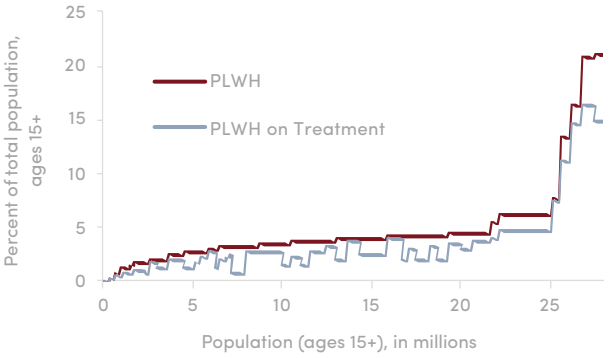
higher HIV prevalence among young women in age-disparate sexual relationships (Evan et al., 2016; Maughan-Brown et al., 2018). However, the picture regarding HIV incidence is more complex. While Stoner et al. (2019) find that age-disparate partnerships are associated with an HIV incidence among women that is 1.9 times higher than for women in age-concordant partnerships in South Africa, Harling et al. (2014) did not find such an effect. For Zimbabwe, Schaefer et al. (2017) also find higher HIV incidence among women in age-discordant relationships, but much of this is driven by relationships with age differences exceeding 10 years and by male partners having multiple sexual partnerships.

HIV and state of the HIV response across sub-national regions and locations

National-level estimates of the state of HIV and the HIV response may mask large differences in HIV prevalence, treatment access, and other factors and accomplishments across the nation. By now, there is substantial evidence on the distribution of HIV within countries. The geospatial analysis by Dwyer-Lindgren et al. (2019) builds on 134 surveys across sub-Saharan Africa, observing differences in HIV prevalence exceeding a factor of at least five across major regions within 14 out of 47 countries. In South Africa, estimated HIV prevalence (ages 15-49) differs by a factor of 2.5 between the provinces KwaZulu-Natal (25.8 percent) and Western Cape (10.3 percent), but also by a median factor of 1.5 between districts within the same province (Eaton, 2021). Such findings show that within countries, HIV epidemics with very different intensity and modes of transmission co-exist, and effective HIV control policies would have to take into account these different circumstances. Such national data are complemented by more localised data, illustrating the importance of local "hotspots" of intense HIV transmission and their role in disseminating HIV.

As an illustration of the implications of within-country differences in the state of HIV and of the HIV response, consider the example of treatment access in Kenya, where HIV prevalence across counties differs widely, ranging from over 20 percent in 2018 around Lake Victoria to less than 0.2 percent. This is illustrated in Figure 9.3, in which the total population is lined up by county, ordered by county-level HIV prevalence (yellow curve). Such differences have implications for policy design. For example, the government may focus its efforts in scaling up treatment on areas where HIV prevalence is highest, where HIV transmission is most intense, where the share of the total population living with HIV but not yet receiving treatment is highest, or where treatment coverage is lowest. Relevant decision factors include the unit cost of extending treatment access (usually lower in areas with high HIV prevalence), and local or regional treatment coverage (the lower the treatment coverage, the more pressing the immediate health needs of people living with HIV tend to be).

Figure 9.3: Kenya: PLHIV, with and without treatment (percent of total population)



Source: NACC & NASCOP (2018).
Notes: Population is grouped by county and ordered by county-level HIV prevalence.

In this example, with the exception of two counties with very high HIV prevalence (Homa Bay and Siaya), many of the counties with the highest need for treatment relative to the size of the total population were not among the counties with the highest prevalence. For example, in Turkana, 2.5 percent of the total population were people living with HIV who were not receiving treatment – one of the highest rates in the country – even though HIV prevalence, at 3.2 percent, was relatively low. This reflects that only about one-quarter of PLHIV were receiving treatment in that county, a much lower rate than in counties with high HIV prevalence (Figure 9.4). More systematically, the majority of people living with HIV but not receiving treatment were located in counties with relatively low HIV prevalence. To the extent that treatment in these low-access counties is initiated later, the immediate health needs of people not receiving treatment in those counties are more pressing than the needs of those in counties with high HIV prevalence and high treatment access. A policy to expand treatment access across counties thus needs to balance the immediate health gains from initiating treatment, the HIV prevention gains from earlier treatment, and the marginal costs of expanding access.

Figure 9.4. Kenya: Unmet need for treatment across counties

Figure 9.4.1: Unmet need (percent of total population)

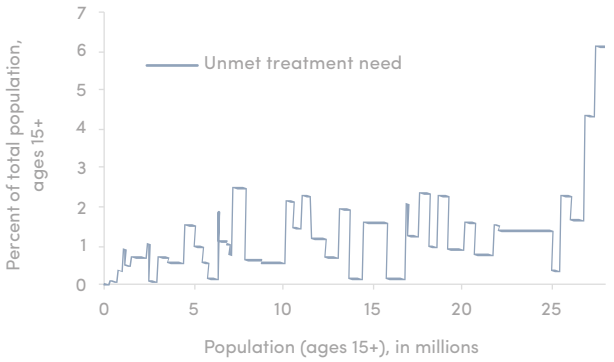
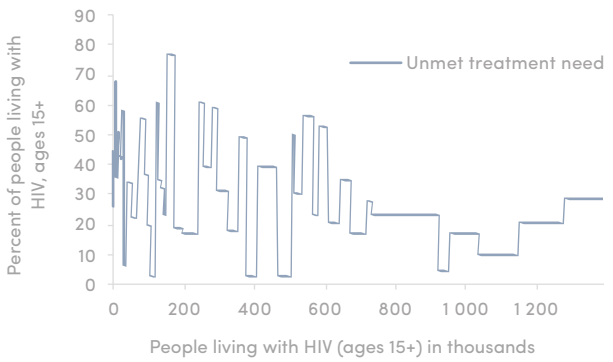


Figure 9.4.2 Unmet need (percent of population living with HIV)



Source: NACC & NASCOP (2018).
Note: Total population (overall or living with HIV) is grouped by county and in ascending order by county-level HIV prevalence.

These and other differences in the state of the HIV epidemic across a country's sub-regions are considered in studies and reflected in policies on adapting HIV prevention and treatment to local circumstances. Anderson et al. (2014) found that fine-tuning HIV treatment and prevention policies in line with county circumstances in Kenya would reduce HIV incidence by one-quarter, relative to spending the same amount on a uniform national policy. This analysis was closely reflected in Kenya's HIV "prevention revolution" strategy of 2014 (NACC & NASCOP, 2014). McGillen et al. (2016) evaluated the potential of aligning HIV strategies with sub-national epidemiology across sub-Saharan Africa (among other strategies), finding that sub-national targeting could reduce HIV incidence by 7 percent, relative to uniform national strategies. Compared with the Kenya results, the lower potential for incidence reduction reflects the fact that sub-national differences in Kenya are unusually large, but also that the administrative/geographical sub-divisions are much coarser in the work by McGillen et al., compared with the Kenya study.

A principal constraint to optimising HIV strategies across sub-national regions is lack of data on modes of transmission. Especially for key populations like female sex workers or men who have sex with men (see below), few data are available which could support sub-nationally differentiated priority-setting.

Key populations

Key populations at higher HIV risk include men who have sex with men, transgender people, sex workers and their clients, and people who inject drugs – all of which are most exposed to HIV and play a disproportionate role in HIV transmission – as well as other populations particularly vulnerable to HIV acquisition, such as prisoners, partners of people living with HIV, fishermen around some African lakes, long-distance drivers and other mobile populations (UNAIDS, 2015). Reaching key populations is critical in effective HIV service delivery, not only because they are particularly vulnerable to contracting HIV, but also because of their indirect role in onward transmission of HIV. For example, sex between female sex workers and paying clients is not only a direct cause of HIV incidence, but it additionally contributes indirectly to HIV incidence through HIV transmission between clients and their non-paying partners (Stone et al., 2021).

Key populations play a dominant role in some "concentrated" HIV epidemics. For example, in Jamaica, men who have sex with men are estimated to account for about 4 percent of the adult male population (UNAIDS, 2019). Since HIV prevalence among men who have sex with men (estimated at 33 percent) is much higher than for the adult population overall, they account for 35 percent of PLHIV and contribute 0.6 percentage points to the total adult HIV prevalence of 1.8 percent (ages 15+, as of 2018). Meanwhile, in Ukraine, people who inject drugs account for 0.9 percent of the adult population but make up 33 percent of people living

with HIV, as HIV prevalence among people who inject drugs (estimated at 23 percent) is more than 50 times higher than the prevalence rate of 0.4 percent for the adult population who do not inject drugs (UNAIDS, 2020b). These numbers on the share of key populations among people living with HIV understate their role in the transmission of HIV, however, because of spillovers of HIV into other population groups. For example, in Jamaica and Zimbabwe one new HIV infection among men who have sex with men was estimated to cause an additional three HIV infections later on – among men who have sex with men and across the general population (Haacker, 2016), though this similarity in total effects reflects very different transmission patterns.

Beyond the dominant role of key populations in concentrated epidemics, they play a critical role in generalised epidemics as well, where, despite higher overall prevalence levels, HIV prevalence among key populations is often higher still. One overview focusing on the countries with highest HIV prevalence overall observes that "concentrated sub-epidemics exist within all generalized epidemic contexts, and addressing the subpopulations within these constituent epidemics will likely be key to substantially reducing population-level incidence" (Tanser et al., 2014). Moreover, as HIV incidence overall has been declining steeply in countries facing generalised epidemics, it has been argued that understanding and targeting HIV transmission involving key populations becomes even more important (Garnett, 2021).

In light of their role in HIV transmission, interventions focusing on key populations are considered critical and often among the most cost-effective interventions in reducing HIV incidence (Garnett et al., 2017), and have formed part of basic programme activities under the UNAIDS investment framework (Schwartländer et al., 2011). However, effective interventions reaching key populations are often hampered by stigma and discrimination, particularly for men who have sex with men – for example through legal constraints that impede the delivery of health services, or through other barriers in access to and by such populations. And the effectiveness of population-level interventions is compromised if coverage in sub-populations with the most intense HIV transmission is lower – Baral et al. (2019) argue that such heterogeneity contributes to the gap between the effectiveness of HIV treatment as prevention in clinical studies and the observed population-level effects following scaling-up of treatment. This implies that HIV epidemics become more concentrated as generalised epidemics recede, and HIV strategies need to be adapted to account for the increasing weight of key populations (Ortblad et al., 2019).

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #10

TRADE-OFFS BETWEEN ALLOCATION TO HEALTH & OTHER SECTORS

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POLICY BRIEF **#10**

TRADE-OFFS BETWEEN ALLOCATION TO HEALTH & OTHER SECTORS

KEY POINTS

- **HIV policies, health policies and policies in other sectors contribute to national development and well-being, but their contributions are different in kind. Budget allocations describe choices and reflect priorities across these contributions.**
- **High-level policy documents like National Development Plans position health policy and interpret its contributions to the national development agenda, in terms of health outcomes in their own right, the socio-economic consequences, and contributions to economic development. Such policy documents offer a template for highlighting not only the contribution of HIV and health spending to health outcomes, but also the effects on economic growth, social equity and other development objectives.**
- **Benefit-cost analysis translates the health gains – as well as outcomes of other policies like education – into an economic value. In this form, the returns to investment in health and HIV can be compared with the returns on alternative non-health investments.**

Choices between allocating resources to HIV, health and/or other sectors involve comparisons of outcomes that are different (e.g., outcomes regarding health, education, social equity, infrastructure or security). Policymakers have preferences across different types of outcomes, and they allocate funding accordingly. Common health economic approaches, such as estimating life years gained or the contribution to reducing child mortality, can be effective in a health context to standardise outcomes and inform policymakers on the most effective methods to improve the state of population health.

However, the focus on health outcomes may be ineffective when making decisions that cut across sectors, e.g., when the government is prioritising GDP growth as a precondition of broader gains, including in health. Positioning health and HIV policies as contributors to economic development – perhaps as described in the National Development Plan or other high-level policy documents – and in terms of their value for generating resources in addition to attaining health gains, can make a more compelling case for funding. For example, the UNAIDS investment framework (Schwartländer et al., 2011) complements its advocacy for investments in the global HIV response and the focus on the most effective programme components with pointers to the "substantial economic gains [...] as people stay healthy and productive."

The alternative to estimating various types of economic gains alongside health gains is to translate the health gains into an economic valuation. This way, the outcomes of investments in health and HIV can be measured against investments in education, infrastructure or any other policies geared towards achieving economic growth. The application of this approach – benefit-cost analysis – in global health has been described by Robinson et al. (2019a, 2019b), and underlies estimates of gains from investments in health adopted by the Lancet Commission on Investing in Health (Jamison et al., 2013) and, specifically with regard to HIV, UNAIDS (2015), Lamontagne et al. (2019) and Forsythe et al. (2019).

Contribution of the HIV response and health to the national development agenda

The HIV/AIDS response contributes to national development objectives in numerous ways - most directly through improved health outcomes, but also through implications for social equity and the economic outlook, among other factors.

Funding decisions on HIV, health and across sectors reflect the government's policy objectives. To support effective funding decisions on HIV, or for advocacy, it is important to understand these policy objectives, and how HIV policies contribute to attaining them.

Policy documents such as National Development Plans (NDPs), which spell out these objectives, offer points of reference for defining the contributions of HIV policies in several ways:

- Do HIV policies and HIV-related targets appear in the NDP or similar documents directly, e.g., in the form of targets on treatment coverage, mortality or HIV incidence?
- Do HIV policies affect objectives spelled out in the NDP – not only health-related ones, but also social and economic outcomes? And how can HIV policies be designed to best contribute to the NDP's policy objectives, while serving immediate objectives such as "ending AIDS"?
- Does the NDP include objectives (e.g., improving access to education for girls) which also contribute to HIV policies?

At the same time, NDPs are also the outcome of a process of deliberation, and engagement on the role of health and HIV in the NDP helps position HIV as a development challenge.

Table 10.1: Contribution of HIV and health to national development agendas

Kenya Vision 2030 (2007)	• Central objective of transforming "country into a rapidly industrialising middle-income nation". • HIV principal cause of divergence from peer countries in terms of health outcomes. • Human resources critical in improving competitiveness, but focus on skills and education rather than health. • Good health contributes to poverty reduction and economic growth. • Aims to "improve access and equity in the availability of essential health care"; emphasis on preventive services as well as local delivery.
South Africa National Development Plan 2030 (2011)	• Emphasis on growing an inclusive economy and redressing inequities. • "Health outcomes are shaped by factors largely outside the health system"; "good health is essential for a productive and fulfilling life". • High-quality free or low-cost health care is a contributor to reducing cost of living for low-income households. • HIV has had major impact on life expectancy, resulted in higher dependency rates and exacerbated existing discrepancies between population groups. Continuing challenge for at least another generation.
Zambia Seventh National Development Plan 2017-2021 (2017)	• "Guide towards Zambia's aspirations of being a developed middle-income nation". Focus on economic development. • "Human development involves [...] freedoms to live long, healthy and creative lives", and contributes to employment and socio-economic growth. • HIV recognised as key cross-cutting issue but addressed largely in line with other health challenges. • HIV and lack of health cover as contributors to poverty and vulnerability.

Sources: GoK (2007); NPC (2011); MNDP (2017).

Most NDPs focus on economic growth and catching up with hitherto more successful countries (see Table 10.1 for a sample). The extent to which NDPs address economic inequalities differs. In this regard, South Africa's NDP is relatively explicit, with a focus on an inclusive economy and redressing past and current inequities. Health (and – in high-burden countries – HIV) appears directly in NDPs. For example, Kenya's "Vision 2030" benchmarks indicators such as child mortality or life expectancy against levels in middle-income peer countries which Kenya aspires to catch up with. The role of health as a contributor to economic growth is often recognised, sometimes in passing, as a constituent of human capital. Health objectives also mirror concerns on social equity overall, with an emphasis on improving access to high-quality health services and prioritising services which benefit the poor.

Consequently, NDPs or other high-level statements of national policy direction offer multiple points of intersection with health policy and the response to HIV/AIDS, and opportunities to widen policy engagement. These opportunities are reflected in some of the briefs in this series, including Policy briefs #3 to #7 (on the impacts of HIV on economic growth), Policy briefs #8 and #9 (on equity aspects of the impact of and response to HIV), and Policy brief #2 (on health outcomes). The method of informing budget allocations across sectors by reference to national development is an informal one that is highly context-specific and does not deliver clear-cut rankings across interventions. However, it relies on criteria which are explicitly endorsed by the government and other stakeholders, and it offers pointers for the design of HIV programmes which serve policy objectives beyond HIV-specific outcomes (e.g., on social equity) and thus strengthen political support.

Benefit-cost analysis and "full income"

Benefit-cost analysis transforms health gains into economic valuations, allowing comparisons between health gains and policy outcomes in other sectors based on their monetary equivalents.

Benefit-cost analysis (BCA) usefully complements engagement on budget allocations for health and other purposes based on projected health outcomes and their links to the government's policy agenda. Concrete expected health gains are powerful arguments for proposed budget allocations on health. BCA contributes in two ways. First, by transforming returns to health into an economic value, it allows direct comparison of the returns to investments in health with other types of investments. Second, BCA – like the human-capital approach (Policy brief #2) – emphasises and values that health gains, and in particular improved survival, yield economic benefits which extend over the lifetime of beneficiaries and are not captured well by the immediate effects of an intervention on economic activity (e.g., as captured by GDP growth).

In the sphere of HIV, BCA links to estimates of the direct health effects of a policy, as the estimated benefits are typically dominated by the estimated value of the health gains. In practice, BCA is closely linked to evaluations of cost-effectiveness in terms of achieving concrete health outcomes. While BCA draws on various sources for imputing valuations of health, effective policy support requires that valuations reflect the government's valuations of health outcomes.

At the core of this method is the "value of statistical life" (VSL). This value reflects an estimate of the valuation of health, typically obtained from estimates of the willingness to pay for reductions in mortality or for improved health, derived from private spending data or policy decisions, or by comparing wages between employments that are characterised by different health risks but which are otherwise similar. Such estimates of the value or costs of a small change in mortality (and, less frequently, morbidity) are then normalised to yield the equivalent value of one life-year gained, or of one death averted. One extension to this approach that is sometimes used in policy analysis is the idea of "full income," adding the value of health gains to output gains from improved productivity or achieved by economic growth. This approach was pioneered by Nordhaus (2003), finding that health gains contributed about as much to improved living standards as economic growth. Bourguignon and Morrisson (2002), using a similar approach, emphasise the disproportionate role of health gains in less developed countries, which have contributed to reducing global inequity in living standards (measured by lifetime income).

Perhaps the greatest challenge in applying estimates of the VSL in low- and middle-income countries is the paucity of empirical evidence from those countries – almost all studies are from high-income countries and a few middle-income countries. Estimates of the VSL are therefore typically anchored by an estimate for high-income countries (typically in the range of 100 to 160 times GDP per capita, see Robinson et al., 2019c), combined with a parameter (the "elasticity") that determines how the VSL changes with income. For example, for an elasticity of 1, the VSL is proportional to income, while if the elasticity is 1.5, a 1-percent drop in income is associated with a decline in the VSL of 1.5 percent (for further discussion of these parameters and methods, see Robinson et al.,

2019c). Because of large differences in GDP per capita across countries, assumptions on elasticity have major implications for the valuation of the life gains in low-income countries. For example, if a VSL of 160 times GDP is assumed for the United States (with GDP per capita around US$ 65,000, this implies a VSL of about US$ 10 million) where there is considerable evidence on the VSL, then the VSL for a country with GDP per capita of US$ 1,000 is US$ 160,000 if an elasticity of 1 is applied, but only US$ 20,000 when an elasticity of 1.5 is used in the extrapolation from the US value to the country with lower GDP per capita.

Estimates of the VSL and projected "full-income" gains have been used widely in advocating for increased spending on health or specifically for HIV. The Lancet Commission on Investing in Health stated that "there is an enormous payoff from investing in health" across low- and middle-income countries, including the contributions of health to economic growth (see Policy briefs #3 to #7) but predominantly reflecting the value of longer lives. Based on these two factors, the authors estimated that "over the period 2015-35 these benefits would exceed costs by a factor of about 9-20, making the investment highly attractive" (Jamison et al., 2013). UNAIDS (2015) argued that investing an additional US$ 176 billion in the global AIDS response would yield US$ 2.6 trillion in benefits, exceeding costs by a factor of 14 (UNAIDS, 2015). A more recent UNAIDS-funded study estimated the value of reduced mortality at 6.4 times the costs (Lamontagne et al., 2019).

The magnitude of these estimates is significant from a macroeconomic perspective, when the contributions of changes in life expectancy are added to the contribution of economic growth to give "full income". HIV has been a dominant driver of changes in full income since 1985 in high-prevalence countries, arguably more important than either growth of GDP per capita or gains in life expectancy from any other sources (Table 10.2). For example, in 1985-2000, living standards (as measured by full income) declined in Botswana, largely as a result of HIV and AIDS; the negative impact of HIV/AIDS offset nearly all gains in life expectancy from other sources in Malawi; and the adverse impacts of HIV were larger than the contributions from economic growth in Uganda. Conversely, the gains in life expectancy owing to the scaling-up of antiretroviral therapy accounted for most of the gains in "full income" in Botswana, and about one-half in Malawi and Uganda.

Table 10.2: Contributions to Full-Income Growth, 1985-2018

	Guyana	Botswana	Malawi	Uganda
1985-2000				
Growth of "full income"	3.0	-2.4	0.3	1.5
Growth of real GDP per capita	2.3	3.7	0.0	2.2
Contribution from life expectancy	0.6	-6.2	0.3	-0.8
of which: HIV/AIDS	-0.08	-7.5	-4.8	-3.2
2000-2018				
Growth of "full income"	3.1	9.1	8.3	5.9
Growth of real GDP per capita	2.6	2.2	1.8	2.5
Contribution from life expectancy	0.5	6.8	6.4	3.4
of which: HIV/AIDS	0.03	5.6	4.1	2.5
Memorandum items:				
HIV prevalence, ages 15-49 (2018)	1.5	20.3	9.2	5.8
Treatment coverage, % of PLHIV (2018)	67	85	79	73

Source: IMF (2019) for GDP per capita, UNAIDS (2019) for life expectancy. See Haacker (2016, chapter 4) for a discussion on methods.
Note: PLHIV = People living with HIV

For policy design, there are several potential insights from this and similar analyses. Do investments in HIV or in other health programmes improve living standards, as measured by "full income," once the resource costs are taken into account, and in which ways? While "full income" provides a summary estimate of the gains, the composition is also important – output gains can be used more concretely for refinancing the costs of a policy. And it is also important to bear in mind that the bulk of "full-income" gains from investments in health often comes from increased life expectancy. In this sense, and other than gains in GDP per capita, "full-income" gains are not additional to health gains, but represent a specific economic perspective on health gains.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #11

DOMESTIC PUBLIC FUNDING FOR HIV

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POLICY BRIEF **#11**

DOMESTIC PUBLIC FUNDING FOR HIV

KEY POINTS

- **External funding has played an unusually large role in the financing of HIV programmes (compared with health or public spending overall), but the share of domestic financing has increased in recent years, especially in middle-income countries.**
- **Decisions on funding allocations are made largely independently of tax policies, and domestic funding comes from the government's general resource account. In this sense, there is no specific domestic funding for HIV, and the principal sources of additional resources for HIV and other purposes are increasing the tax base and improved public financial management.**
- **HIV-specific financing instruments – in the form of trust funds and earmarked taxes, borrowing or "innovative" financing – have played a minor role in the financing of HIV programmes, and generally do not represent additional funding.**

The issue of raising additional domestic public funding plays an important role in the HIV policy discourse, for at least two reasons. First, HIV strategies are often developed as stand-alone programmes, often accompanied by an "investment case" for additional HIV spending (Schwartländer et al., 2011), and identifying a funding gap that needs to be overcome to attain the projected objectives. Second, the ongoing shift from external to domestic HIV funding in many countries means that domestic funding challenges (HIV-specific as well as the wider fiscal context) become more relevant in developing coherent and realistic HIV policies.

Raising additional public resources, however, is only one of the options for meeting funding needs. HIV programmes could be financed by the reallocation of resources from elsewhere in the health sector (Policy brief #12) or from outside the health sector (Policy brief #10). Efficiency gains – by allocating HIV funding optimally (Policy brief #16), or improving the efficiency of how HIV services are delivered, also play an important role by reducing funding required to meet objectives, or achieving more with the available resources. Concurrent policies towards achieving universal health coverage or establishing a national insurance could also have implications for domestic HIV funding.

Changing role of domestic funding

While external funding has played a relatively large role in the financing of HIV programmes, the role of domestic public funding is increasing across low-income and especially middle-income countries.

In the context of public expenditure or health financing, HIV stands out through the large role of external funding and a corresponding low share of domestic financing. Indeed, in various low-income countries, external funding has accounted for well over 90 percent of HIV funding, and HIV

also stands out in terms of external support to a number of middle-income countries which otherwise receive very little development assistance. A large share of external financing has implications for the policy discourse on domestic financing – HIV policies reflect the donors' priorities (through funding criteria or policy discourse) as well as those of the government, and domestic funding allocations may represent the outcome of a negotiation with donors to unlock external support. However, large external support can also result in less domestic health expenditure being allocated than otherwise, if foreign funding for HIV enables the government to allocate domestic expenditure to other, non-health purposes (Lu et al., 2010).

Such a displacement effect has been demonstrated, among others, by Dieleman and Hanlon (2014), showing that an additional US$ 1 in development assistance for health results in a net increase in health expenditure of only US$ 0.38. However, it is important to take into consideration that HIV is a shock that is highly unevenly distributed across countries, and external funding serves to alleviate the financial burden of responding to HIV, often playing a critical role in enabling an effective response.

The renewed focus on domestic financing is not confined to countries where domestic funding is playing a large role, but is also a reaction to the changing global landscape of HIV financing. Since 2011, global HIV funding has grown very slowly – from US$ 18.6 billion in 2011 to US$ 22.3 billion in 2017, and stagnated at that level through 2020 (UNAIDS, 2021; in 2019 U.s. dollars, adjusted for inflation). External funding declined over this period both absolutely (e.g., from a high of US$ 9.9 billion in 2013 to to US$ 8.5 billion in 2020) and in terms of its share (from about one-half to under 40 percent). As a consequence, a large number of countries had to disproportionately increase budget allocations to HIV. This trend is clearly visible in Figures 11.1 and 11.2 – the domestic funding share increased steeply across middle-income countries (Figure 11.1), and about one half of the global population living with HIV in low- or middle-income countries are located in countries which have experienced a steep increase in domestic funding share between 2010 and 2017 (roughly those between the 35th and 85th percentile in Figure 11.2).

Figure 11.1: Domestic government share of HIV funding and GDP per capita

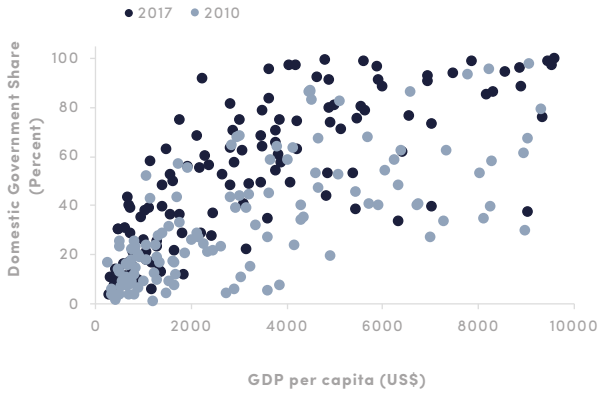
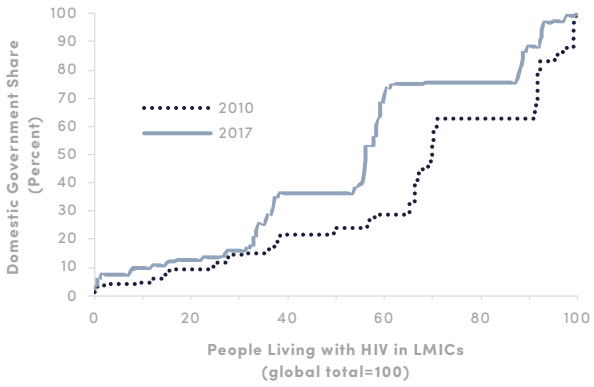


Figure 11.2: Domestic government share of HIV funding across population living with HIV



Source: IHME (2020) for expenditure data and PLHIV, IMF (2021) for GDP per capita. For 2017, GDP per capita has been adjusted using US CPI to control for inflation between 2010 and 2017.

A fiscal perspective on domestic HIV financing

Domestic public HIV financing implies that HIV programmes are funded either through taxes or borrowing. However, in public finance, most decisions on spending are separate from decisions on taxation or borrowing.

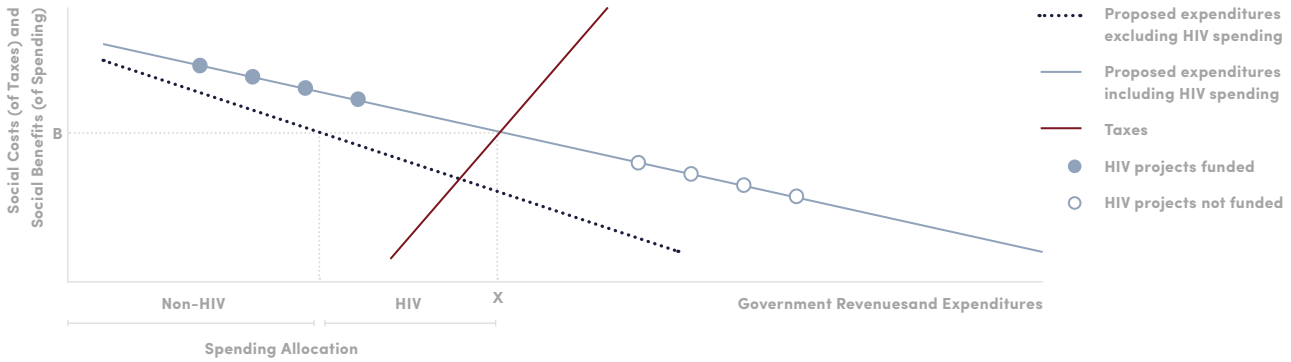
Fiscal policy involves choices about raising revenues and allocating available resources. In a much-simplified manner, these choices are illustrated in Figure 11.3, which draws from a more extensive discussion by Haacker (2016). Higher tax collection comes at increasing social costs, in terms of the costs of collection and the private expenditures it crowds out (represented by the tax curve – the upward sloping line). Optimal choices on allocation of funding reflect the social benefits of alternative spending options.

In Figure 11.3, this is represented by an expenditure curve (the downward-sloping solid line) in which these options are ordered by social benefit per expenditure unit. In this setting, the government would want to raise taxes up to a point "X" where the social costs of taxes equal the social benefits derived from additional public expenditures (at level "B").

HIV interventions which yield social benefits of at least "B" per expenditure unit would then be implemented, and interventions which do not meet this threshold would not. This means that funding decisions almost always involve choices among spending options, and there is no direct link to revenue measures. A severe health shock may shift the expenditure curve to the right by introducing new high-priority spending needs. Even then, decisions on revenue measures would be made not on the basis of the high social benefits of the HIV interventions being implemented (represented by the solid dots along the expenditure curve in Figure 11.3), but based on the benefits of the marginal programmes (at level "B", located on the expenditure curve around the point of intersection with the tax curve), on which there is a debate on whether the benefits justify the social costs of raising additional public revenues.

From this perspective, the issue of domestic financing of HIV programmes boils down to one of effective allocation between the HIV programme, other health programmes, and across government sectors. There are, however, a number of issues regarding domestic public financing of HIV programmes where decisions on funding allocations and revenue measures may be linked directly. These include the earmarking of taxes and of revenues from innovative financing measures for the HIV response. In addition, borrowing – while not an instrument that creates additional public resources as it needs to be repaid – may contribute to public funding by making resources available at a time when the government is facing particularly pressing spending needs.

Figure 11.3: Fiscal Perspective on HIV/AIDS Spending and Financing



Source: Adapted from Haacker (2016).

Taxes and trust funds

While the bulk of domestic public spending is financed indirectly through taxation (via the government's general resource account), there are examples of, and ongoing discussion about, taxes specifically dedicated to support the HIV response, typically in combination with some "trust fund" arrangement.

The best-known example of a tax in support of an HIV programme is Zimbabwe's "AIDS levy", which is a surcharge of 3 percent on personal and corporate income taxes that has been collected since 2000. The "AIDS levy" is administered through the National AIDS Trust Fund of Zimbabwe (NATF), and supports the National AIDS Commission. In 2014, the AIDS levy raised US$ 38.7 million, equivalent to about 0.3 percent of GDP and about 15 percent of the costs of the national HIV/AIDS response (Bhat et al., 2016). Other examples include the AIDS Trust Fund of Uganda, supported by a portion of a tax on beer and other alcoholic beverages, which however covers only an insubstantial portion of the costs of the HIV response. A substantial trust fund in support of the HIV response (or for both HIV and non-communicable diseases) has been under discussion in Kenya for several years, but it has not yet been legally established or launched (Saleh et al., 2018).

Reasons proposed for establishing a trust fund for HIV financing include prioritisation and achieving a more reliable source of funding, compared with allocations

through the annual budget (Haacker & Alkenbrack, 2019). From the scant evidence, it is unclear if these objectives have been met. For example, through the economic crisis in Zimbabwe from about 2000, the funding of the NATF – linked to income taxes – collapsed similarly to government revenues overall (IMF, 2021).

In sum, the evidence on positive contributions of trust funds to the domestic financing of HIV programmes (or health programmes) remains thin. There are only a few examples of such trust funds operating (unlike funds designed to pool external financing, including health-sector financing in conflict or post-conflict situations). Positive contributions in terms of additional resources or prioritisation are unclear, although they may play a role in improving transparency and accountability of the use of funds. In contrast, there are a number of drawbacks. Where the revenues raised through earmarked taxes are small in relation to the expenditure they support (and need to be topped up by general resources), it is unclear whether they result in additional funding – having a dedicated financing instrument may backfire if there is a perception that funding has been taken care of. Moreover, revenue is not necessarily more secure and predictable, because any specific tax the trust fund is tied to is likely to fluctuate more than government revenue overall.

Borrowing

Borrowing does not create fiscal space, because it binds future financial resources as the loan needs to be repaid, but it may play a role in accommodating spikes in spending or revenue shocks.

Borrowing does not play a large role in the policy discourse on HIV financing. External funding predominantly comes in the form of grants, and ministries of finance are wary of embarking on a programme of spending without a clear understanding of how it will be funded. However, borrowing is one regular aspect of public HIV financing at least indirectly, when HIV spending is financed from the government general resource account, which in turn is funded by a mix of taxes and borrowing.

Nevertheless, there are circumstances when borrowing may play an enabling role in responding to acute health challenges (Haacker, 2015), when there is a large health shock which disrupts economic activity and government revenues, and/or results in large immediate spending needs. One obvious example is the fiscal response to Covid-19, where additional spending needs, and drops in tax revenues, were in part accommodated by increased borrowing. Similarly, the Ebola crisis in Sierra Leone (2014-2016) resulted in a steep drop in the growth of GDP and of government revenues, while necessitating additional public expenditure (Haacker, 2015). In addition to external grant support, this was met by increased borrowing. In these examples, borrowing plays a role in mitigating disruptions in government spending allocations arising from a health shock.

The economic implications of HIV, though, are different from those of Covid-19 or Ebola: HIV does not result in acute macroeconomic disruptions, and spending needs, in particular for treatment, persist over many years or even decades. From this perspective, there is no obvious role in HIV financing for borrowing to mitigate acute fiscal disruptions. However, proposed HIV policies typically assume a spike in spending early on, followed by a gradual decline. In this case, borrowing in years when HIV expenditures peak could make a positive contribution by mitigating the shifts in spending allocations required to sustain the changing funding needs of the HIV response. In most cases, though, the magnitude of such spikes is not significant from the perspective of government revenue or expenditure overall, so that financing decisions are made separately as part of the overall budget.

The economic case for borrowing (or otherwise accommodating a spike in expenditures) to support rapid scaling-up of HIV interventions is strongest for one-off interventions like male circumcision, which are one-off investments whose health benefits (reduced HIV infections and their consequences) and financial benefits (notably, reduced treatment costs) extend over many decades (Haacker et al., 2016). These time lags also bring in an intergenerational aspect, with borrowing as a vehicle to make the main beneficiaries (the next generation) contribute to the costs. Such properties have motivated funding vehicles involving borrowing in non-HIV areas, for example, to "front-load" funding for immunisation (World Bank, 2009). Moreover, in the case of HIV, front-loading of prevention and treatment programmes has been shown to result in higher effectiveness and reduced longer-term costs (Anderson et al., 2018, Schwartländer et al., 2011, Chiu et al., 2017). The reason for this is that the effectiveness of interventions in terms of preventing HIV infections depends on the underlying risk of contracting HIV, and this risk declines over time with increased treatment coverage, increased viral suppression rates and eventually declining HIV prevalence.

Innovative financing

Innovative financing mechanisms have played a considerable role in the global HIV policy discourse on raising domestic public HIV funding, but their actual and potential contributions appear very small.

"Innovative" financing mechanisms have been promoted as a means to increase fiscal space, and – by topping up government revenues from traditional sources – as contributions to closing funding gaps in HIV programmes (UNAIDS, 2013).

International instruments are outside the scope of this brief, but a brief pointer is in order in light of their role in the policy discourse on "innovative" financing. These include Product Red (a contributor to the Global Fund), an airline levy (an important contributor to UNITAID), social impact bonds, and innovative arrangements like the International Finance Facility for Immunisation (World Bank & GAVI Alliance, 2010).

Proposals on domestic "innovative" financing instruments include instruments for borrowing and revenue-creating measures. The principal "innovative" instrument for borrowing by the domestic government is a diaspora bond. Most "innovative" instruments proposed for domestic financing include taxes hitherto not considered by the government, such as taxes on remittances or on mobile phone airtime (Booth & Whiteside, 2016). However, the contributions of such "innovative" financing tools to domestic HIV financing have been minimal so far, and their potential contributions are considered small (Booth & Whiteside, 2016), in part because of the limited base of the various new taxes proposed. Government officials, in a well-documented survey in Malawi, have gravitated to more traditional taxes rather than innovative ones (Chansa et al., 2018), which may reflect a reluctance to single out specific transactions (rather than broad-based taxes) as sources of public revenues. Instead, discussions on the potential role of "innovative" financing consistently emphasise the importance of raising taxes overall and improving public financial management as primary sources of fiscal space for HIV or any other government programmes (Atun et al., 2016; Booth & Whiteside 2016; Chansa et al., 2018).

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #12

TRADE-OFFS AND SYNERGIES BETWEEN HIV AND OTHER HEALTH OBJECTIVES

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POLICY BRIEF **#12**

TRADE-OFFS AND SYNERGIES BETWEEN HIV AND OTHER HEALTH OBJECTIVES

KEY POINTS

- **HIV is associated with a range of other diseases, through shared risk factors, effects of HIV on the incidence of other diseases, and the ageing of populations living with HIV.**
- **While investment in HIV may crowd out other health services, investments in the HIV response have contributed to the strengthening of health systems overall. Empirical evidence suggests positive and negative effects on the delivery of specific types of non-HIV health services.**
- **Integration of HIV and other health services serves to improve efficiency and to address the changing needs of people living with HIV, which – for most patients – has been transformed into a chronic disease.**

HIV programmes do not occur in isolation, but are linked to other health challenges – on the demand side through interactions between diseases, and on the supply side through interactions (synergies or trade-offs) in the delivery of health services. Where such effects are important, a **health-systems perspective** complements and improves the insights from an intervention-focused cost-effectiveness analysis. In this brief we develop some of these interactions: the role of HIV as a contributor to a range of other diseases, most notably TB; the implications of the growing burden of non-communicable diseases (NCDs) among people living with HIV, primarily as a consequence of ageing; and supply-side intersections as HIV investments contribute to the strengthening of health systems overall, or as allocations of resources to HIV programmes crowd out the delivery of other health services.

Intersecting burdens of HIV and of other diseases

HIV is associated with a range of other diseases, since it weakens the immune system and shares risk factors. In addition, as the population living with HIV ages because of increased treatment access, non-communicable diseases are becoming more common among people living with HIV.

HIV is directly linked to various other diseases, since it weakens the immune system. These diseases include some which occur predominantly among people living with HIV (PLHIV) – such as certain "AIDS-defining" cancers – as well as otherwise-common infectious diseases which occur much more frequently among PLHIV. The most important of these is tuberculosis (TB) (Figure 12.1), for which HIV is one of the most important risk factors. As of 2000, there were 1.5 million TB cases among PLHIV globally, accounting for 13.8 percent of the total number of TB cases, and the incidence of TB among PLHIV was 41 times higher than for HIV-negative people. Since then, the incidence of TB among PLHIV has

declined sharply, from 6.1 percent annually in 2000 to 2.1 percent annually in 2019, largely in line with the scale-up of treatment (see example in Figure 12.2). Consequently, while the number of people living with HIV has increased sharply (from 24 million in 2000 to 38 million in 2019), the share of PLHIV in global incidence of TB has declined to 8.2 percent over the same period.

However, HIV-TB co-infections remain an important challenge. TB incidence among PLHIV remains much higher than for HIV-negative people (by a factor of 18 globally), and in several countries PLHIV account for more than one-half of all TB cases (Eswatini, Lesotho, South Africa, Zimbabwe). For the provision of services, these data and developments have at least two implications. First, HIV prevention and treatment contribute strongly to reducing the burden of TB, both among PLHIV and – through the prevention of onward transmission of TB – among the population overall. Second, the fact that a large share of TB patients are also HIV-positive has implications for the effective delivery of HIV and TB services. Indeed, this is an area in which integrated models of service delivery have long been used or considered (Legido-Quigley et al., 2013).

Figure 12.1: TB incidence total and linked to HIV versus HIV prevalence (15-49)

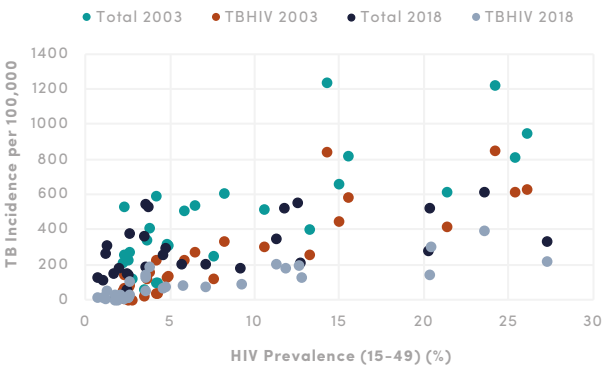
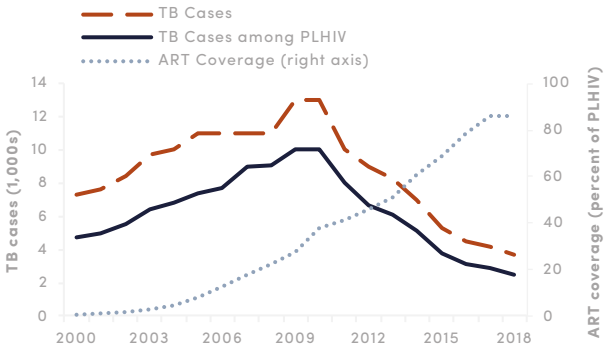


Figure 12.2: Total number of TB cases and number of TB cases among PLHIV, Eswatini



Source: WHO (2020) for TB incidence and population, UNAIDS (2019) for HIV prevalence.
Note: Figure 12.1 excludes countries where HIV prevalence was less than 2 percent as of 2003.

HIV is linked to several other diseases (such as sexually transmitted infections and drug-use disorders) through common risk factors, such as condomless sex and injecting drug use. These links have been recognised in the design of HIV prevention and care programmes that focus on key populations such as female sex workers, or that use harm-reduction interventions for people who inject drugs. An important but indirect linkage occurs in the areas of maternal and child health. Mother-to-child transmission of HIV is largely preventable, making maternal health services a focus of HIV prevention and a significant way to diagnose HIV in patients and refer them for care. Conversely, investments in maternal health services to combat the spread of HIV typically improve the performance of maternal health services overall (see next section).

A third driving factor between HIV and other diseases is the ageing of the population living with HIV. Following the scale-up of treatment and increased survival, the population living with HIV is ageing. An increasing share of PLHIV are reaching age brackets where significant NCDs such as cardiovascular diseases, diabetes and chronic kidney disease become more common (Hontelez et al., 2016; Mahy et al., 2014). The treatment of HIV becomes more complex when ageing PLHIV increasingly develop NCDs or multi-morbidities (Atun et al., 2009), and the prevalence of significant NCDs among PLHIV is projected to increase steeply overall (Smit et al. 2018, Figure 12.3). Relatedly, prevalence of HIV among (generally older) populations affected by NCDs remains high even if headline HIV prevalence – in which younger cohorts with low HIV prevalence carry a large weight– declines (Haacker et al., 2019, see Figure 12.4). One emerging challenge is the role of HIV and long-term exposure to antiretroviral therapy (ART) as risk factors for some NCDs, especially cardiovascular disease and diabetes (Calcagno et al., 2015), and the potential of adapting treatment to minimise such risks. This has several consequences for addressing the challenges posed by HIV and NCDs.

Figure 12.3: Projected prevalence of selected NCDs in Kenya, by HIV status (ages 18+)

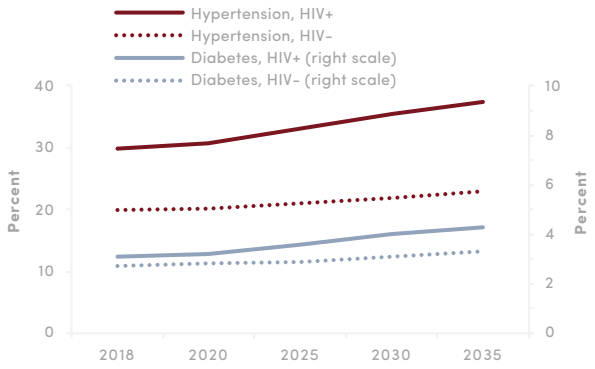
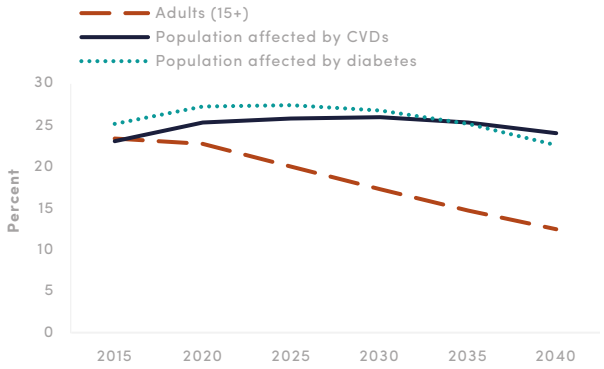


Figure 12.4: HIV prevalence, selected populations, Botswana, 2015-2040



Sources: Haacker et al. (2019) for Figure 12.3. Figure 12.4 adapted from Smit et al. (2019), using data provided by Smit. CVDs (Figure 12.3) = cardiovascular diseases.

HIV crowding out other health services?

In many countries, the HIV response has caused a steep increase in demand for health services and has also triggered a strong health-system response, often enabled by very substantial external support. For an appraisal of the impact of the HIV response, it is important to understand its implications across the health sector, and the extent to which populations beyond PLHIV have been affected. These implications could be negative if limited health resources are reallocated to the HIV response at the expense of other health services. They can also be positive if investments under the umbrella of the HIV response contribute to overall health-systems strengthening and capacity-building.

Concerns regarding the implications of HIV programmes on health systems include inequities in access to and quality of care, access to HIV services versus other under-resourced services of the health system, distorted incentives for health workers caused by disparities in salaries and workloads (Mussa et al., 2013), and lack of coordination between HIV and non-HIV services (Biesma et al., 2009).

These challenges, however, have long been recognised in HIV policy planning. For example, the UNAIDS "Fast Track" strategy 2016-2021 (UNAIDS, 2014) highlights the contributions of health-systems strengthening and progress towards universal health coverage to ensuring "access to comprehensive and integrated (where appropriate) HIV and health services." Relatedly, some funding for HIV programmes has been dedicated to health-systems strengthening. For example, 9 percent of budget allocations by the US President's Emergency Plan for AIDS Relief (PEPFAR) were dedicated to health-systems strengthening (also including lab infrastructure and strategic information) in the financial years ending 2016 to 2020 (PEPFAR, 2020).

One channel through which HIV services may improve access to health services in other areas is engagement at the point of delivery of HIV care. PLHIV receiving ART "are more likely to have received health-care services for diabetes and hypertension" (Manne-Goehler et al., 2017). The presence of clinics providing ART may also result in increased acceptance and uptake of public primary-health services across the population, irrespective of HIV status (Hontelez et al., 2016).

In terms of access and quality of health services beyond people living with HIV, the picture is uneven. There is evidence of positive effects of the presence of HIV services on related services – that is, services which are often delivered in combination with HIV interventions. For example, facility-level data (Kruk et al., 2015) and cross-country evidence (Grépin, 2012) support a positive impact of the presence of HIV programmes on maternal health services, where capacity-building in support of prevention of mother-to-child transmission of HIV has contributed to stronger functioning of facilities (Brugha et al., 2010; Rasschaert et al., 2011; Kruk et al., 2015). In contrast, the scaling-up of HIV services may have affected health services negatively in areas not directly linked to the delivery of HIV services, including neonatal health (Lee & Izama, 2015) and immunisation (Grépin, 2012; Wilson, 2015; Brugha et al., 2010; though Cohen et al. (2013) suggest a positive effect of PEPFAR investments). Wollum et al. (2017) do not find a statistically significant link between provision of ART and of outpatient services.

Integration of HIV and other health services

Integration of HIV services and other health services serves a number of often overlapping objectives – adapting to the changing context and nature of the HIV response, realising efficiency gains and achieving cost savings, aligning service delivery as funding becomes more integrated, and responding to the changing needs of PLHIV.

In part, integration of HIV and other health services mirrors the declining role of donors in funding national HIV programmes (Binagwaho et al., 2016). At the same time, the delivery of HIV-related services has become much more effective, through the development of robust drugs and task-shifting of some services from doctors to nurses (Kredo et al., 2013, 2014). The constraints and immediate needs which motivated the establishment of vertical programmes outside the public-health sector at the beginning of the global HIV response have correspondingly become less binding.

On a more specific level, integration is motivated by the objective of improving the cost-effectiveness of delivering HIV-related services. Gains in cost-effectiveness may arise from two factors: the presence of economies of scale, and synergies in the delivery of HIV services and other health services (i.e., economies of scope). Economies of scale are well documented in the delivery of HIV prevention services such as testing and counselling, prevention of mother-to-child transmission, and male circumcision (Galárraga et al., 2017; Bautista-Arredondo et al., 2018). Conversely, this means that the relative cost of each positive HIV test can be very high in facilities where the number of patients overall, or HIV prevalence among patients, is low. This insight led PEPFAR to focus site-level support on regions where HIV prevalence was high (Wilhelm et al., 2019), relying on more integrated modes of service delivery in other areas.

Probably the most important example of synergies between HIV-related services and other health services is the integration of prevention of mother-to-child transmission of HIV into antenatal and maternal health services, and the role of antenatal care in increasing access to HIV testing and counselling and, ultimately, treatment. Client interactions with health services at the point of (HIV) care offer numerous further opportunities for screening for health conditions like cervical cancer, hypertension or diabetes (Golovaty et al., 2018; Haldane et al., 2018; Nugent et al., 2018; Sigfrid et al., 2017). Such interactions are strengthened by effective referral to care, which is facilitated by proximity (if not full integration) of facilities and consistent quality of care across diseases (not always satisfied, see Rabkin & Nishtar, 2011). In practice, gains from service integration are driven by the presence of both economies of scale and economies of scope. For instance, Obure et al. (2016) find that efficiency gains are "most achievable in settings that are currently delivering HIV and SRH [sexual and reproductive health] services at a low scale with high levels of fixed costs."

Looking ahead, one of the most complex challenges is posed by the ageing of the population living with HIV (discussed above). This means that the prevalence of NCDs (and, frequently, of NCD multi-morbidities) will increase steeply among PLHIV (typically more so than for the population overall), and that the management of these NCDs is complicated by a history of HIV and long-term ART (Althoff et al., 2016). The needs of PLHIV thus become more specific and complex. Effective care for ageing PLHIV therefore requires some integration across health-system functions (Atun et al., 2013). At the same time, the chronic-disease model of HIV offers a template for meeting the increasing demand for NCD-related health services (Binagwaho et al., 2016).

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #13

ASSESSING COST-EFFECTIVENESS ACROSS HIV & HEALTH INTERVENTIONS

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This brief forms part of a body of work on the Economics of HIV, funded by the Bill & Melinda Gates Foundation (INV-002382). The authors acknowledge the contributions of the participants of the 'Economics of HIV' meeting in Cascais, Portugal, in September 2018 for general direction on this work, and thank participants of a webinar in November 2020 for comments on a previous version of this brief. The brief was reviewed in-depth by Arjun Vasan from the US Treasury and by David Wilson from the Bill & Melinda Gates Foundation. We are grateful for the excellent work of James Baer in proofreading the briefs, Carla Hauptfleisch in designing them, and Michael Obst in research support. The findings and conclusions contained within this brief are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or of the institutions the authors represent.

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POLICY BRIEF **#13**

ASSESSING COST-EFFECTIVENESS ACROSS HIV & HEALTH INTERVENTIONS

KEY POINTS

- **While other criteria may also be taken into account, decision support on choices between health interventions typically focuses on cost-effectiveness in terms of health gains per monetary unit spent.**
- **Comparisons between HIV interventions and other health-related interventions require common measures of health gains. The most common are the disability-adjusted life year (DALY) and the quality-adjusted life year (QALY).**
- **Socio-economic considerations often come in only indirectly, e.g., in the form of cost-effectiveness thresholds derived from an economic valuation of health gains or reflecting a country's fiscal context.**

Investments in the HIV response involve choices. Decisions regarding the distribution of funding between HIV and other development challenges (Policy brief #10) consider a range of desired health and other development outcomes, the contributions of the HIV programme to attaining these objectives, and the contributions of alternative investments in health or other sectors.

Decisions between spending on HIV and other health objectives also involve comparisons between outcomes. Planners typically use some measure of life years gained per monetary unit spent as a benchmark for identifying the most cost-effective interventions. The most common criteria are the loss of life years as a consequence of a disease (or gain as a result of an intervention), and the health impairment caused by the disease. These criteria are often summarised in the form of disability-adjusted life years (DALYs) or quality-adjusted life years (QALYs).

Social and economic considerations are often only implied in decision support within the health sector, to the extent that the magnitude of the health outcomes offers sufficient statistical basis for a ranking according to economic or social criteria. But more explicit approaches are available (see Policy brief #10, or discussion of benefit-cost analysis in Policy brief #2), and economic and fiscal criteria may enter in the form of thresholds informed by economic valuations of health gains or fiscal constraints.

Measuring outcomes across health interventions

Numerous aspects of the consequences of disease are relevant for decision-makers, including the impacts on mortality, impairment of capabilities and loss in well-being, the age profile of the population affected, and the distribution across the population according to regional or socio-economic criteria. However, assessments and comparisons of the effectiveness and cost-effectiveness of interventions targeting different diseases typically apply

standardisation to summarise the consequences of an intervention. The most common summary measures of health states or losses are the QALY and the DALY. Both combine estimates of life years lost and of the change in health while alive.

QALYs assign weights to distinct health states (of experiencing a disease, possibly differentiated by severity or stage of progression), drawing on patient or population preferences elicited through large-scale surveys (see Drummond et al., 2005, for a discussion on measurement). QALYs are the measure used most commonly in health cost-effectiveness analysis, especially in high-income countries. They account for over 90 percent of published academic studies reporting either QALYs or DALYs (Neumann et al., 2018), and have been endorsed as a standard by the U.S. Panels on Cost-Effectiveness Analysis in Health and Medicine (Neumann et al., 2016; Feeny et al., 2017).

The DALY was developed in connection with the World Health Organization's (WHO) Global Burden of Disease estimates (Murray, 1994) and is the most commonly used measure in global health. The DALY measures losses in healthy life compared to an ideal state of health. The DALY distinguishes between years of life lost (YLLs) due to premature death and years lived with disease (YLDs). The latter adds up the losses of quality of life attributed to living with disease(s), compared to perfect health, over the projected duration of life. Unlike the preference-based QALY estimates, the disability weights included in DALYs were originally based on expert assessments, but they are now generated using a more empirical and survey-based approach (Salomon et al., 2015).

Economic gains are often only implied in cost-effectiveness analyses (to the extent that better health gains result in higher economic gains). For comparing health interventions, though, it is often sufficient to compare the health outcomes and costs, because of the decision situation or because adding a valuation to health gains would not affect the ranking of interventions. If economic returns matter additionally, there are a number of methods for capturing those, depending on purpose. Feeding the health outcomes into a macroeconomic model of economic growth provides insights on how health interventions contribute to economic activity and may help stabilise the economy during a health crisis. (Covid-19 comes to mind, but it stands out since the economic consequences primarily result directly from disease-control policies, rather than from the actual health impacts.) However, current economic growth yields an incomplete picture of economic gains in case of longer survival, the economic benefits of which accrue over the life cycle. Such lifetime gains are often estimated under the "human capital" approach. A third economic interpretation of health gains is benefit-cost analysis, based on the amount of money an individual would exchange for an improvement in his or her own health (Robinson et al., 2019; also see Policy brief #2).

Cost-effectiveness of HIV and other health interventions in context

There are two broad approaches to deploying cost-effectiveness analysis for decision support:

- Direct comparisons of cost-effectiveness between two or more interventions, or
- Assessments of cost-effectiveness against some threshold, below which interventions are considered for implementation.

In practice, these two approaches are complementary and related. Of two methods of delivering the same intervention, only the more cost-effective would normally be funded, even if the cost-effectiveness of both is below the threshold. And if some interventions are selected for funding in the order of their cost-effectiveness until the available budget is exhausted (similar to the example described in Policy brief #11, Figure 11.3), and others are not, then the cost-effectiveness of the least effective intervention selected for funding defines a threshold.

The most comprehensive recent effort to rank health interventions across diseases is the Disease Control Priorities (DCP) project, illustrated in Table 13.1, which lists a number of interventions for HIV or cardiovascular disease (a small selection from the range of diseases covered by DCP3 (the third edition of the DCP, 2018; see Horton, 2018). Such "league tables" can be used, among other criteria, to identify priorities for public policy and define health-benefit packages, depending on the resources available. Indeed, DCP3 uses the rankings to identify a) interventions which cost less than US$ 200 per DALY averted, which it proposes "could be considered for publicly funded health care in low-income countries"; b) interventions costing US$ 200-500 per DALY averted, which "could be considered for lower-middle-income countries"; and c) interventions costing more than US$ 500 per DALY averted, which are "potentially appropriate for consideration in upper-middle-income countries."

Table 13.1: Cost-effectiveness of selected interventions (Disease Control Priorities, 3rd Edition)

Intervention	Cost-effectiveness (US$/DALY)
Blood pressure management, upper-middle-income countries	Cost-saving
Polypill for high-absolute-risk cardiovascular disease, upper-middle-income countries	Cost-saving
Giving female condom to sex workers, South Africa	Cost-saving
Salt reduction policy in food	Cost-saving to 45
Voluntary male circumcision	10
Prevention of mother-to-child transmission of HIV Option B versus no treatment, Africa	26
ACE inhibitor versus no medication, heart failure, no access to treatment	28
Scale up HIV antiretroviral therapy to all with a T-cell count <350, or all infected, South Africa	188–256
Beta-blocker and ACE inhibitor vs no med, heart failure, no access to treatment	274
Primary prevention of cardiovascular disease with four drugs, middle-income countries	1070–3207
Pre-exposure prophylaxis with HIV antiretrovirals for non-infected partner in serodiscordant couples	Cost-saving to 6468

Source: Horton, 2018.
Note: US$ are at 2012 prices. Table shows selection from interventions covered by DCP3, focusing on HIV and cardiovascular diseases.

However, Table 13.1 also reflects several challenges associated with the use of "league tables" in priority-setting. First, economic capacities and costs differ widely according to economic circumstances, even within country income categories. GDP per capita differs by a factor of about 4 among low-income countries, by 4 among lower-middle-income countries, and by 3 among upper-middle-income countries. Second, DCP estimates of cost-effectiveness for many interventions are based on evidence from a few countries only. These estimates might not be representative, and might be misleading when applied to specific countries. Third, some of the estimates (e.g., on male circumcision for HIV prevention) depend on the epidemiological context. For instance, cost-effectiveness of some HIV prevention interventions is closely linked to HIV incidence and/or prevalence and the risk of contracting HIV, so that the cost-effectiveness of such interventions differs steeply depending on context.

Thresholds

The use of thresholds can facilitate decision support by allowing comparison of the cost-effectiveness of an intervention with just one benchmark rather than a string of estimates (where appropriate; for different means of serving the same purpose, direct comparison is required). Such thresholds can be derived from economic criteria – do the health and economic gains expected from the proposed intervention outweigh the costs? – or from the budget context – is there a threshold that divides interventions which are typically funded and those which are not?

The most influential such thresholds derived from general economic criteria have been the income-based thresholds associated with the Generalised Cost-effectiveness Analysis framework developed by the WHO (Hutubessy et al., 2003). Interventions that cost less than 1x per capita income per DALY averted were considered "very cost-effective", as income gains owing to longer survival are considered to outweigh the costs. Interventions costing less than 3x per capita income per DALY averted were considered cost-effective. This latter benchmark draws on economic valuations of health gains around the value of statistical life (see Policy brief #2) – for interventions costing less, the welfare gains from improved health were thought to exceed the costs.

This approach has been used extensively in the academic literature and in advocacy for increased investments in health, including the report of the Commission on Macroeconomics and Health (2003), the UNAIDS HIV Investment Case (Schwartländer et al., 2011), or the report by the Lancet Commission on Investing in Health (Jamison et al., 2013), highlighting the economic value of the health gains which can be achieved and comparing it with investments in other sectors (see Policy brief #10). These thresholds, however, have not been effective in identifying those interventions which should receive funding (Marseille et al., 2014). According to Griffiths et al. (2016), over 90 percent of academic studies on new or additional interventions in low- and middle-income countries concluded that they "would be highly cost-effective or cost-effective" according to these thresholds. These income-based categories therefore offer little guidance on prioritisation, especially in low- and middle-income countries (Robinson et al., 2017).

For effective decision support, it is instead necessary to interpret findings regarding cost-effectiveness in light of the country-specific economic, fiscal, political and health context (Marseille et al., 2014; Leech et al., 2018), a point also now recognised by WHO staff (Bertram et al., 2016). One response to this challenge is the estimation of thresholds which reflect actual budget allocations, identifying the least cost-effective interventions which are typically supported by a health programme or estimating the marginal return (in terms of health outcomes) of health spending.

Using regional difference in spending and health outcomes, the marginal return to health spending has been estimated at about one-half of GDP per capita per QALY (Claxton et al., 2015) in the UK. The only study available so far applying these methods in a low- or middle-income country estimates a threshold of 53 percent of GDP, based on the provincial variation in health outcomes and health spending in South Africa (Edoka & Stacey, 2020). Under a fixed budget, these estimates can be interpreted as an opportunity cost – introducing a new intervention would crowd out some other health services and impose a health loss at least equal to the marginal return. This approach, however, is demanding on data as it requires sufficient sub-national data on variations in spending and health outcomes, and extrapolating from the scant evidence in the UK or South Africa does not yield reliable benchmarks for decision support (Woods, 2016).

The other source of evidence on thresholds is budget prioritisation exercises. One survey finds that HIV services are included in health-benefit packages (i.e., the "list of priority/essential services to be delivered through the wider health system") in most of 26 countries where such a plan was operating (Regan et al., 2021). The design of a health-benefits package of the Health Sector Strategic Plan 2017-2022 for Malawi (Government of the Republic of Malawi, 2017) implied a threshold (based on the least effective interventions included under the plan) of US$ 61 (18 percent of GDP per capita) per DALY averted. Based on South Africa's HIV investment case, Meyer-Rath et al. (2017) report a threshold of between US$ 547 per life-year saved (for the least effective intervention included in the programme) and US$ 872 per life-year saved (for the most cost-effective intervention not included), corresponding to between 10 percent and 15 percent of GDP. These estimates suggest that at least in middle-income countries the cost-effectiveness of the most common HIV interventions is typically within the range of interventions funded by the public health sector. The large scale of HIV in countries where it is concentrated, though, means that HIV interventions are not necessarily affordable from domestic sources alone, even if cost-effectiveness is below observed thresholds. This is so because financing them would exhaust much of the health budget – which is one reason for the relatively large role of donors in supporting HIV programmes.

Concluding notes

The use of cost-effectiveness analysis in decision support is evolving. The principles are well established and used to good effect by initiatives like the Disease Control Priorities project to highlight interventions which contribute to improved health outcomes in low- and middle-income countries at lowest costs. However, there are few examples in which cost-effectiveness analysis has been used in comprehensive budget-allocation exercises, reflecting lack of country-level evidence on costs (intervention-specific estimates in DCP3 are typically based on observations from a few countries only), and little work that casts thresholds in terms of opportunity costs and the fiscal context.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #14

EXTERNAL AND DOMESTIC HEALTH FINANCING, AND THE ROLE OF PUBLIC VS. PRIVATE DOMESTIC HEALTH FUNDING

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POLICY BRIEF **#14**

EXTERNAL AND DOMESTIC HEALTH FINANCING, AND THE ROLE OF PUBLIC VS. PRIVATE DOMESTIC HEALTH FUNDING

KEY POINTS

- **Financing of HIV programmes is more dependent on foreign assistance than health financing in general, which makes them more vulnerable to a slowdown in external funding, in particular during the current phase of increased uncertainty as a result of COVID-19. This situation makes domestic resource generation – through the government or from the private sector – more pertinent.**
- **Domestic funding may come from public or private sources. From a public policy perspective, both sources can be assessed in terms of the incidence of taxes or costs borne by households and the degree of risk protection they offer.**
- **Raising resources from increased out-of-pocket spending runs against the principles of the "public health" approach to HIV and moving towards universal health coverage.**
- **Raising revenues through contributory schemes has become more feasible (owing to reduced unit costs of treatment) but such policies need to consider equity issues, the objective of increasing coverage overall, and a fair distribution of costs.**

External financing plays a large role in the area of HIV, even more so than in the health sector overall. As the share of external funding is projected to decline (e.g., as the economy is growing), and in light of the uncertainties introduced by the Covid-19 pandemic, increasing domestic resource mobilization is pertinent. One such route is increasing domestic public funding, especially if economic growth is accompanied by a disproportionate increase in tax revenues as the role of the formal sector of the economy expands (see Policy brief #11). Alternatively, additional domestic resources may come from the private sector. While this does not directly draw on public resources, private sector funding can nevertheless be interpreted from a public policy perspective and compared to public funding in terms of the incidence of the financial burden to households and the degrees of risk protection alternative arrangements offer.

Role of domestic and external health financing

To provide some context on the changing role of domestic financing, we discuss how the role of domestic and external financing of health spending differs across countries by level of economic development, and illustrate that these differences are even more pronounced for HIV spending.

Between 2003 and 2018, GDP per capita in many countries most affected by HIV has grown steeply – on average by 36 per cent in sub-Saharan Africa, the region where most countries facing high HIV prevalence are located. Such increases in GDP per capita are associated with a declining

role of foreign assistance, as illustrated in Figure 14.1 with cross-sectional data. Whereas in 2017 foreign assistance accounted for up to 90 per cent of health spending financed by the domestic government and donors in countries with a level of GDP per capita below US$1,000, it accounted for less than 35 per cent of such spending in countries with GDP per capita exceeding US$2,000.

These differences in the role of domestic public health financing across countries are predominantly driven by increasing domestic resources. The average amount of foreign financing per capita changes very little across low- and lower-middle-income countries with different levels of GDP per capita. For example, as GDP per capita doubles from US$1,000 to US$2,000, the typical level of foreign assistance for health declines from about US$9.70 per capita to US$8.40 per capita (Figure 14.3). Domestically financed public spending (Figure 14.4) increases from 1.5 per cent of GDP to 2.0 per cent of GDP, and nearly trebles in absolute terms (from US$15.50 per capita to US$40.60 per capita). Private health spending across countries is roughly proportional to GDP, with levels of out-of-pocket spending around 1.3 per cent of GDP, and voluntary prepaid schemes around 0.3 per cent of GDP (with many observations at or around zero). This means that the sharp drop in the share of foreign funding as GDP increases across low- and lower-middle-income countries is almost entirely a consequence of increased domestic resources, which is accompanied by a very gradual tapering off in foreign support.

Figure 14.1: Foreign-financed health spending (percent of domestic public plus foreign-financed spending, 2017)

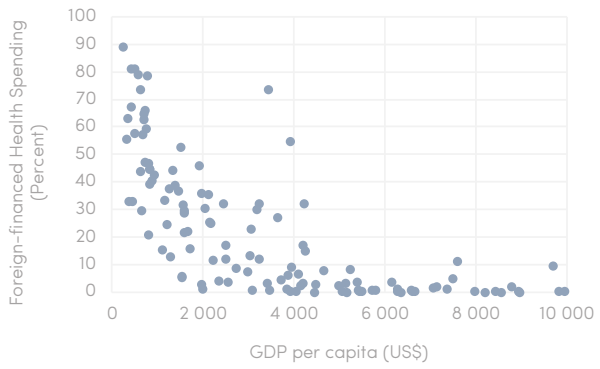


Figure 14.2: Share of foreign funding in HIV spending (latest year, median 2017) HIV prevalence (15-49)

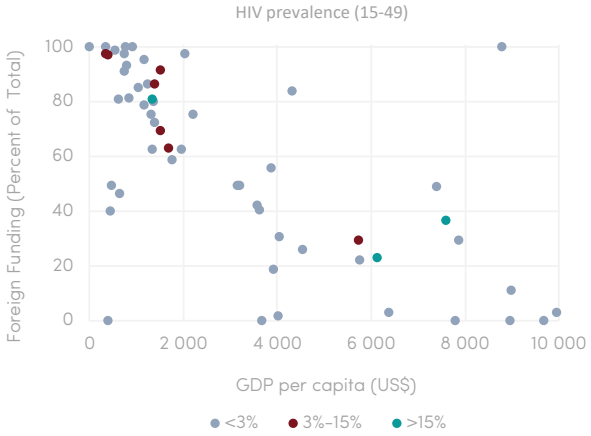


Figure 14.3: Foreign-financed health spending (US$, 2017)

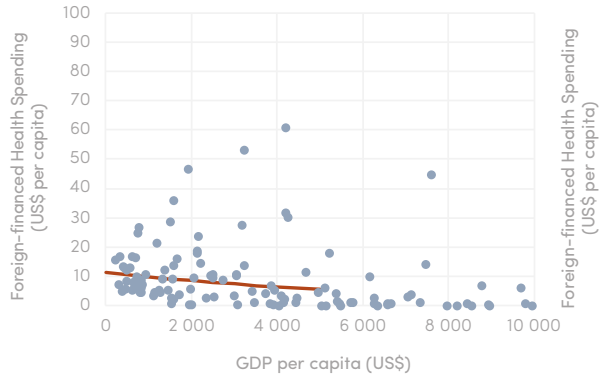


Figure 14.4: Domestically financed public health spending (percent of GDP, 2017)

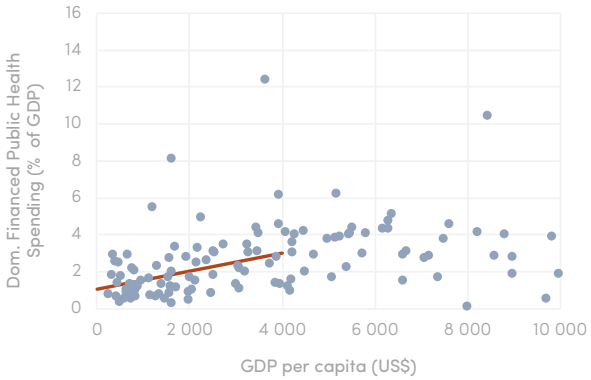


Figure 14.5: Private out-of-pocket health spending (percent of GDP, 2017)

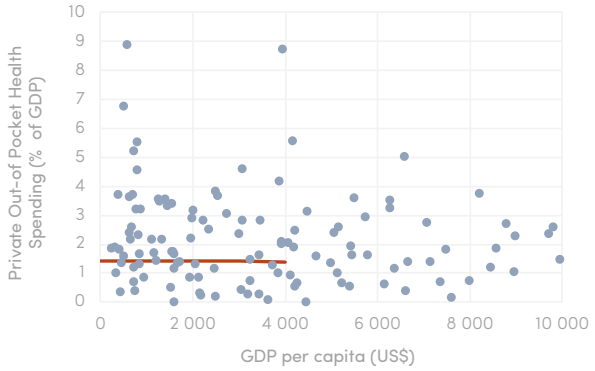
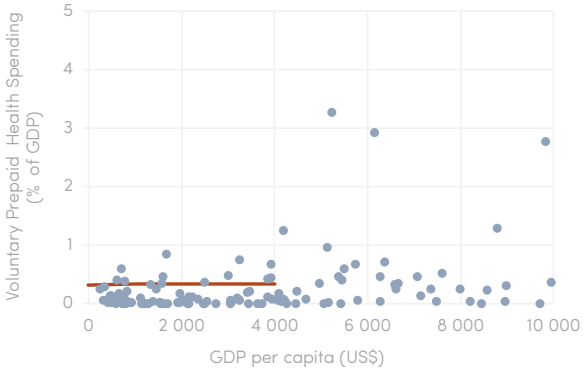


Figure 14.6: Voluntary prepaid private health expenditures (percent of GDP, 2017)



Source: WHO (2020) for health spending and financing overall, UNAIDS (2020) for HIV spending and funding, and IMF (2019) for GDP per capita.
Note: Trend lines have been estimated for countries with GDP per capita of less than US$4,000 (broadly corresponding to low-income and lower-middle-income countries), and exclude countries with a population of less than 1 million.

The roles of domestic and foreign funding for HIV are similar to the respective roles in health financing in general, with a high share of foreign funding at low levels of GDP per capita, and a much lower rate for middle-income countries. However, there are some important differences. First, foreign funding accounts for a higher proportion of the costs of HIV programmes than of health programmes in general (up to 100 per cent in some low-income countries), but also declines steeply as GDP per capita increases (Figure 14.2). Second, perhaps surprisingly, the severity of the epidemic does not play an apparent role in the share of foreign funding (see breakdown by HIV prevalence, Figure 14.2).

Donors have prioritized HIV in general over other areas of development assistance, including health, and support countries facing a more severe burden by (proportionally) larger disbursement. However, financial support is not disproportionately targeted at countries where HIV prevalence is higher. Third, foreign funding per person living with HIV declines with GDP per capita, but more slowly than for foreign support of health programmes in general (Figure 14.7, compare Figure 14.3). Fourth, domestically financed public HIV spending increases with GDP per capita, but less than proportionally (Figure 14.8).

Figure 14.7: Foreign HIV funding per PLHIV (latest year, median 2017)

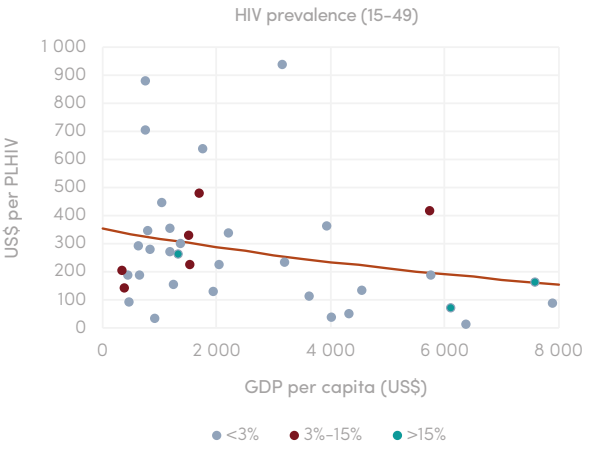
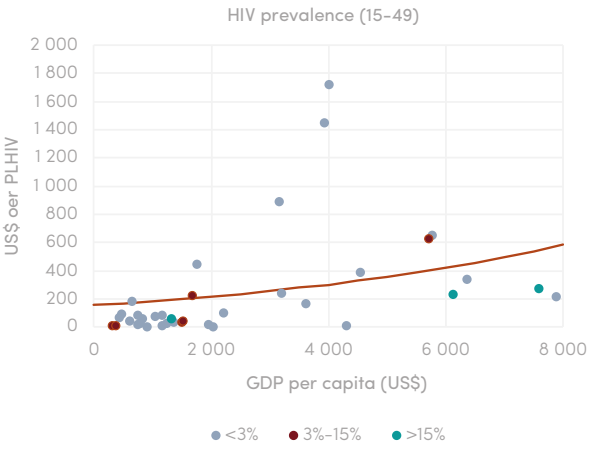


Figure 14.8: Domestically financed public HIV spending per PLHIV (latest year, median 2017)



Source: UNAIDS (2020) for HIV financing and spending data, UNAIDS (2019) for HIV prevalence and the number of people living with HIV, IMF (2019) for GDP per capita.
Note: Figures exclude countries with a population living with HIV of less than 10,000. PLWH = people living with HIV.

Our review suggests that vulnerabilities in the financing of HIV programmes with respect to shortfalls in external funding arise for two reasons. First, changes in donor priorities impact on HIV funding more than other health funding. HIV programmes are to a much larger extent financed from foreign sources than health spending in general. Comparing Figures 14.1 and 14.2 suggests that the share of foreign funding in HIV programmes is about 20 percentage points higher than for the health sector overall. A perception that HIV no longer constitutes an exceptional health challenge could expose HIV programmes to steep declines in external support. Second, declines in external assistance for health are usually dwarfed by increased domestic health spending made possible by economic growth. Because of the higher share of external financing, this is not necessarily the case for HIV programmes. This means that accommodating shortfalls in HIV funding may require reallocations of domestic public funding– across the health sector (see Policy brief #12B) or from other sectors (Policy brief #10) – or additional contributions from the private sector. If this process is driven by economic growth, though, it is useful to bear in mind that the increased domestic allocation to HIV would come out of fiscal resources which are increasing overall, and that HIV programs could benefit from improved health sector capacities, e.g., by realizing efficiency gains from integration.

Raising revenues directly from the private sector

Private contributions could make a contribution to the financial sustainability of HIV programmes by complementing funding from other sources, but their potential needs to be assessed in the context of households' ability to pay and the broader drive towards attaining universal health care (UHC).

Private domestic funding is not additional to public domestic funding in the sense that in both cases the costs of providing HIV services are raised from the private sector. For tax financing or compulsory national insurance schemes, the costs are distributed in line with the incidence of the relevant taxes and contributions. With voluntary contributory schemes, the distribution of costs depends on the schedule of contributions and uptake across the population, but also on the extent to which the scheme is co-financed by contributions from the government or donors. With out-of-pocket payments, the beneficiaries of services pay at least some of the costs directly. Private (and public) contributions therefore need to be assessed in terms of the fairness or equity of the distribution of the costs (directly or indirectly) and the degree of risk protection alternative arrangements offer. Relatedly, alternative financing arrangements have implications for progress towards universal health coverage.

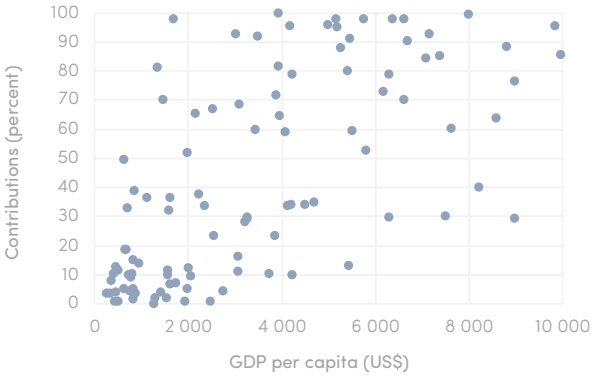
Private contributions in the form of out-of-pocket payments have played virtually no role in HIV programmes across low- and middle-income countries, reflecting a consensus that treatment should be provided free of charge. This consensus has been spelled out in the World Health Organisation's (WHO) "public health approach" to HIV (Gilks et al., 2006), which advocated free access to antiretroviral therapy (ART) from the perspective of the human right to health, and for efficiency reasons. WHO argued that, "even with sliding fee scales or full reimbursement", user fees would reduce the uptake of HIV services and would compromise treatment effectiveness if they resulted in reduced adherence, and that treatment costs would create "an insurmountable, highly inequitable barrier" for many poor people. This approach has recently been reaffirmed in a stock-taking by WHO staff (Ford et al., 2018), which emphasised that "financial barriers associated with ART lead to weak adherence, poor clinical outcomes, and catastrophic health-related expenditures." More generally, reliance on out-of-pocket payments runs against the drive towards UHC, specifically its financial protection pillar (WHO, 2010).

The other broad option for raising private funding is through some form of pre-payment arrangement, either through a compulsory national insurance or through a voluntary (i.e., non-compulsory) arrangement. A compulsory scheme closely resembles a tax, and we do not discuss them further here, and therefore raises similar issues as public funding of HIV spending (see Policy brief #11). For this reason, our discussion below focuses on the potential contributions from voluntary health insurance.

Voluntary health insurance schemes include private health insurance, the coverage of which is typically restricted to beneficiaries employed in the formal sector, and schemes designed to improve pre-paid access to basic health services across the population, often heavily subsidized by donors or the national government (Giedion et al., 2013). Especially in low-income countries, the latter type of voluntary insurance schemes dominates – across least-developed countries, member contributions account for at most 20 per cent of the funds administered through these schemes (WHO 2020, see Figure 14.9). Assigning responsibilities for funding some HIV-related services to voluntary contributory schemes thus does not necessarily shift some of the financing burden

to the private sector. Instead, the increased costs may get passed through to the government or donors, to keep contributions easily affordable for households and help to raise coverage of contributory schemes.

Figure 14.9: Private contributions (percent of funds administered through voluntary contributory schemes, 2017)



Source: See Figures 14.1-14.6

Funding of HIV treatment through private insurance schemes played a role in Southern Africa early on when publicly-funded treatment was not widely available and largely unaffordable for much of the population. Indeed one of the earliest models of the progression of HIV in South Africa (the Metropolitan-Doyle model) was developed on behalf of a large insurance company (Geffen and Welte, 2018), and some private (company) health programs for employees and their family members were among the first to offer antiretroviral therapy in South Africa (Connelly and Rosen, 2005 and 2006). One obvious challenge with this form of HIV care financing is the limited coverage of private insurance and inequity in access in many countries. In any case, the issue of including antiretroviral therapy in medical benefit packages became largely obsolete with the roll-out of free treatment of HIV funded by donors and the domestic government.

However, prepaid voluntary insurance could play a more prominent role in the future, because of the shift towards domestic financing and two developments which would reduce the costs of including antiretroviral therapy in a medical benefit package – (1) treatment has become much cheaper and (2) HIV incidence in most countries has declined steeply. Consequently, the cost of insuring against the risk of contracting HIV and requiring treatment (HIV incidence times lifetime cost of treatment) are often very low.

However, if the responsibility for financing treatment is shifted to a contributory scheme, the scheme assumes the liability for funding treatment for (1) all members already living with HIV (many of whom already receive treatment through other means, including the public sector), and (2) all members newly diagnosed HIV-positive. Where HIV incidence has been declining, the latter group of members could be insured at relatively low cost, while the costs of funding treatment for existing cases – distributed across members of the scheme – could be very substantial (National AIDS Control Council of Kenya, 2014), and the resulting increase in monthly contributions could compromise the objective of expanding insurance coverage. Consequently, decisions on involving contributory schemes in funding HIV treatment and care should distinguish between funding the financial liability implied by the health needs of people already living with HIV, and insurance for those newly diagnosed with HIV.

The other challenge in expanding the role of voluntary health insurance in financing HIV services regards equity and access, with respect to the population overall and specific populations.

Expanding UHC is about extending pre-paid (and affordable) access to health services to population groups to whom they were previously not available, or available only at low quality. In contrast, HIV treatment services across low- and middle-income countries are normally functioning well, and they are delivered free of charge. The pathway to a partly contribution-based funding of the HIV response would therefore need to be defined clearly, avoiding (1) discrimination against contributors (who would pay for HIV services delivered free of charge elsewhere) and thus compromising the objective of extending coverage of pre-paid schemes overall, or (2) a departure from the goal of universal access to treatment and the WHO's public health approach, by making treatment contingent on membership of a contributory scheme. For both reasons, the public sector would have to continue to cover the bulk of the costs of HIV services at least for poorest through (otherwise also common) subsidies to the insurance program.

While contributory schemes in the context of achieving UHC are designed to mitigate exclusion due to poverty, gender or geographical inequalities, the global HIV/AIDS response additionally "accords special attention to exclusion due to sexual orientation and gender identity, sex work or drug use" (Ooms & Kruja, 2019). If HIV services are integrated in national health services and health financing schemes, this would have to be introduced in a way that preserves a priority for "key at-risk populations" (Ford et al., 2018) in line with the WHO's public health approach.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #15

PUBLIC AND PRIVATE PROVISION OF HEALTH AND HIV SERVICES

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WITS UNIVERSITY

BOSTON UNIVERSITY

UCL

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POLICY BRIEF **#15**

PUBLIC AND PRIVATE PROVISION OF HEALTH AND HIV SERVICES

KEY POINTS

- **Private sector provision of health services – through for-profit, not-for-profit and informal providers – is widespread in low- and middle-income countries, and has played a role in the provision of HIV services.**
- **Empirical evidence on the role of private-sector service provision is hampered by the great heterogeneity of private health providers. Overall, private-sector providers appear roughly as effective in providing HIV-related services as public services, and they disproportionately serve wealthier populations.**
- **Public-private partnerships describe more evolved collaborations between the government, the private sector and, frequently, donors, and have played a role especially in capacity building and technology transfer.**
- **The potential to improve coverage, efficiency and equity of health services by complementing public services with private-sector involvement depends on local context and the nature of barriers to access.**

Private providers – comprising non-public entities, including for-profit, not-for-profit and informal providers, as well as traditional healers – play an important role in providing healthcare in low- and middle-income countries. This brief discusses the evident or potential contributions of private provision of health and HIV services, focusing on three questions: (1) What is the role and potential of private providers in extending coverage of health services? (2) What is the actual and potential role of private providers in improving equity in access to health services? (3) What is the efficiency of private vs public provision of health services, and where can involvement of private providers improve the efficiency of the health system in delivering specific services? We also consider more complex models of collaboration with the private sector in the form of public-private partnerships.

Coverage

With regard to the role of the private sector in extending coverage of HIV-related services, it is necessary to distinguish between an aggregate perspective and a focus on specific populations. As for health services in general, private providers play a role in delivering HIV services. These data may yield insights on the strengths and weaknesses of respective types of providers, but not so much on their contributions to coverage, as the counterfactual is not well defined. Patients with private providers may otherwise draw on the public sector and vice versa. Instead, provision of HIV services to key populations often relies on private providers

– typically non-governmental organisations (NGOs) or civil society organisation (CSOs) – as a tool for improving coverage where the public sector is considered less effective.

Private provision of health services is widespread in low- and middle-income countries. Data on private health spending (voluntary pre-paid and out-of-pocket) offer some indirect evidence (Figure 15.1) on the role of private provision, with the caveat that not all private spending goes to private providers. Overall, private spending plays a larger role in low-income countries (roughly, those countries with GDP per capita at US$1,000 or less in Figure 15.1) than in middle-income countries, with a large variation in its contribution across countries at similar income levels. For example, private spending accounts for between 30 percent and over 90 percent of health spending in low-income countries (WHO, 2020).

Direct data on the proportional provision of private vs public health services across countries are rare; most cross-country studies build on standardised data from Demographic and Health Surveys (DHS). Figure 15.2 illustrates such data, comparing the share of births (deliveries) taking place with the appropriate healthcare service with the share of those deliveries that take place in the private sector. Service coverage differs widely across sub-Saharan Africa (between 13 percent and 92 percent), as does the role of private-sector providers (with between 0 percent and 40 percent of all births receiving the appropriate service).

Overall, there is a (weak) negative correlation between overall service coverage of maternal health services and the share of private-sector provision. This means that the public sector played a relatively stronger role in countries attaining higher service coverage for maternal healthcare. This applies even though the picture is blurred by the presence of a small group of "outlier" countries (Chad, Ethiopia and Niger) where both indicators are very low (especially for overall service coverage, at below 20 percent in Figure 15.2), perhaps indicating the presence of factors which impede an effectively functioning health system and (even more so) private-sector development.

Figure 15.1: Private sector health funding

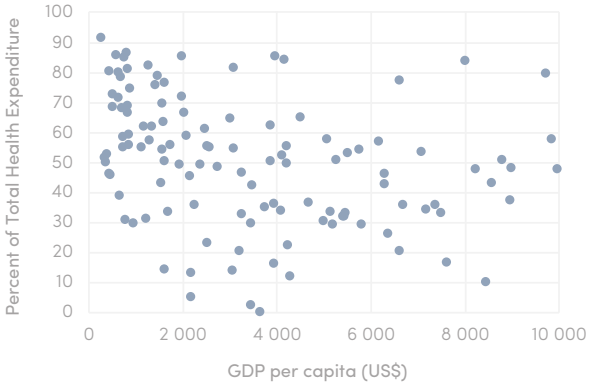
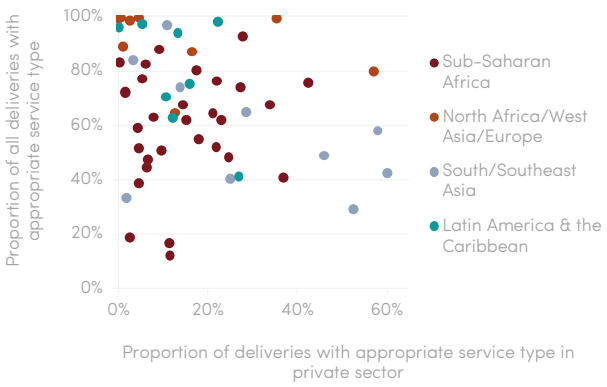


Figure 15.2: Deliveries with appropriate service type



Source: WHO (2020) for Figure 15.1, Benova et al. (2015, reprinted with permission) for Figure 15.2.

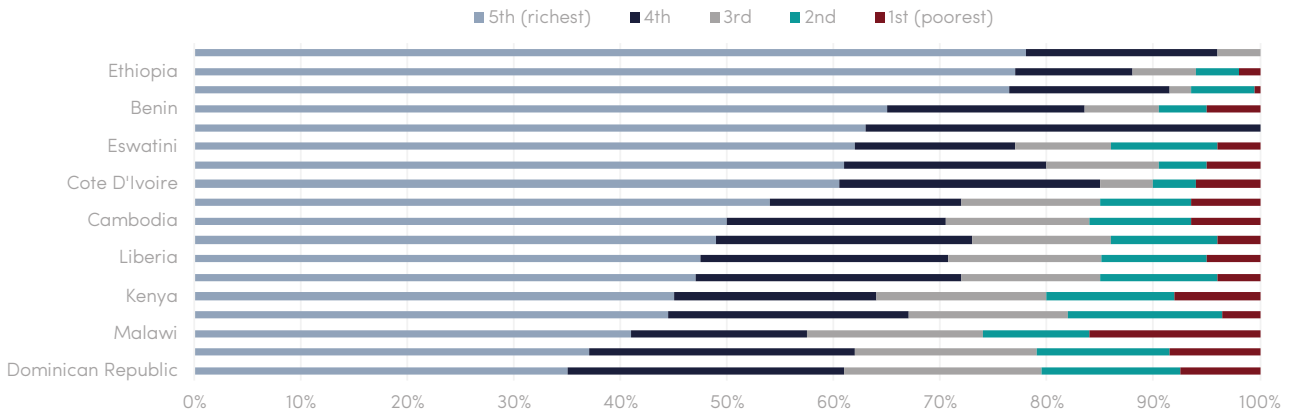
Meanwhile, the private sector (often through NGOs and CSOs) has been instrumental in extending access to HIV services to key populations, e.g., for HIV prevention and support services for sex workers or men who have sex with men, or harm reduction programmes for people who inject drugs. In these cases, non-state organisations complement public HIV services and are considered effective in overcoming barriers related to stigma and criminalisation, and in improving outcomes through peer education and support (Macdonald et al., 2019; also see Atuhaire et al. (2021) for a differentiated discussion on programmes targeting female sex workers).

Equity

The heterogeneity of the private health sector also makes it difficult to assess equity in access to private health services – differences in headcounts of services provided across population categories may not reflect the quality of those services. With this drawback in mind, the most substantial evidence on equity in access, as well as for service coverage overall, comes from DHS data. For example, data on antenatal and delivery care show that use of the private sector increases consistently with household wealth, while use of the public sector is fairly even across wealth quintiles (Benova et al., 2015). (In contrast, women in households with lower wealth are more likely to give birth without skilled birth attendance in either a public or private facility.)

Since antenatal care is an access point for HIV testing and treatment, the share of women who get tested for HIV and receive their tests through the private sector also increases strongly with household wealth (Johnson & Cheng, 2014). The implications of these gradients for the population groups served by private and public providers, respectively, can be dramatic: across 18 countries covered by Johnson & Cheng (2014, Figure 15.3), the share of patients receiving HIV tests in private-sector antenatal care who belonged to the top two wealth quintiles ranged from 58 percent to 100 percent (with a weighted average of 69 percent), while the share of patients from the lowest wealth quintile ranged from close to zero to 16 percent (weighted average: 7.6 percent).

Figure 15.3: Users of private health services by wealth quintile



Source: Johnson & Cheng (2014).

Efficiency and quality

Any assessment of the efficiency of public versus private services in general is hampered by the heterogeneity of the private sector. It is challenging to draw broad conclusions given the vast range of private providers, including formal-sector for-profit and not-for-profit providers, as well as informal providers and traditional healers.

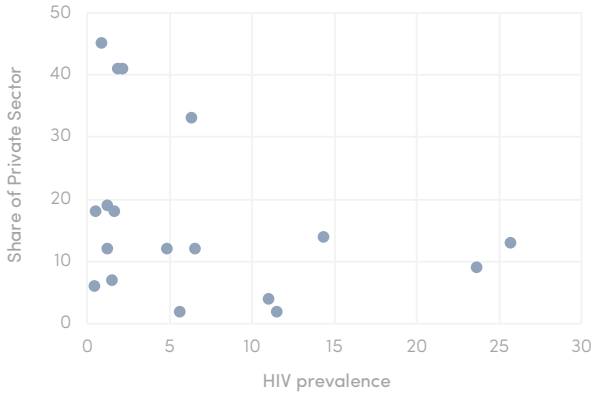
One systematic review, covering mostly studies comparing private-sector and public-sector entities across different types of health services in low- and middle-income countries, concludes that the "reported efficiency tended to be lower in the private than in the public sector, resulting in part from perverse incentives for unnecessary testing and treatment," whereas "public sector services experienced more limited availability of equipment, medications, and trained healthcare workers" (Basu et al., 2012).

For HIV and related services, Powell-Jackson et al. (2015) document superior performance of the private healthcare sector (both commercial and non-profit) compared with the public sector in terms of delivering a bundle of services during antenatal care. According to Johnson & Cheng (2014),

women are more likely to receive an HIV test during antenatal care at private health facilities than at public facilities, based on data from several DHS studies. This difference, though, disappears when controlling for patients' wealth – the result may therefore reflect that the private-sector facilities specialise in providing higher-quality care to wealthier patients, while private facilities perform only about as well as public-sector ones if they serve similar populations (a point that might also apply to the results by Powell-Jackson et al., 2015). A preliminary analysis from South Africa on provision of antiretroviral therapy for HIV patients (Long et al., 2020) suggests that private-sector clinics are similarly effective in terms of treatment outcomes as the public sector, and that the costs of service delivery are similar (but this relies on access to antiretroviral drugs procured through the public sector).

Looking ahead, the roles of private- vs public-sector provision are likely to shift where vertical HIV programmes (dominated by the public sector and various non-profit providers) are integrated into health systems in which private providers play a larger role, for two reasons. First, models of differentiated care offer opportunities for shifting some tasks from dedicated providers of HIV services to general providers – including community health workers, but also any private-sector facilities. Second, the lower costs of antiretroviral therapy (ART), reduced HIV incidence, and simplified delivery of ART have lowered the bar for including ART in medical-benefit plans offered by private providers and delivered through private facilities. Thus, there is an argument for increased provision of HIV-related services through private providers for patients paying privately (typically through private insurance) for higher-quality packages of care. Some cross-country data point to a role for the private sector both in expanding coverage and realising efficiency gains at the programme level. For example, the private sector contributed one-fifth of HIV tests in DHS data from 18 different countries (Johnson & Cheng, 2014). This role, though, differed widely across countries (Figure 15.4). Specifically, the role of the private sector was most pronounced (at least 40 percent of HIV tests conducted) in three countries with HIV prevalence below 2 percent, while it was less than 15 percent in countries where HIV prevalence exceeded 10 percent. This means that the private-sector providers are used more in countries where setting up dedicated HIV services could be less viable due to relatively lower demand. Relatedly, as countries attempted to reach the UNAIDS 90-90-90 targets by 2020, the surge in testing and treatment initiation over the last five years has favoured the public over the private sector in many countries, changing the distribution of services.

Figure 15.4: HIV prevalence and private sector share in HIV testing (percent)



Source: Johnson & Cheng (2014).

Public-private partnerships

Public-private partnerships (PPPs) describe more evolved collaborations – going beyond simple contractual arrangements for the delivery of services – between the government, the private sector and, frequently, donors, and often involve capacity building and technology transfer. These partnerships can serve different purposes: managing the transfer of resources when there is involvement by international funders, collaborating in the production of health goods and services, and setting up governance mechanisms to share risks and investments and accommodate different stakeholders (Fanelli et al., 2020).

With regard to the management of resource transfer, PPPs serve similar purposes as trust funds which are sometimes set up to manage largely externally funded programmes jointly between the government and donors (Haacker, 2015) – the difference being that here the bulk of services is delivered through the private sector, and private-sector representatives may also have a seat at the table in the governance of the programme. This aspect of PPPs is strongly linked to donor involvement (Palmer, 2006), while governments tend to adopt leaner contracting arrangements without some of the other elements mentioned above.

One of the most involved forms of PPPs regards responses to new and complex health challenges, such as Covid-19 and (earlier) HIV, in which private sector know-how is pulled in to rapidly and efficiently scale up health services or functioning of the health system in response to a pressing need, or the private sector collaborates with government agencies in research and development. At the global level, this approach has been used, for example, by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) in partnerships with industry leaders from advanced countries to build drug-supply networks and laboratory infrastructure across sub-Saharan Africa in response to HIV (Sturchio & Cohen, 2012).

One example in the area of HIV is the African Comprehensive HIV/AIDS Partnership supporting the HIV response in Botswana, involving a private company, the Bill & Melinda Gates Foundation and the Government of Botswana, driven by the perception that effective support required not only financial resources or drug donations, but also "support for strengthening the health care infrastructure to assure that medicines are used effectively" (Ramiah & Reich, 2006). Shrivastava et al. (2019) document several other examples in which PPPs have contributed significantly to the scaling-up of national HIV viral-load testing programmes.

Can the private sector's potential to address priority health challenges be harnessed for better HIV care?

Looking ahead, what are the lessons for using the private sector's capacities to address pressing health challenges? The answer to this question depends in part on the existing health financing system in a given context. A comprehensive national insurance system with a strong public component, and with a mix of public and private providers, offers a means of aligning the private sector with urgent national health priorities. In this sense, universal health coverage is a method for "harnessing" the private sector's potential.

Within this system, or through specific arrangements, there is potential to pull in the private sector's capacities in response to health emergencies such as Covid-19, for example by leasing underused capacity like hospital beds from private providers. More generally, contracting the private sector could be an efficient way of expanding coverage, reaching populations which are not reached well by public services – considering operating costs, and the location and capacities of existing facilities. For example, if the treatment of some HIV patients is assigned to general practitioners or other private health providers, this frees up capacities in public facilities serving people living with HIV (Igumbor et al., 2014). The principle of differentiated care for people living with HIV who are receiving treatment offers opportunities to involve private providers to meet the needs of patients shifted into less intensive modes of care, depending on local demand for services and availability of providers. Whether the private sector provides a more effective and cost-effective mode of delivery, though, depends on the local context, and other considerations such as transaction costs, as well as the government's capacities for oversight, quality assurance, and regulation (Hanson et al., 2008; Rao et al., 2011).

Since evidence on the efficiency of private vs public health services is ambiguous, any potential for using private-sector capacities to improve the efficiency of health services overall rests on the local context and the type of services being delivered. Principal examples include the use of local private providers to improve population access to specific services, or the experience of PPPs in improving supply chains, in particular in drug delivery and laboratory systems (Shrivastava et al., 2019), although it is often unclear whether the PPP works as a means of capacity building or a sustainable business model. More generally, potential for efficiency gains through cooperation with private providers rests on the existence of capacity bottlenecks (or excess capacity) in some facilities, and the presence of economies of scale, for example in labs or distribution networks.

Arguments for using private providers to reach poor populations often rest on the weakness of public health services, for example as "a result of insufficient drugs supply, poor healthcare infrastructures, scarce resources and generally low quality of care" (Fanelli et al., 2019). However, it is often unclear whether investments in strengthening capacities of the public sector would not reach the desired outcomes more effectively or sustainably. The potential role of the private sector in overcoming barriers to access thus depends on the causes of such barriers (Hanson et al., 2008). Perhaps the most clear-cut example of private providers improving healthcare access of poor populations is the use of private providers (often non-profit organisations) where state capacities are weak, such as in a post-conflict situation. While there are studies on private providers contracted to extend health coverage to poor sub-populations, available reviews consider this evidence weak because the studies lack comparison with public-sector provision (Basu et al., 2012), or the schemes rely on substantial financial support from donors, the government or social health insurance schemes (Tung & Bennett, 2014).

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF #16

TRADE-OFFS WITHIN THE HIV BUDGET

Health Economics and Epidemiology Research Office
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UCL

This brief forms part of a body of work on the Economics of HIV, funded by the Bill & Melinda Gates Foundation (INV-002382). The authors acknowledge the contributions of the participants of the 'Economics of HIV' meeting in Cascais, Portugal, in September 2018 for general direction on this work, and thank participants of a webinar in March 2021 for comments on a previous version of this brief. Additionally, the brief was reviewed in-depth by Tim Hallett from Imperial College London. We are grateful for the excellent work of James Baer in proofreading the briefs, Carla Hauptfleisch in designing them, and Michael Obst in research support. The findings and conclusions contained within this brief are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or of the institutions the authors represent.

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POLICY BRIEF **#16**

TRADE-OFFS WITHIN THE HIV BUDGET

KEY POINTS

- **Governments need to choose between different HIV interventions in order to maximise impact under limited funding. This can be done by ordering interventions by cost-effectiveness in a league table, or by employing allocative efficiency models to determine how to allocate funds across packages of interventions in the most cost-effective way.**
- **There can be a tension between cost-effectiveness (often expressed as cost per health outcome achieved, such as HIV infections averted or life-years saved) and other optimisation targets such as equitable access to services, or ending AIDS as a public health threat. Trade-offs also apply over time, as increasing the coverage of interventions today improves health outcomes but also affects spending needs in the future.**
- **Decision-making is complicated by (a) declining returns to investment in individual interventions, (b) increasing marginal costs at high coverage levels, (c) interactions in effectiveness between different interventions and (d) a lack of effectiveness data for some interventions.**
- **Additional practical constraints to achieving allocative efficiency include political promises from local and global actors, and budgetary inertia that makes drastic shifts across years difficult. These and the need for large amounts of data (and the risk of injurious advice given the uncertainty in the data) limit the usefulness of optimisation models, particularly for HIV programmes at high levels of intervention coverage.**

Even within the HIV budget, choices are necessary to sustain or increase progress towards AIDS control – in this case, trade-offs between different interventions. In the context of a global HIV funding envelope that has stagnated for the last ten years, governments and donors emphasise allocative efficiency in HIV programming – in other words, the identification of the mix of HIV interventions that produces a defined level of output at the lowest possible cost or achieves maximum results within a given budget constraint.

Traditionally, the economic value of interventions is analysed considering one intervention at a time. In order to establish the allocative efficiency of an entire programme with many different potential interventions, models often integrate additional aspects such as the impact of one intervention on another (e.g., of prevention on treatment), non-linear effects of different coverage levels, spatial targeting and additional objectives such as equitable coverage or epidemic control.

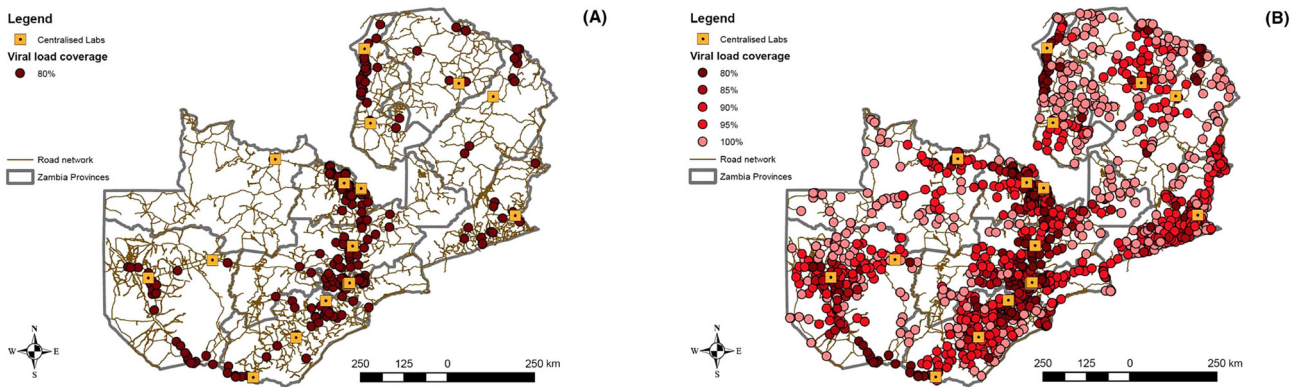
The role of allocative optimisation models

Governments need to choose between different HIV interventions. One traditional approach is to order interventions by cost-effectiveness and allocate budget to the most cost-effective interventions. This can be supported by models that optimise the allocative efficiency of the HIV budget.

Allocative efficiency optimisation models in HIV aim to optimise spending allocations to the HIV programme, often under a constraint such as those posed by a given budget, or other considerations such as a given human-resource envelope. In a recent review of 23 papers based on 14 HIV optimisation models, the most common optimisation target, or optimand, was minimising HIV incidence, followed by maximising survival and utility (measured as disability-adjusted life-years (DALYs) averted or quality-adjusted life-years gained), minimising deaths or minimising costs (Avanceña et al., 2020).

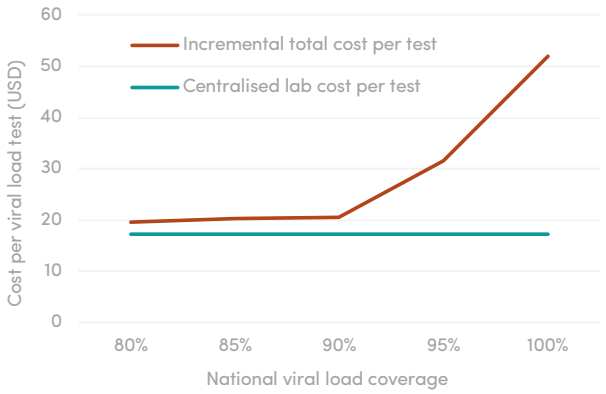
Other types of optimisation include spatial and temporal optimisation, as well as optimisation under explicit constraints such as health-systems capacity. Anderson et al. (2014) showed that targeting prevention interventions by population and locale was more impactful than a non-targeted approach under a limited budget in Kenya, with the locally focused approach reducing HIV infections by 33 percent per year compared with the blanket national-level approach. Kedziora et al. (2019) found that geographically optimising budget allocation within different regions in Ukraine would reduce DALYs lost to HIV by 26 percent, while optimisation across regions would reduce DALYs by 29 percent. Geospatial optimisation has its limits, however: Nichols et al. (2019) optimised the logistics of the sample-collection network for viral load tests in Zambia in order to increase test coverage from 80 to 100 percent of patient volumes (Figure 16.1) and found that, despite optimised sample-transport networks, cost per test would have to increase 2.6-fold due to the increased reliance on decentralised transport systems (Figure 16.2).

Figure 16.1: Maps of Zambian viral load sample transport networks at 80% (A) and 100% (B) of patient volumes



Source: Nichols et al., 2019. Reproduced with author's permission.

Figure 16.2: Cost per viral load test



Source: Nichols et al., 2019

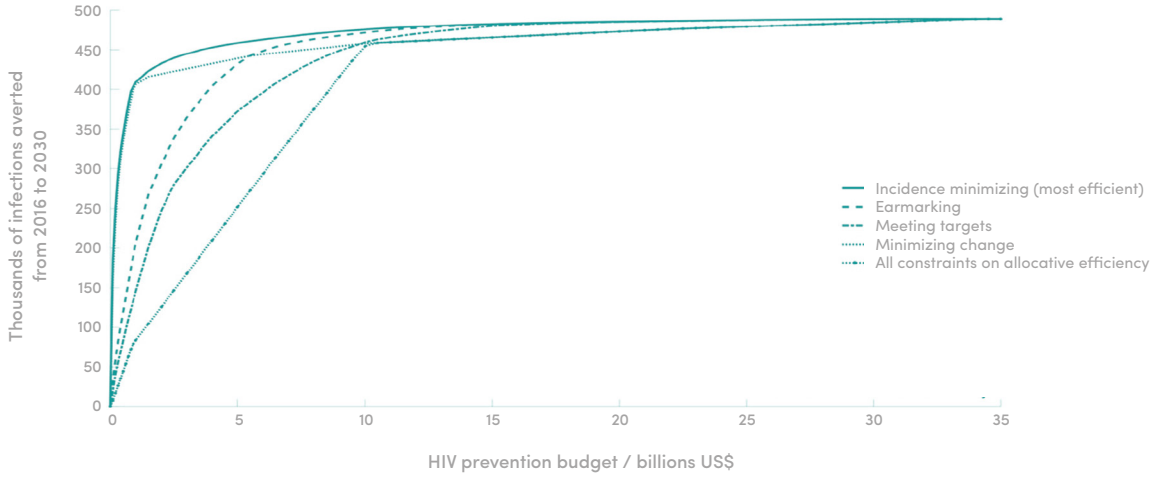
As an illustration of the impact of varying programme optimisation over time using the Optima HIV allocative optimisation model, Shattock et al. (2016) allowed annual HIV budgets for Zambia to vary over time within the same overall 10-year budget envelope and achieved a 7.6% decrease in projected new HIV infections compared with a constant baseline budget.

Combining different optimisation targets

There can be a tension between cost-effectiveness and other optimisation targets such as equitable access or ending AIDS as a public health threat.

Efficiency, allocative or otherwise, might not be the only, or not the primary, goal in allocating HIV budgets. However, tensions can arise if additional optimands are in juxtaposition to the main aim of allocative efficiency. For example, both internal and external healthcare targets can skew the HIV response away from its optimal impact, especially when resources for the implementation of these targets are constrained. This is especially severe when targets are set by international organisations that do not contribute major funding to their implementation. Stopard et al. (2019) optimised the allocation of HIV prevention budgets in Benin, Tanzania and South Africa considering a) the earmarking of funding to novel interventions, b) the attainment of the UNAIDS 90-90-90 targets and c) the stickiness of local planning processes. They found that all three reduced the impact of prevention programmes, though they only did so at budget levels lower than the current prevention budget (Figure 16.3). At higher budget levels, the impact of these technical inefficiencies became negligible.

Figure 16.3: Changes in HIV prevention efficiency under different scenarios and budget levels



Source: Stopard et al., 2019. Reproduced with author's permission.

Another tension arises when optimal allocation means the down-scaling of some interventions. Traditionally, HIV budgets in many countries have funded interventions such as the improvement of systems for patient tracking and documentation, supply chain management or pharmacovigilance (often summarised as programme enablers), which benefit health systems beyond HIV, or social enablers such as stigma reduction, community mobilisation and political commitment and advocacy work that prepare society's response to HIV more broadly. Where HIV funding has grown more than general development assistance, sometimes this has extended to programmes furthering other development aims (also called development synergies) such as social protection, education, legal reform, gender equality and the reduction of poverty and of violence by men against women (Schwartländer et al., 2011). These structural enablers and development synergies might need to continue to be funded in order to progress towards these other development aims, even though they might not contribute directly to the attainment of HIV endpoints or are less cost-effective in doing so than other HIV interventions.

Lastly, an additional optimand might be equitable coverage. Aiming for the highest coverage levels necessarily includes reaching underserved population groups, which in turn can increase both the average and marginal cost of an intervention so much so that it is no longer the most cost-effective. However, extending coverage to key populations at highest risk can also be cost-effective, such as in an analysis of different scenarios of expanding the HIV programme of Côte d'Ivoire to allow different key population groups to

reach the UNAIDS 90-90-90 targets by 2020 (and the 95-95-95 targets by 2030) alongside the general population. While the authors found that the maintenance of current coverage trends was almost three times more cost-effective than achieving the UNAIDS targets, they also found that a number of scenarios in which key population groups reached the UNAIDS targets first were more cost-effective than having all population groups reach these targets at the same time (Maheu-Giroux et al., 2019).

Additional aspects such as policymakers' obligations to reaching international goals or financial protection might play a role (Avanceña et al., 2020). Analytical methods such as multi-criteria decision analysis allow the consideration of these additional aspects, the elicitation of decision-makers' preferences between these additional criteria, and their weighting relative to each other, in order to produce rankings of interventions bearing all criteria out (Baltussen et al., 2016). Extended cost-effectiveness analysis additionally allows the joint consideration of the health and financial consequences, including financial risk protection and distributional benefits (Verguet et al., 2016). Despite these developments, there will remain a grey area of decision-making where alternative criteria are not known at the time of analysis, or cannot be quantified sufficiently.

Complexities in allocative efficiency modelling

Analysis that hopes to inform healthcare decision-making is complicated by (a) declining returns to investment in individual interventions, (b) increasing marginal costs at very high coverage levels, (c) interactions in effectiveness between different interventions and (d) lack of effectiveness data for some interventions.

Most countries' HIV programmes consist of a number of interdependent interventions. Once these have been implemented for a period of time and have reached high coverage levels, two interlinked analytical problems emerge. First, interaction effects increase as the number of interventions already implemented or considered for implementation increases. For example, scaling up any prevention intervention will likely reduce the need for treatment in later years, while scaling up treatment will reduce population HIV viral load and, by thus decreasing HIV transmission, will diminish the impact of prevention interventions (Chiu et al., 2017). Second, the relationship between the marginal cost of producing the next unit of output of an intervention and coverage is non-linear: average costs, in particular at the facility level, often decline initially with scale-up due to economies of scale but may increase at higher coverage levels because the remaining population groups tend to be harder to reach. Increasingly, models accommodate this "portfolio approach" to analysis, which makes it possible to include all interventions that are currently implemented from the same budget, or that are under discussion for funding, and analyse the cost-effectiveness of each while taking into account the impact of changing the coverage of one intervention on the need for all others.

The results of portfolio models can be presented in two ways. First, interventions can be ordered in a league table by their incremental cost-effectiveness over the same baseline. This allows policymakers to compare all interventions at a glance and to allocate budget to the most cost-effective interventions until the budget envelope is exhausted, i.e., until the total cost of the combined interventions is more than the available budget. While this allows an easy incorporation of notions of affordability into the analysis, the interdependence of interventions is still excluded. Alternatively, the incremental cost-effectiveness of each intervention can be analysed over a baseline including all more cost-effective interventions, incorporating diminishing returns. These are relevant in particular when considering HIV testing, whose yield of a newly diagnosed person living with HIV (PLHIV) must decrease over time as most PLHIV have already been diagnosed, and for prevention interventions whose returns decrease with decreasing incidence, at which stage more targeted approaches might be more useful. As Figure 16.4 shows, considering diminishing marginal returns greatly increases the incremental cost-effectiveness ratios (ICERs) but leads to more realistic estimates of each intervention's impact.

Figure 16.4: Comparison of conventional league table and optimisation routine in South African HIV investment case

Conventional league table		Optimisation routine		% change in ICER*
Rank	*ICER ($/LYS)*	*Rank*	*ICER ($/LYS)*	
Condom availability	Cost saving	Condom availability	Cost saving	
Male medical circumcision	Cost saving	Male medical circumcision	Cost saving	
SBCC 1 (HCT in adolescents, reduction in MSP)	46	ART (Eligibility at 500 CD4 cells/microl)	109	14%
ART (Eligibility at 500 CD4 cells/microl)	96	PMTCT	142	7%
PMTCT	132	Infant testing at 6 weeks	248	20%
Universal ART	186	Universal ART	249	34%
Infant testing at 6 weeks	208	SBCC 1 (HCT in adolescents, reduction in MSP)	749	1525%
HCT for sex workers	366	SBCC 2 (condoms)	1 200	112%
SBCC 2 (condoms)	566	General population HCT	1 236	-3%
SBCC 3 (condoms, HCT, MMC)	697	SBCC 3 (condoms, HCT, MMC)	1 816	161%
PrEP for sex workers	926	HCT for sex workers	2 643	621%
General population HCT	1 273	Infant testing at birth	2 937	118%
Infant testing at birth	1 349	PrEP for sex workers	9 947	974%
HCT for adolescents	1 772	HCT for adolescents	19 540	1003%
PrEP for young women	3 703	PrEP for young women Max	26 375	612%
Early infant male circumcision	8 712 984	Early infant male circumcision	89 642 731	929%

Source: Chiu et al., 2017. ICER: incremental cost-effectiveness ratio. $: US dollars. LYS: life-year saved. HCT: HIV counselling and testing. MSP: multiple sexual partners. PMTCT: prevention of mother-to-child transmission. ART: antiretroviral therapy. SBCC: social and behaviour change communication. MMC: medical male circumcision. PrEP: pre-exposure prophylaxis.

* Between methods

Lastly, some interventions, including a number of programme or other structural enablers, but also interventions implemented as packages, do not easily lend themselves to inclusion in optimisation models, as their effectiveness has often not been measured at all, or has not been measured against HIV-relevant endpoints such as incidence, reduction of AIDS-related deaths, or uptake of other interventions with known effectiveness. If there are reasons to believe that structural enablers provide a role in increasing uptake or demand for other interventions, it is often still possible to include their cost alone, based on programme data regarding the types and quantities of resources needed for their implementation; but the lack of effectiveness data prevents an assessment of their impact on a country's HIV epidemic in a transmission model and, hence, ultimately their cost-effectiveness.

Trade-offs over time

Trade-offs also apply over time. Increasing intervention coverage today improves health outcomes but also affects spending needs in the future.

As with many other diseases, decisions regarding the funding of HIV programmes must take into account the timing of expenditure. In HIV, it is additionally important to consider the timing of the impacts of interventions which often come to fruition quite a bit later than the upfront investment – in particular in prevention interventions. Interventions such as ART have early and sustained impacts on survival and transmission but create a longer-term financial commitment that has to be factored into the initial decision-making process. This is particularly important when motivating funding towards longer-term aims such as "ending AIDS" as a public health threat. UNAIDS' analyses as part of the "Fast-track" programme launched in 2014 projected that front-loading the investment would save US$ 24 billion of costs for HIV treatment annually by 2030 – while also saving 21 million lives and preventing 28 million HIV infections (UNAIDS, 2014).

Modelled analyses additionally aim to choose a time horizon that incorporates the bulk of both costs and outcomes of the intervention under analysis, including the impact on onward transmission and secondary cases averted, and future births and deaths. Throughout the analyses mentioned above, the costs of countries' HIV programmes are projected to

increase over the first years, before they fall again – at least for interventions whose coverage is sub-optimal at baseline. Care needs to be taken, then, in choosing the correct time horizon. The time-varying optimisation by Shattock et al. (2106) mentioned above found that recommendations regarding which interventions to prioritise changed greatly between analyses with a 5-, 10- and 20-year programme horizon, depending on the timing of costs and benefits and the discount rates applied; a finding supported by Haacker et al. (2020).

Another important aspect in HIV decision-making is framing the decision problem so that the cost of inaction can be incorporated. In many analyses this is done in the shape of a baseline or counterfactual representing the current HIV programme (by keeping the choice of interventions and their coverage constant), or, in early analyses, the counterfactual of "no HIV care". While these scenarios are often difficult to estimate, one analysis of the HIV programme in Zimbabwe using the Optima model found that a scenario of "no funding" would increase HIV infections by between 80,000 and 120,000 annually over 15 years and lead to between 30,000 and 100,000 HIV-related deaths, compared to below 20,000 infections and deaths per year expected under a baseline of keeping the current programme constant (World Bank, 2019). In situations of decreasing funding or traditional funders disengaging altogether, more pessimistic counterfactuals might be warranted.

Practical and political limitations of allocative optimisation models

While adding these optimisation targets into analyses often produces impressive results vis-à-vis the status quo, a number of ethical and political aspects apply that might reduce their feasibility and their ability to be implemented. Among these are the political and practical issues associated with focusing resources on certain areas of a country (Anderson et al., 2014; Meyer-Rath et al., 2018) or ignoring district boundaries in planning and budgeting (Nichols et al., 2019), the non-fungibility of resources which does not allow for quick "switching" on and off of interventions over time (Shattock et al., 2016), the influence of the targets of donors and international organisations (Avanceña et al., 2020), and the presence of constraints on the supply and demand side that are unknown or hard to quantify at the time of analysis (Vassall et al., 2016).

However, adding these additional aspects into an optimisation model holds two risks. First, the requirement for additional data representing each of these aspects, across all geographic and population levels at which programmes could be optimised, limits the number of countries that can plausibly hope to gain useful insights from these models. Second, over-interpretation of the models' results, given the level of uncertainty in their inputs, might in turn lead to net-injurious programming, for example if the wrong sub-populations or geographical areas are targeted for prevention interventions, or targeting of incidence "hotspots" jeopardises general population coverage. These aspects might reduce the role of optimisation models in planning HIV programmes.

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POLICY BRIEFS ON

ECONOMIC IMPACT OF HIV

POLICY BRIEF **#17**

THE ECONOMICS OF HIV AND OF HIV PROGRAMMES IN THE ERA OF COVID-19

Health Economics and Epidemiology Research Office
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This brief forms part of a body of work on the Economics of HIV, funded by the Bill & Melinda Gates Foundation (INV-002382). The authors acknowledge the contributions of the participants of the 'Economics of HIV' meeting in Cascais, Portugal, in September 2018 for general direction on this work and thank participants of the 'HIV Programmes in the Era of Covid-19' webinar on July 31, 2020 for comments on this paper. Additionally, the brief was reviewed in-depth by Arjun Vasan and colleagues from the US Treasury. We are grateful for the excellent work of James Baer in proofreading the briefs, and Carla Hauptfleisch in designing them. The findings and conclusions contained within this brief are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation or of the institutions the authors represent.

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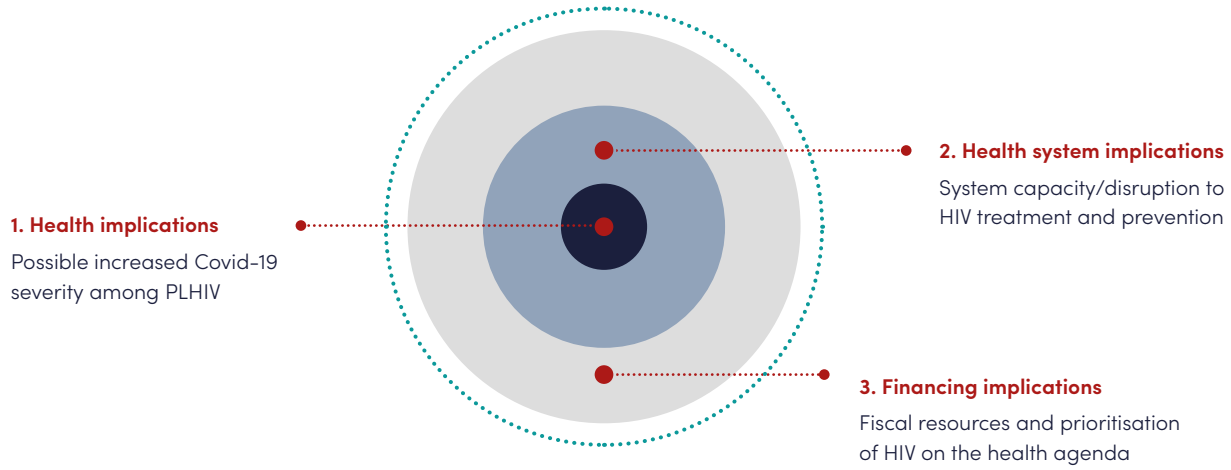
POLICY BRIEF **#17**

THE ECONOMICS OF HIV AND OF HIV PROGRAMMES IN THE ERA OF COVID-19

A framework for considering the impact of Covid-19 on the economics of HIV

The Covid-19 pandemic has profound negative implications for the economies of countries most affected by HIV, as well as for donor countries that support the global HIV response. It undermines underlying economic fundamentals and adds considerations for HIV policymaking. This paper explores three interrelated ways in which the Covid-19 pandemic and the response to Covid-19 affect people living with HIV and the HIV response: (1) the health impacts of those living with or at risk of acquiring HIV; (2) healthcare capacity challenges; and (3) the consequences for domestic and global financing for HIV. These considerations affect three overlapping and increasingly large proportions of the population in low- and middle-income countries and constitute a framework that can be updated as more data on the size of the impacts become available (Figure 17.1).

Figure 17.1: A framework for the potential impacts of Covid-19 on HIV and HIV programmes



1. Individual health implications

Emerging evidence, suggests that people at risk of or living with HIV are more likely to be negatively impacted by Covid-19. While people living with HIV (PLHIV) are not necessarily at higher risk of contracting Covid-19, HIV appears to be a risk factor for the more severe forms of Covid-19 disease and death, irrespective of HIV treatment status. In addition, disengagement from care and decreased healthcare-seeking with delayed initiation of treatment due to fear of Covid-19 have been documented. If HIV treatment for existing patients is delayed or interrupted due to the Covid-19 pandemic, this could contribute to a further spread of HIV (as treatment no longer works as prevention by suppressing viral load). Beyond this, the implications of Covid-19 for HIV prevention are complex and little understood.

2. Health system implications

Covid-19 will likely exacerbate the existing capacity constraints of healthcare systems in countries fighting both the HIV and Covid-19 epidemics. Covid-19 is changing health system priorities which, when there is a scarcity of both medical professionals and infrastructure, may result in even more disengagement and less access to HIV prevention and treatment services.

3. Financing implications

Covid-19 will reduce the amount of resources available for both domestic and donor governments, including for HIV. Covid-19 has resulted in steep fiscal deficits from (1) revenue losses due to the deteriorating economy, and (2) the fiscal costs of stabilizing businesses, providing income support to households, and funding the government response to Covid-19. Fiscal deficits result in a build-up of public debt, constraining fiscal space for years ahead. Countries relying predominantly on donor financing are particularly exposed, as donor countries have so far generally experienced a steeper macroeconomic and fiscal impact from Covid-19.

The substantial uncertainty surrounding the impacts of Covid-19 and its intersections with HIV poses immediate and longer-term programmatic challenges for HIV policies. In the short run, HIV programs need to adapt to disruptions (e.g. in supply chains, or resource constraints) caused by the impact of and response to Covid-19. Looking beyond the Covid-19 pandemic period, the uncertainty complicates planning for financial sustainability and potentially shortens relevant policy and planning horizons, including for HIV. As a result, the framing of HIV programs in terms of health benefits and financial returns spread over the next decade(s) becomes less forceful.

The following assessment builds on various types of data available in the public domain – data on the distribution of cases of Covid-19 and HIV across countries and across population groups, emerging data on Covid-19 patients and their health outcomes, data on the use of HIV-related services as the impacts of Covid-19 and of lockdowns have been felt, and estimates and projections of the macroeconomic and fiscal consequences of Covid-19 across countries. Much of this evidence, such as the course of the Covid-19 epidemic across countries, or estimates and expectations about the economic impacts, is evolving quickly or only just emerging. Our analysis does not provide results about how Covid-19 is currently affecting the economics of HIV programs. Instead, in this highly volatile environment, it seeks to develop a framework for identifying intersections between Covid-19 and HIV, discuss the evidence available so far, and draw lessons on HIV policy challenges.

A transformed health context

Countries with high HIV prevalence did not experience early Covid-19 epidemics, but the epidemic has subsequently escalated in South Africa and some neighbouring countries.[1] As of December 8, 2020, there were 822,000 confirmed Covid-19 cases in South Africa, corresponding to 1,386 cases per 100,000 inhabitants (Figure 17.2.b). However, South Africa is one of the countries that was initially relatively successful in controlling the number of new infections – after hitting 1,000 infections per 100,000 inhabitants in early August and ranking 13th out of 179 countries in the accumulated number of cases at that time, the epidemic spread much more slowly in September to November, with a doubling time (at which the number of cases would double at current infection rates) increasing from 2 weeks in July to 10 months in October. By early December, the number of cases in South Africa was much lower than in countries like the United States (4,582 accumulated cases per 100,000) or Brazil (3,140 cases) (Figure 17.2.a). However, the country has most recently experienced a dramatic resurgence in cases, potentially in at least parts driven by the emergence of a new SARS CoV-2 variant, N501Y, that appears to be more transmittable. This means South Africa has now joined countries in the Northern hemisphere where the number of cases had stabilized but infection numbers exploded in recent months. Among countries with high HIV prevalence, the next-highest rates of Covid-19 cases were observed in Namibia (602 per 100,000, doubling time of 3 months in week ending December 8, 2020), Eswatini (602 per 100,000, doubling time of 9 months), and Botswana (513 per 100,000, doubling time of only 6 weeks). Additionally, the number of reported cases is escalating rapidly in Kenya (166 cases per 100,000 so far, doubling time of 3 months, Uganda (51 cases per 100,000, but doubling every 7 weeks and Zimbabwe (73 per 100,000, doubling in about two months).

1 Comparing Covid-19 case data across countries and over time is made difficult by the unequal access to SARS CoV-2 PCR testing technology, and by changes to testing policies and coverage between and within countries over time. This makes it especially difficult to compare case data between different low- and middle-income countries (LMICs), or between LMICs and high-income countries.

Figure 17.2: Cumulative number of Covid-19 cases, selected countries, April 1, 2020 to December 8, 2020 (per 100,000)

Figure 17.2.a: Five countries with high Covid-19 case counts

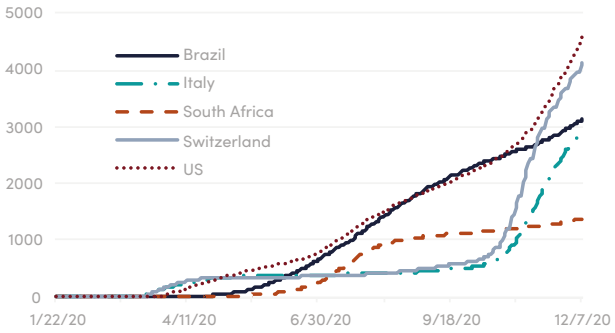
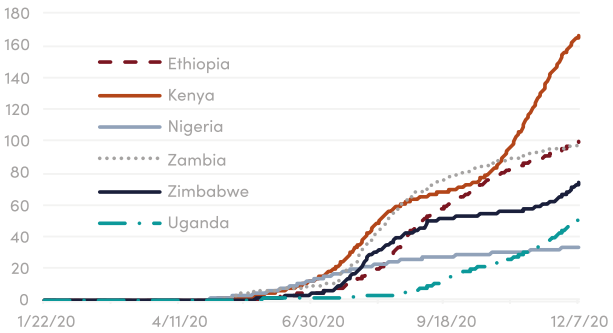


Figure 17.2.b: Six African countries



Source: CSSE/JHU (2020)

Interactions between HIV and Covid-19

Available data suggest that people living with HIV are not at greater risk of acquiring Covid-19. Boulle and others (2020), drawing on a sample of 22,308 public-sector patients with Covid-19 in South Africa (including 3,778 people living with HIV), find that HIV prevalence is slightly higher among patients diagnosed with Covid-19 than among patients not diagnosed with Covid-19 (18 percent vs. 16 percent). Data from the United Kingdom and the United States are less conclusive, because the number of people living with HIV in the sample is quite small, the data concern hospitalized patients only, and the data do not include a comparator group of patients without Covid-19. According to the most substantial study from the United Kingdom, 0.26 percent of hospitalized Covid-19 patients were HIV-positive (Geretti and others, 2020), about the same as the adult HIV prevalence of 0.23 percent (Public Health England, 2020). In New York, 0.8 percent of hospitalized patients were HIV-positive (Richardson and others, 2020), which compares to a local HIV prevalence of 1.3 percent. These comparisons between HIV-positive and other patients could be misleading, however, because serious cases of Covid-19 requiring hospitalization are concentrated in an age group (70+) where HIV prevalence is relatively low. The summary data from the three studies, which do not clearly differentiate by age, could therefore mask higher odds for people living with HIV of Covid-19 infection after controlling for age.

Emerging evidence suggests that HIV is a risk factor for the more severe forms of Covid-19 disease and death, irrespective of HIV treatment status. Boulle and others (2020) find that HIV increased the risk of mortality about two-fold when compared to HIV-negative cases (adjusted hazard ratio: 2.14; 95% confidence interval: 1.70; 2.70), and that this effect was observed whether or not people were receiving treatment or had suppressed HIV viral loads. Whilst the impact of HIV was much less than the impact of age and some other conditions such as diabetes, it was important among those under the age of 50, and was observed among Covid-19 patients in the South Africa's Western Cape province who were well cared for with interventions such as oxygen support. Based on a sample of 47,539 Covid-19 patients from the UK (115 HIV-positive, almost all of them receiving treatment), mortality among HIV-positive patients was 1.6 times higher than mortality among HIV-negative Covid-19 patients (Geretti and others, 2020). However, both studies do not control for higher underlying mortality among HIV patients, so the additional mortality among HIV patients caused by Covid-19 is smaller than the observed difference in mortality among HIV-positive and HIV-negative patients with Covid-19.

The population of sub-Saharan Africa is relatively young, a factor that may contribute to a lower prevalence of severe COVID-19 disease. One of the most important determinants of intersections between HIV and Covid-19 is the population share of PLHIV in the 60-70 age group. Indeed, the share of the population at ages 70+ for countries shown in Table 17.1 ranges from 1.1 percent to 3.2 percent, much lower than the corresponding shares in some countries highly affected by Covid-19, such as the United Kingdom (13.7 percent) or the United States (11.2 percent). The percentage of PLHIV who are aged 70+ is similarly low, also reflecting the maturity of the HIV epidemic, and of treatment scale-up for people living with HIV.

2 Global deaths from Covid-19 are concentrated in older age groups, from about age 60 or 70 (Verity and others, 2020). Since these older age groups also tend to be in poorer health, the age profile of deaths may reflect the higher prevalence of pre-existing conditions, such as hypertension and diabetes mellitus, that affect disease severity. Indeed, while mortality involving Covid-19 in March and April increased steeply with age in the UK, the share of deaths associated with Covid-19 in total was fairly stable, at about one-quarter from age 50, and a little lower, at 22 percent, at ages 40-49 (Office of National Statistics, 2020).

Table 17.1: Age, HIV status and living circumstances (selected countries)

	HIV prevalence, 15+	Share of population aged 70+	Share of PLWH, 70+ in total PLWH (15+)	Share of PLWH, 70+ in the total population (15+)	Share of PLWH who are not virally suppressed in all PLWH (15+)	Share of PLWH who are not virally suppressed in the total population (15+)	Share of population living in urban slums
Source	*(1), (3)*	*(2)*	*(2)*	*(2)*	*(1)*	*(1,3)*	*(4)*
Botswana	22.6	2.6	1.7	0.27	17.2	3.9	n.a.
Eswatini	26.8	2.6	1.8	0.32	18.0	4.8	7.6
Kenya	4.4	1.3	1.5	0.06	n.a.	n.a.	14.1
Lesotho	22.6	3.0	2.2	0.35	43.7	9.9	13.5
Malawi	8.9	1.6	2.1	0.13	28.1	2.5	10.8
Mozambique	11.7	1.7	1.2	0.08	n.a.	n.a.	27.2
Namibia	11.8	2.2	2.1	0.19	11.9	1.4	15.2
Nigeria	1.5	1.5	1.1	0.02	n.a.	n.a.	23.6
South Africa	17.7	3.2	2.0	0.24	45.8	8.1	14.8
Uganda	5.2	1.1	1.5	0.05	34.8	1.8	11.5
Tanzania	4.3	1.5	1.8	0.05	36.8	1.6	15.7
Zambia	11.5	1.2	1.6	0.11	41.7	4.8	22.3
Zimbabwe	14.1	1.8	1.7	0.15	n.a.	n.a.	8.2

Sources: (1) WHO (2020b), (2) World Bank (2020b), (3) Kavanagh and others (2020).

Many population groups vulnerable to HIV – including prisoners, migrants, and sex workers – are also at greater risk of acquiring Covid-19 and suffering worse outcomes. This is well documented for prison populations, considered a key population at risk of HIV and also one experiencing extremely high rates of infection with Covid-19, owing to overcrowding and poor sanitary conditions. In the United States, 7 of the 10 largest local clusters of Covid-19 occurred in prisons (New York Times, May 25, 2020), and this is likely to be more pronounced in countries where prison populations are housed more densely. For example, isolated prison outbreaks fuelled the early rise in cases in South Africa's Eastern Cape province (News24, May 19, 2020). Another population at high risk of both HIV and Covid-19 is migrants, owing (for Covid-19) to often dense living conditions and (for both) to suboptimal healthcare access. Sex workers, due to the nature of their work, are also at high risk of contracting Covid-19, but the principal impact for them may be economic, owing to lockdowns and reduced demand for their services.

According to evidence mostly from advanced countries, the impact of Covid-19 is distributed unevenly across the population, not only by age but also according to socioeconomic factors, some of which intersect with HIV risk factors. In Singapore, 88 percent of Covid-19 cases were recorded among migrant workers living in foreign-worker dormitories, which account for about 5 percent of the total population; this means that the incidence of Covid-19 among these migrant workers was 130 times higher than for the rest of the population (Koh, 2020). In the United Kingdom, age-standardized mortality owing to Covid-19 in the most deprived areas is 2.2 times higher than in the most affluent ones (ONS, 2020b), compared to a factor of 1.9 for all-cause mortality. This indicates that the impact of Covid-19 in part replicates existing inequities in health between socio-economic strata (e.g., by intersecting with pre-existing health conditions which are reflected in higher all-cause mortality), but it also exacerbates such inequities. The causes of these discrepancies by socio-economic categories are not yet well understood, and could reflect a combination of dense living conditions, inability to adopt social distancing at work or to take time off from work for quarantining, and health-related factors (e.g. prevalence of diabetes), as well as weaker health systems and poorer health care access in these areas.

The implications of this socio-economic gradient of Covid-19 for the economics of HIV are complex. Covid-19 disproportionately affects poorer households, and these households are more exposed to the macroeconomic consequences of Covid-19. In turn, Covid-19 is likely to magnify poverty-related HIV risks, both in terms of risk behaviour and the health prospects of people living with HIV; for example, food insecurity has been greatly exacerbated in countries such as South Africa (Spaull and others, 2020), and poor nutrition is a risk factor for HIV disease progression as well as for less access to effective care and treatment. However, while some aspects of the risk of contracting HIV are linked to economic disadvantage, the overall picture of the socio-economic gradient of HIV is not consistent across countries (e.g. HIV prevalence is higher in poorer populations in some countries, but lower in others).

Importantly, Covid-19 adversely impacts health care use by people living with HIV. For example, lapses in engagement in care or delayed initiation of treatment due to Covid-19 have been documented. In South Africa, the number of CD4 cell count tests (a marker for treatment initiation) declined by one-third during the most restrictive phase of the country's lockdown, and the number of viral load tests (a marker for engagement in care of people receiving treatment) declined by 22 percent over the same period (Mahdi and others, 2020). These developments (and even more pronounced drops in TB tests) likely reflect the difficulties in accessing treatment during lockdown, with reduced transport capacities, or concerns about the risk of Covid-19 infection when accessing health services. These estimates are consistent with recent household survey data from South Africa, according to which nearly 40 percent of respondents with a chronic condition (including but not only HIV) "could not access medicine, condoms or contraception" (Spaull and others, 2020).

A transformed health systems context

The absorption of health sector resources by Covid-19 exacerbates existing healthcare system capacity constraints in countries fighting both epidemics, and may result in less access to HIV treatment and prevention services due to a scarcity of both medical professionals and infrastructure. The current and impending demand for care and treatment for patients with Covid-19 poses immediate and longer-term challenges for the HIV response. In the short run, health-care staff and facilities cannot be expanded significantly, and increased demand in response to a health emergency may have to be met by re-allocating resources away from other health services such as HIV. Service disruptions in the area of HIV, in turn, have the potential to contribute to higher HIV incidence and thus a growing burden of HIV in the future.

The availability of human resources, including to treat Covid-19, in countries severely affected by HIV is often very limited (especially considering that they already experiencing the severe health shock of HIV) and is also highly uneven across countries (see Table 17.2). However, comparing per capita availability of doctors, nurses, and hospital beds across countries does not tell the full story. Effective care for patients suffering severe complications from Covid-19 requires intensive care and high-flow oxygen therapy, which are largely unavailable in countries facing severe HIV epidemics, apart from South Africa (Walker and others, 2020); in these countries, peaking Covid-19 epidemics have drastically reduced inpatient resources for other patients, including those living with HIV.

Emerging evidence suggests that Covid-19 and the disruptions associated with the response to it are already having an effect on the provision of services to people living with HIV. The World Health Organization (2020) reports that 36 countries (home to almost one-half of people living with HIV) reported some disruptions in the provision of antiretroviral treatment services between April and June 2020, and assessed that 73 countries were facing risks of service disruptions, reflecting factors including production shut-downs, capacity constraints such as health worker shortages, or restrictions of movement because of lockdowns.

In terms of testing for Covid-19 and tracing contacts – if enough test kits are indeed made available by manufacturers – countries facing severe HIV epidemics may be in a better position than otherwise similar countries, if community health assets used for HIV outreach and testing are utilized for Covid-19, and if testing draws on the same strengthened lab infrastructure used by (and often developed in support of) HIV programs. Programmes for dispensing medicines for chronic illness, developed in support of HIV programmes, can likewise help buffer the impact of Covid-19-related disruptions to HIV and other chronic care.

Two recent modelling studies suggest that disruptions in HIV treatment could increase AIDS-related mortality by about 50 percent if health systems are overwhelmed by an unfettered Covid-19 epidemic (Jewell and others (2020), Hogan and others (2020), the latter also addressing

Table 17.2: Indicators for health sector capacities (selected countries)

	Health expenditures per capita, 2017				Health sector capacity, latest available year			HIV tests
	Total	Government	External	Private	Physicians	Nurses and midwifes	Hospital beds	(Q4 2019)
Source	*(1)*				*(2)*			*(3)*
	(US$)				(per 1,000 population)			(% of population)
Botswana	466	353	45	69	0.37	3.30	1.8	1.5
Eswatini	225	114	53	57	0.08	2.00	2.1	n.a.
Lesotho	105	66	21	17	0.07	0.65	1.3	n.a.
Malawi	32	10	17	5	0.02	0.25	1.3	5.5
Mozambique	21	6	13	2	0.07	0.44	0.7	5.8
Namibia	447	206	18	223	0.37	2.78	2.7	n.a.
South Africa	499	268	10	222	0.91	3.52	2.8	12.3
Tanzania	34	15	11	8	0.04	0.41	0.7	2.4
Zambia	68	26	29	13	0.09	0.89	2.0	5.2
Zimbabwe	110	57	16	37	0.08	1.15	1.7	4.3
China	441	250	0	191	1.7	2.1	4.2	n.a.
Italy	2 840	2 099	0	741	4.1	5.9	3.4	n.a.
Spain	2 506	1 770	0	736	4.1	5.5	3.0	n.a.
United Kingdom	3 859	3 064	0	794	2.8	8.3	2.8	n.a.
United States	10 246	5 139	0	5 107	2.6	8.6	2.9	n.a.

Sources: (1) WHO (2020b), (2) World Bank (2020b), (3) Kavanagh and others (2020).

excess mortality from TB and malaria). According to these studies, effective suppression of Covid-19, by delaying and mitigating the peak in demand for Covid-19 health services, would also be effective in preventing many of the excess HIV deaths. In this sense, investments in controlling Covid-19 may positively contribute to the HIV response, and decisions regarding the allocation of financial resources between HIV, Covid-19, and other health challenges need to take into account such non-financial capacity constraints.

The consequences of Covid-19 for health care access for people living with HIV could result in increased HIV incidence, whether through reduced viral suppression as people living with HIV access treatment later, or because they are monitored less effectively and do not achieve or maintain viral suppression on treatment, or through disruptions to HIV prevention programs. Some of these disruptions may have small effects if they are of short duration (e.g. viral monitoring or interventions aimed at reinforcing HIV prevention awareness), others would have an immediate impact (e.g. disruption to mother-to-child-transmission programs, condom supplies, or delays in treatment initiation). One factor that is not well understood is the effect of physical distancing measures, which could lead to a reduction in risky sex (Jewell and others, 2020). While this could offset some of the negative effects of service disruptions on HIV incidence, it does not invalidate the concerns about the negative consequences of the service disruptions. An effective response to Covid-19 (and HIV) requires that these disruptions are mitigated by ensuring continuation of the most essential services and accelerating efforts to improve the effectiveness of treatment delivery (e.g. through differentiated care and multi-month dispensing of drugs).

A transformed economic and fiscal context

Covid-19 has caused arguably the deepest global recession since the Great Depression, although at this point most observers expect that it will be shorter. The IMF (2020) estimates that global GDP will contract by 4.4 percent in 2020, which represents a decline in economic growth by 7.2 percentage points (Table 17.4). Economic growth in advanced economies is projected to decline by 7.5 percentage points between 2019 and 2020, and in emerging markets and Covid-19 has caused arguably the deepest global recession since the Great Depression, although at this point most observers expect that it will be shorter. The IMF (2020) estimates that global GDP will contract by 4.4 percent in 2020, which represents a decline in economic growth by 7.2 percentage points (Table 0.4). Economic growth in advanced economies is projected to decline by 7.5 percentage points between 2019 and 2020, and in emerging markets and developing economies is projected to drop by about 7 percentage points. For 2021, the IMF projects a partial recovery, with global economic growth higher than before the recession, but not enough to make up for the contraction in 2020. These estimates primarily reflect the disruptions caused by lockdowns and their gradual easing. Looking ahead, it is plausible that global GDP will for many years remain lower than had been projected before the economic shock triggered by Covid-19 hit, to the extent that investment is delayed because of high uncertainty or displaced by the financial costs caused by Covid-19.

Decreased economic growth is also projected in countries facing severe HIV epidemics. In sub-Saharan Africa, for example, economic growth is projected to drop by about 6 percentage points (from 3.1 percent to -3.2 percent; see Table 17.3), and by 8 percentage points in South Africa, which also strongly impacts neighbouring economies (including countries with the highest HIV prevalence anywhere). Such estimates of GDP growth (at constant prices), though, understate the implications of the economic shock if the economic contraction is associated with a terms-of-trade shock or a depreciation of the currency. For example, for a country depending on oil exports, whatever the change in GDP at constant prices (including constant oil prices), the value of output in terms of purchasing goods and funding imports would drop steeply as the price of oil is projected to be over 40 percent lower in 2020 than in 2019, and government revenues would contract much more than GDP. This distinction is important – in Angola, dependent on oil exports, the value of GDP in US$ terms contracted by 30 percent in 2020, even though real GDP declined by only 4 percent. And in South Africa, Zambia, and Zimbabwe, GDP in US$ terms declined by about 20 percent or more (i.e., by much more than real GDP).

Table 17.3: Projected economic growth, selected countries, 2018-2021

	2018	2019	2020	2021
	(percent)	(percent)	(percent)	(percent)
World	3.6	2.9	-4.9	5.4
Advanced Economies	2.2	1.7	-8.0	4.8
Japan	0.3	0.7	-5.8	2.4
Germany	1.5	0.6	-7.8	5.4
United States	2.9	2.3	-8.0	4.5
United Kingdom	1.3	1.4	-10.2	6.3
Emerging Market and Developing Economies	4.5	3.7	-3.0	5.9
China	6.7	6.1	1.0	8.2
Sub-Saharan Africa	3.2	3.1	-3.2	3.4
Nigeria	1.9	2.2	-5.4	2.6
South Africa	0.8	0.2	-8.0	3.5

Sources: IMF (2020b).

These economic projections are subject to extreme uncertainty, arising especially from the spread of the pandemic, the pace and the effectiveness of vaccination campaigns, and the nature of its unprecedented economic shock are the key factors underlying the economic uncertainty. For example, in the United States, the number of Covid-19 cases doubled in just two months between October 8 (just before the latest IMF WEO projections were published) and December 8, which necessitated new restrictions on economic activity. This an escalation likely invalidates the IMF's assumption of a gradual recovery in one of the world's biggest economies through the second half of 2020 as the epidemic is gradually brought under control. As vaccinations are just beginning to be rolled out, there is little experience at this time on their long-term effectiveness and especially on the duration of protection they offer. The other source of uncertainty is the nature of the economic shock, which on this global scale is unprecedented. In particular, the impact of ongoing restrictions on the global economy through disruptions in trade, travel, and production chains, and the speed at which economies could recover once those restrictions are lifted, are not well understood.

This era of severe macroeconomic uncertainty has several important consequences for HIV policy and planning. First, an uncertain outlook means that the focus of policymakers is more strongly oriented towards the short term. Existing HIV analytical tools and policies that may rely on time horizons extending over a decade or more become less persuasive. Second, planning for an HIV policy that is financially sustainable becomes much more challenging, given the uncertainty around the availability of domestic public and external financing. This is especially detrimental to countries that have been trying to increase domestic financing for HIV.

In addition to the economic contraction, Covid-19 is resulting in reduced government revenue and increased government expenditures, and consequently increased fiscal deficits. Across sub-Saharan Africa, government revenues are projected to decline by US$ 53 billion (IMF (2020), and by 2.0 percentage points relative to GDP (from an average of 17.1 percent of GDP in 2019 to 15.1 percent of GDP in 2020). These declines are very substantial, meaning that revenues drop by 18 percent in US$ terms, and by 12 percent relative to (and on top of the decline in) GDP. This loss in government revenue, however, is distributed unevenly. Exporters of oil and other commodities, and countries dependent on tourism, are particularly severely affected.

The value of fiscal measures announced so far in response to Covid-19 amounts to about US$ 11.7 trillion globally, or 12 percent of global GDP (IMF, 2020b). Of these, about one-half reflect additional spending or tax breaks, while the other half represents liquidity support to companies in the form of loans and guarantees. In most countries, expenditures on health-related measures are dwarfed by "other" expenditure and foregone revenue, which includes measures of income support to households, grants to businesses, and broad measures to stimulate the economy such as tax cuts (Table 17.4).

While there is large variation in the value of fiscal measures across countries, there are also important systematic differences between countries at different levels of economic development. First, the fiscal response in terms of expenditure and foregone revenue is much stronger in advanced economies (8.4 percent of GDP) than in emerging markets (3.9 percent of GDP) or in low-income developing countries (1.6 percent of GDP). Second, non-health spending dominates across all countries but plays a relatively smaller role in low-income countries (about 80 percent of the total value of expenditure and foregone revenue) than in middle- or high-income countries (about 90 percent, respectively). The most pronounced differences across countries, though, occur with respect to equity injections, loans, and guarantees, which amount to 9.7 percent of GDP in advanced economies but only 2.2 percent of GDP in emerging markets, and 0.3 percent of GDP in low-income countries.

Table 17.4: Fiscal costs of Covid-19 response, selected countries

	Expenditure and foregone revenue			Equity, loans & guarantees
	Total	Health	Other	
	(percent of GDP)			
37 Advanced Economies	8.4	0.8	7.6	9.7
Germany	8.3	0.7	7.7	30.8
Japan	11.3	1.0	10.3	23.7
United Kingdom	9.2	1.5	7.6	16.6
United States	11.8	1.5	10.3	2.5

Table 17.4: Fiscal costs of Covid-19 response, selected countries *(continued)*

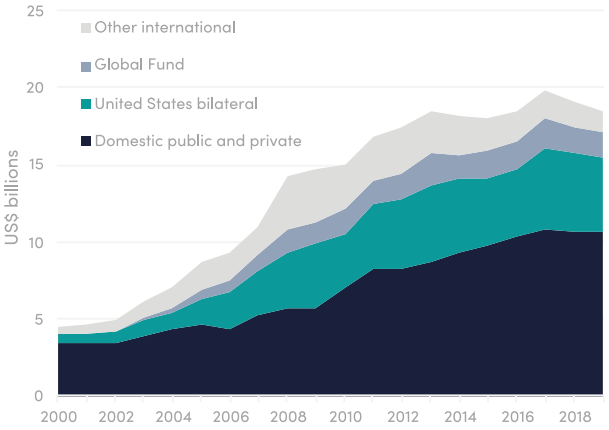
	Expenditure and foregone revenue			Equity, loans & guarantees
	Total	Health	Other	
	(percent of GDP)			
87 Emerging Markets	3.9	0.3	3.4	2.2
China	4.6	0.1	4.5	1.3
Eswatini	2.8	0.4	2.5	n.a.
Namibia	1.1	0.6	0.6	1.3
South Africa	5.3	0.4	4.9	4.3
56 Low-Income Developing Countries	1.6	0.3	1.3	0.3
Democratic Republic of the Congo	1.1	0.2	0.9	n.a.
Ethiopia	1.5	0.5	1.0	0.6
Malawi	0.2	0.2	0.0	n.a.
Mozambique	4.8	0.8	4.0	n.a.
Nigeria	1.5	0.3	1.2	n.a.
Zambia	2.1	0.3	1.8	0.3
Zimbabwe	4.8	0.1	4.7	n.a.

Sources: IMF (2020b), using IMF country classifications.

Domestic and global HIV financing

As of 2019, US$ 18.6 billion was being spent on HIV in low- and middle-income countries, of which domestic financing accounted for 57 percent (UNAIDS, 2020). Global HIV spending has broadly stagnated in nominal (US$) terms since 2013 (apart from a peak attained in 2017). The share of domestic funding has gradually increased over the last years, and by 10 percentage points between 2013 (when it stood at 47 percent) and 2019 (Figure 17.3). Over this period, funding from the US government and through the Global Fund was broadly stable in nominal terms, but direct contributions from other international sources (mainly direct bilateral support for HIV programs) declined by nearly one-half. In relation to economic capacities (and taking into account the appreciation of the US$ over this period), the funding trends are consistent with a declining emphasis on financing of the global HIV response both in the United States (the nominally constant contributions mask a decline of about 20 percent relative to US GDP between 2013 and 2019) and other donor countries.

Figure 17.3: Resources for HIV across low- and middle income countries by funding source, 2000-2019



Source: UNAIDS, accessed online on July 26, 2020 at http://hivfinancial.unaids.org/hivfinancialdashboards.htm

These global aggregates, however, mask important differences in the role of domestic financing of HIV programs across regions and countries. Regionally, much of the increase in domestic financing took place in Latin America (accounting for about one-half of the global increase), whereas in Eastern and Southern Africa total spending, and the contributions from different sources, were broadly stable in 2013–2019. As is well known, contributions from external sources and domestic resources, respectively, differ greatly among countries, with external resources accounting for around 90 percent or more of HIV spending in some low-income countries (Table 17.5). For countries with higher GDP per capita, this share gradually declines. In this regard, external support for HIV programs resembles development assistance for health, or development assistance overall. However, HIV stands out, as the role of external funding tends to be larger than for health financing overall, especially for middle-income countries.

Table 17.5: HIV financing: contribution of domestic financing varies across countries

Country	PLWH	HIV prevalence	GDP per capita	HIV spending		
				per capita	per PLWH	Domestic financing
	Millions, 2019	%, ages 15–49, 2019	US$, 2019	US$, 2017	US$, 2017	% of total, 2017
Brazil	0.899	0.5	8 751	8	1 840	99.7
Kenya	1.560	4.7	2 004	18	553	50.5
Malawi	1.049	9.2	378	17	302	14.8
Mozambique	2.185	12.6	488	12	163	7.7
Nigeria	1.909	1.5	2 230	2	233	37.5
South Africa	7.740	20.4	5 978	38	290	80.1
Tanzania	1.555	4.6	1 080	9	283	11.4
Uganda	1.388	5.7	916	11	279	17.4
Zambia	1.241	11.3	1 318	18	250	14.1
Zimbabwe	1.305	12.7	1 254	17	177	30.0

Source: UNAIDS (2020b), IMF (2020), and IHME (2020)

Taking into account the different configurations in terms of countries' reliance on domestic and external financing, and evidence and projections on the macroeconomic and fiscal consequences of Covid-19, there are a number of consequences for the sustainable financing of HIV programs:

Covid-19 will reduce the amount of resources available for both domestic and donor governments to spend on HIV. This is predominantly a consequence of the macroeconomic repercussions of Covid-19 rather than the financial resources absorbed by the health-sector response, as the latter typically accounts for only about one-tenth of the fiscal costs of Covid-19 in low- and middle-income countries, and about one-fifth in developing countries. Thus, the principal determinant of resource availability is the depth of the macroeconomic shock, and its fiscal consequences in terms of lost revenues and government spending on mitigating the fallout from this shock on enterprises and individuals. This suggests that two types of countries are particularly exposed to shortfalls in HIV financing:

- Countries relying predominantly on donor financing. Donor countries have generally experienced a steeper fiscal impact. The United States, the main source of external HIV funding, is experiencing a deteriorating and highly unpredictable fiscal situation.
- Countries experiencing steep declines in government revenues as a consequence of a negative terms-of-trade shock. For example, oil exporters such as Nigeria are suffering from the decline in oil prices triggered by the global economic impact of Covid-19, while countries depending on revenues from tourism have been impacted by the large-scale international travel bans.

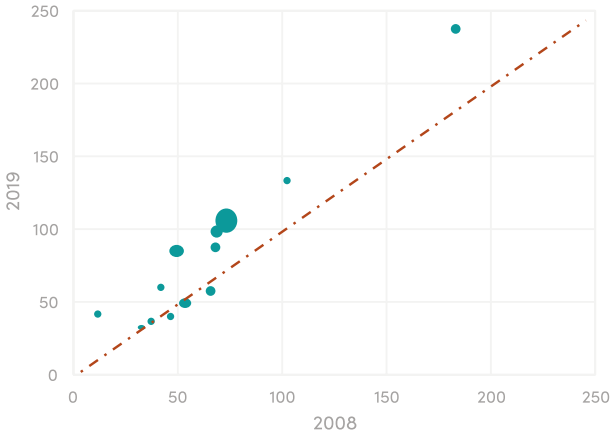
Over the longer term, the fiscal measures in response to Covid-19, and the resulting higher fiscal deficits, will constrain fiscal space through an accumulation in public debt. The relevance of this aspect can be gauged by comparison with the consequences of the global financial crisis of 2008-09. That crisis also resulted in steep increases in fiscal deficits, of the same order of magnitude as the estimated emerging impacts of Covid-19 though typically somewhat smaller, and more concentrated in advanced economies. Advanced economies are especially exposed because many of them rely extensively on loans and guarantees to stabilize businesses affected by Covid-19. This is not included in fiscal deficits so far, but it represents a contingent liability – if the crisis persists some of these loans may have to be written off, and guarantees be called, adding substantially to the fiscal deficits recorded so far.

This build-up in debt could be very significant and sustained, judging from the experience of the 2007-08 global financial crisis; HIV donor countries are in a much worse position to manage the consequences of an economic shock than they were in 2008. For example, in countries like the United States and the United Kingdom, public debt increased by about 40 percentage points of GDP during the financial crisis and its aftermath, and has not come down from this level. Overall, the level of public debt in principal HIV donor countries (13 countries identified by Kates, Wexler, and Lief (2020), accounting for 98.1 percent of all disbursement of external HIV funding in 2019) has increased from 72 percent of GDP to 101 percent of GDP (weighted average, applying the disbursements made in 2019 as weights), or from 65 percent of GDP to 86 percent of GDP if the United States are excluded (Figure 17.4.a).

Public debt in countries facing a high HIV burden has doubled between 2008 and 2019, from 29 percent of GDP to 58 percent of GDP (average weighted by number of people living with HIV in each country, covering all countries with HIV prevalence of at least 1 percent) (Figure 17.4.b). This increase occurred gradually and was mostly unconnected to the 2008-09 financial crisis (which affected most strongly and directly high-income countries). As a consequence of this build-up in public debt, countries facing a high HIV burden are now in a worse position to manage the economic shock through expansionary fiscal policy, and to isolate priority expenditures like health spending or HIV programs from the economic disruptions.

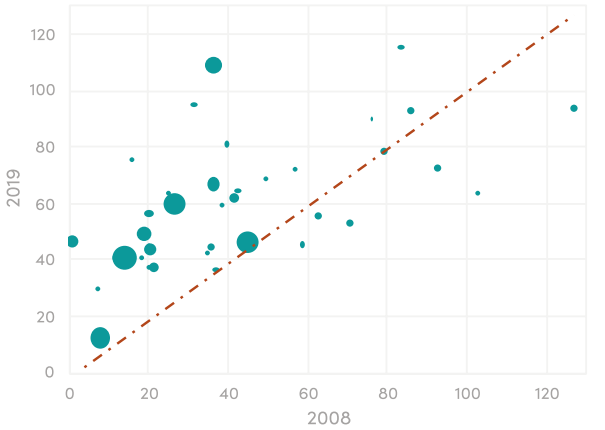
Figure 17.4: Gross public debt, selected countries, 2008 and 2019

Figure 17.4.a: Gross public debt in donor countries supporting HIV programs (percent of GDP)



Source: IMF (2020) for public debt. Bubble size increases (less than proportionally) with size of disbursements in 2018.

Figure 17.4.b: Gross public debt in countries with HIV prevalence (ages 15-49) exceeding 1 percent (percent of GDP)



Source: IMF (2020) for public debt. Bubble size is proportional to HIV prevalence in 2019 (source: UNAIDS, 2020b).

The capability of many governments in countries with high HIV prevalence to respond to Covid-19 is compromised by limited access to financial markets. Capital has been flowing out of emerging markets and developing economies since the global spread of Covid-19 and its potential economic consequences have become apparent. For example, capital outflows from sub-Saharan Africa amounted to US$ 5 billion in February to May 2020 (IMF, 2020c), followed by a modest rebound (an inflow of US$ 1.3 billion in June to September). Additionally, private

remittances – which normally increase when a developing country experiences a crisis – are projected to drop by 20 percent (IMF, 2020c). Interest rates have increased by up to 1,000 basis points (10 percentage points) for bonds issued by governments in sub-Saharan Africa, much higher than during the global financial crisis, and remain higher than before the onset of Covid-19 by about 4 percentage points (IMF, 2020c). These high costs of borrowing add to the strain on public finances when existing debt needs to be repaid or refinanced at a higher interest rate, and compromise the government's capability to manage the revenue shortfalls and acute expenditure needs as a consequence of Covid-19.

Where governments are shut out of financial markets, or face very high borrowing costs, international financial institutions like the International Monetary Fund (IMF) or the World Bank may fill the gap. The IMF so far has released financial assistance amounting to US$ 83 billion to buffer the impact of Covid-19. In countries facing a high HIV burden, these loans so far typically amounted to between 1 and 2 percent of GDP (but spread over several years, so the annual contribution is smaller), e.g. in Malawi (1.2 percent of GDP), Mozambique (2.0 percent of GDP), Rwanda (2.2 percent of GDP), and Uganda (1.6 percent of GDP), and Kenya (exceptionally, 8 percent of GDP). The World Bank (2020) has pledged US$ 160 billion to help developing countries manage the consequences of Covid-19. The first round of support from the World Bank under this umbrella, though, was relatively small (total of US$ 1.9 billion, distributed over 25 countries), focusing on funding immediate needs of the Covid-19 response. Overall, these loans or grants appear to cover only a small proportion of the size of the fiscal shock caused by Covid-19, which means that countries' HIV responses could face acute competing demands and pressures for expenditure cuts across low- and middle-income countries.

Discussion

Covid-19 poses immense challenges for countries facing severe HIV epidemics. This applies in particular to Southern Africa, where Covid-19 infections have been taking off in countries which are also facing the highest rates of HIV prevalence globally. With low health-sector capacities that are already coping with a severe idiosyncratic health shock wrought by HIV, and emerging evidence that Covid-19 is already compromising access to effective care by HIV patients, it is likely that an escalation of Covid-19 will result in disruptions of HIV prevention and treatment services.

The consequences of Covid-19 for HIV policies fall into two categories. First, the economic outlook has deteriorated sharply, so that prior expectations on resource availability for HIV programs may not play out. Second, Covid-19 – by disrupting service delivery or absorbing specific health sector resources – poses direct challenges to the continuity or scaling up of HIV services.

Covid-19 has triggered arguably the steepest global recession since (though much smaller than) the Great Depression starting in 1929. One immediate consequence of the economic crisis and its fiscal repercussions is the fact that there is less funding available for HIV or any other purpose. This will test assumptions about what constitutes politically and financially sustainable HIV programming.

Beyond the current financial pressures owing to reduced fiscal revenues and increased expenditure needs, the economic crisis caused by Covid-19 means that there will be less funding available over the coming years as well. In part this is because the economic recovery may be slower than anticipated, especially for the United States, which is currently experiencing an escalation of Covid-19, and which of course is the biggest funder of the global HIV response. The other reason is that current spending needs are partly met by increased borrowing, resulting in increased public debt. It is possible that the consequences of this build-up in debt will be more severe than following the global financial crisis of 2008-09, because major donors and most developing countries start with a level of public debt that is much higher than before the global financial crisis.

A third factor that may limit availability of funding for HIV programs is the increased uncertainty. While observers agree that the current recession will be of much shorter duration, the possibility of second and onward waves of Covid-19, the resulting need to impose new restrictions on economic activities and movement, and the lack of experience in addressing such a joint health and economic crisis, introduce tremendous uncertainty to the economic picture. This creates a challenge for HIV policy planning and advocacy. HIV is a chronic disease, and the consequences of current HIV policies, in terms of providing effective HIV prevention and treatment, are spread over decades. The pressing and acute economic and health concerns linked with Covid-19 could affect the time horizons relevant for policymaking, rendering investment cases built around longer-term strategies (e.g. towards "ending AIDS") less persuasive.

For service delivery, there are immediate challenges to HIV programs arising from disruptions both in accessing available services by people living with HIV (e.g. because of concerns about visiting health centres, or transport disruptions) and the delivery of services (e.g. through disruptions to supply chains, or resource constraints). The potential consequences of disruptions in HIV services have been illustrated by several modelling studies suggesting that HIV mortality could increase by one-half if health systems are overwhelmed by an unfettered Covid-19 epidemic (Jewell and others (2020), Hogan and others (2020)). In the longer run, such disruptions have the potential to slow down progress in controlling HIV and towards "ending AIDS" (notwithstanding any short-term gains which may arise through social distancing during lockdowns).

In the immediate term, strategies to mitigate such disruptions include measures to accelerate transitions to HIV service delivery modalities that economize on human resources (e.g. extending drug dispensation cycles for stable patients), and dedicated funding to overcome specific bottlenecks which have a high potential for disrupting services (e.g. distribution of drugs and others medical supplies).

Over the coming years, much will depend on the course of the Covid-19 pandemic, the speed of the economic recovery, and the depth of the lingering fiscal consequences (e.g. through a build-up in debt). Much of this is speculation at this stage, but there are a few lessons so far on how these challenges may be approached. Where established narratives on HIV control are no longer politically or financially feasible, these will have to be adapted, while preserving gains and momentum towards "ending AIDS" as much as possible. More generally, it may be necessary for policy discourse to take a non-HIV-specific but health systems perspective (or an even wider one, incorporating economic repercussions), as financial and health sector capacities on HIV are in part shaped by the effectiveness of efforts to control Covid-19, and because Covid-19 may have disproportionate consequences for people living with HIV. Consequently, where countries face a dual challenge of a severe HIV epidemic and a large impending Covid-19 shock, joint planning and effective resource prioritization will be important, protecting essential health services through effective suppression of Covid-19 while effectively prioritising HIV and other health services to enable the Covid-19 response.

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ECONOMIC IMPACT OF HIV

AN OVERVIEW OF GAPS IN CURRENT RESEARCH

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BACKGROUND TO RESEARCH GAPS REPORT

The *Economic Impact of HIV* project aimed at not only reviewing the available evidence on the economic impact of HIV but also, while doing so, taking stock of gaps in this evidence, with an aim of informing future research in this area. This report summarises our findings regarding this aspect- in other words, on the evidence that is still missing. The report starts with an overview of how the role of economic analysis has changed as both the HIV epidemic and the response to it have changed over the last decades (Section I), then summarises main research themes and the gaps in current research in the areas of HIV programming (Section II), the macro-economic impacts of HIV (Section III), a fiscal perspective on HIV (Section IV), and a health-sector perspective (Section V).

In each section, outstanding research questions are highlighted in bold.

Finally, we summarise all research gaps and suggest methodologies for specific studies to close these gaps in the evidence in a Table.

I.
THE ROLE OF ECONOMIC ANALYSIS AS HIV AND HIV RESPONSE CHANGE

The shape of the HIV pandemic – in terms of the transmission dynamics, the population groups most affected, and the health consequences – has changed drastically over the last decades. These developments are predominantly a consequence of the scaling-up of the HIV response and especially of universal access to HIV treatment (Policy brief #1). This has resulted in reduced mortality among people living with HIV (Policy brief #2), and contributed to declining HIV incidence. However, due to opposing effects of increased survival and reduced incidence, the number of people living with HIV has often changed only little. Moreover, increased survival and reduced HIV incidence contribute to an ageing of the population living with HIV, the health needs of whom are changing accordingly (Policy brief #3).

These developments have implications for the economic costs and consequences of HIV, and the contribution of economic analysis for motivating investments in HIV and refining the HIV response. The focus has shifted from preventing imminent deaths and averting severe economic disruptions to improving health outcomes among people living with HIV (further), shifting the trajectory of the epidemic on a path towards "ending AIDS," and improving the effectiveness and cost-effectiveness of the HIV response (Policy brief #16) contemporaneously (technical and allocative efficiency) and over time (returns to investment).

The interplay between the shape and perception of the HIV pandemic on the one hand, and economic approaches to framing and supporting HIV policies on the other hand, is apparent across different phases of the HIV response. The "tipping point" in the global perception of HIV around 2000 – which saw AIDS elevated "to levels at which no health issue has ever been discussed before" (Piot, 2012) – was supported by mounting evidence on the appalling socio-economic consequences of AIDS. In this phase, HIV was framed not only as "one of the most formidable challenges to human life and dignity," but also one "which undermines social and economic development throughout the world" (United Nations General Assembly, 2001).

Economic analysis, however, played a subordinate role at this time as the evidence was only emerging, and the fundamental concerns – regarding HIV threating economic development, its devastating economic consequences, and the dramatic situation especially in sub-Saharan Africa (United Nations General Assembly,

2001) – were valid in their own right and did not call for a finely calibrated economic evaluation.

The situation changed over the next decade, in part as a consequence of the global effort to fight HIV/AIDS. The scaling-up of treatment contributed to a steep decline in the number of AIDS deaths (from 1.9 million at the peak in 2005 to 1.3 million in 2010, see Policy brief #1 and UNAIDS (2021)), and the more negative scenarios regarding possible macroeconomic effects did not play out (Policy brief #7). At the same time, the HIV response became an important and recurrent component of global health financing, with annual spending of US$ 15.1 billion across low- and middle-income countries, split roughly evenly between domestic resources and external support (Ávila, Loncar, Amico, and De Lay, 2013). HIV had thus become a dominant aspect of health overseas development aid (ODA), accounting for 41 percent of ODA in the areas of health and population policies, and an important component of ODA overall (5 percent of total; OECD (2022)). Because external assistance was concentrated on less developed countries with low domestic resources, domestic HIV spending in the most heavily affected countries only very rarely exceeded 0.3 percent of GDP (Haacker, 2016). This, however, often amounted to a significant share of public health spending.

A second important development was the global financial crisis of 2008/09, which had lasting consequences for fiscal space in high-income countries and thus resulted in increased scrutiny of ODA (and any other) budgets. While causality is difficult to establish, the global financial crisis also coincided with a shift in HIV financing. Between 2000 and 2008, the bulk of increases in HIV financing across low- and middle-income countries came from external funders. Since 2008, however, external funding has stagnated (in real terms), and has declined relative to GDP of advanced economies. Meanwhile, contributions from domestic public resources nearly doubled and now account for more than 60 percent of funding across low- and middle-income countries (Policy brief #14).

For the global HIV response, this means that there is greater scrutiny and accountability on the effectiveness and cost-effectiveness of the HIV response, in relation to other health investments but also – considering that external HIV financing usually comes from ODA budgets and domestic HIV funding involves trade-offs with other sectors through the budget envelope – across objectives of the national development agenda (Policy brief #12). One influential approach which aimed to address these challenges is the UNAIDS investment framework (Schwartländer and others, 2011), which responds to these challenges in several ways: (1) Framing HIV spending as investment, thus emphasizing the lasting benefits (or "returns") and placing HIV alongside other investments and contributors to economic developments; (2) emphasising on economic returns in addition to health gains, e.g., by emphasising the financial savings that can be achieved by effective HIV prevention. Another influential effort at the same time – associated with the Global Fund's [year] investment case and frequently replicated in global health since then – involves estimating the production gains resulting from longer survival and improved health of people living with HIV (Resch and others, 2011, see Policy briefs #3, #6, and #7)). While not focusing on HIV, the report of the Lancet Commission on Investing in Health (Jamison and others, 2013) also contributed to developing this perspective, and emphasised the economic value of health gains per se as contributor to the returns to investment (Policy brief #2).

Assessing recent and ongoing changes in the role of economic analysis is a tad more difficult, without the benefit of hindsight, especially as the simultaneous health and economic crises caused by Covid-19 are playing out. Owing to the high fiscal costs of managing the economic fall-out of Covid-19 in advanced economies, it is plausible that there will be even more scrutiny on ODA budgets and any other forms of public expenditures – similar to the period following the global financial crisis of 2008/09. The situation on health spending, though, is somewhat different, as the impact of Covid-19 has driven home the consequences of underinvesting in health sector capacities for health and economic security.

At the same time, there are longer-term developments related to the changing shape of the HIV epidemic and the response to it. The success in extending access to treatment in most countries has two distinct consequences. First, for most of the populations living with HIV, extending treatment coverage further means initiating treatment somewhat earlier, which leads to improvements in long-term survival and realizing prevention gains through viral suppression but has less immediate health benefits for the individual (Policy brief #2). This means that arguments for HIV investments based on economic returns (which largely rely on increased survival) have become much less forceful, while HIV poses similar long-term health systems and health financing challenges as other chronic diseases (Atun and Bataringaya, 2011). Second, aggregate high treatment coverage rates may mask sub-populations without adequate access to treatment, for HIV-specific

reasons (e.g., stigma) and/or because they lack adequate access to health services overall. For these populations, extending access to HIV services remains a pressing concern, but effective approaches need to be tailored to the relevant barriers.

Much of the discussion so far – and throughout this document – focuses on the global picture and general lessons from the experience of HIV and the HIV response. However, countries differ in terms of the maturity and transmission patterns governing their HIV epidemics, their health systems and barriers in access to health and HIV services, their financial resources, and the contribution of domestic and external sources to the financing of their HIV programmes. Meanwhile, the role and presumably influence of global funders has been waning, and HIV often has evolved from an acute and pressing health challenge into a stable epidemic and a cause of chronic disease. As a consequence, HIV policies are increasingly embedded and subordinated in national health strategies. For example, South Africa has developed an integrated strategy on HIV, TB, and sexually transmitted diseases (SANAC, 2011), and Botswana has merged aspects of its HIV and NCD control programmes. At the same time, the transitions in funding have contributed to increased integration of HIV services and other health services (Brief #12), with generally positive results (Bulstra and others, 2021), and this trend is likely to be reinforced as the populations living with HIV are aging (Haacker, Bärnighausen, and Atun, 2019).

II.
RESEARCH CHALLENGES POSED BY A CHANGING HIV EPIDEMIC

The evolving HIV epidemic does fundamentally change the role of economic analysis. It also poses new policy challenges and creates new research needs in support of these challenges. Most of these new challenges are connected to the scaling-up of HIV services which has occurred so far (Policy brief #1). Following rapid success in scaling up treatment and other HIV services, the focus is shifting to populations which so far have been underserved. Increased survival means that people living with HIV live longer and get older, and their health needs change accordingly (Policy brief #2). Moreover, in countries with high HIV prevalence, these changes have significant demographic implications.

The success of efforts to extend access to HIV services is predominantly measured by national-level indicators like treatment coverage or along the cascade of care from HIV infection to diagnosis, treatment initiation, and effective viral suppression. Underneath these indicators, the **understanding of gaps in service coverage** remains weak (Policy briefs #8 and #9). For many countries, there is limited evidence on service coverage among key populations, with programme analyses relying on small sample surveys and infrequently collected data- which for some sub-populations reflects barriers in access related to stigma or criminalization.) And national household surveys like Demographic and Health Surveys (if they include an HIV module) offer a wealth of data on the socio-economic gradient of HIV, but only little data on prevention service access (typical through questions on HIV awareness) and no data on barriers to treatment access.

These data challenges are not new. The scaling-up of HIV services, and specifically of treatment, has however changed the picture. When access to treatment is low and extending both treatment and testing prevents imminent death, increased treatment and testing coverage is an obvious indicator of progress. At higher coverage rates, the usefulness of treatment-based indicators is compromised. If access to treatment is uneven, then populations where people living with HIV normally receive treatment early and have near-normal life expectancy and populations where AIDS-related mortality remains high coexist. Under these circumstances, the ***distribution* of treatment access and of additional gains in extending access** matters for programme effectiveness in terms of lives saved, but also to assess how effective the HIV programme is in terms of supporting broader health policy goals like improving health equity and progress on universal health coverage (Policy briefs #8 and #9).

There is however very **limited data on sub-national differences in treatment coverage.** Sub-national regional estimates from Kenya suggest that while

national adult treatment coverage was 75 percent in 2017, regional coverage rates ranged from 23 percent to close to 100 percent (Ministry of Health (of Kenya), 2018). In Nigeria national treatment coverage was estimated at 89 percent in 2020 but differed between 33 percent and close to 100 percent by state (UNAIDS, 2021). These estimates document that sub-national differences in treatment coverage can be an important part of the picture and that reliance on national aggregates obscures the understanding of program effectiveness and health equity implications.

These ambiguities in interpreting national-level coverage rates are compounded by the fact that coverage rates are weak indicators of treatment access. One reason is attrition bias, which arises from the fact that people not receiving treatment are more likely to die, and cross-sectional coverage rates therefore tend to overstate the odds of progressing to treatment. Second, some of the ongoing increases in treatment coverage reflect low mortality among people on treatment, without progress in getting people on treatment more effectively and earlier. For these reasons, cross-sectional differences in treatment coverage rates (as in the illustration on Kenya and Nigeria) tend to understate **gaps in effective access to treatment.**

Addressing research gaps in effective treatment first requires more comprehensive analysis of routine data including viral suppression, not just treatment initiation and retention, and validating such clinical data against population level HIV trends. Assessing gaps in service coverage would first require larger surveys sampled and designed to capture sub-populations by age, sex, geography, risk, and socio-economic factors. Where such data remain unavailable, some insights can be drawn from increasingly available sub-national estimates on the state of HIV and access to treatment.

Estimating attrition bias requires longitudinal data which capture treatment coverage as well as HIV diagnosis, transition to treatment, and of course deaths. These data are essentially unavailable, in their absence some insights can be gained from vital statistics from countries with HIV prevalence where trends in mortality can be attributed to changes in the state of HIV and treatment access, and dedicated as well as opportunistic (using established HIV models) modeling

The second major evidence gap arises with regard to **underserved populations who carry a disproportionate HIV burden** (Long and others, 2021). Concentrated sub-epidemics exist even in countries where the HIV epidemic is classified as generalized, and – against the backdrop of increased treatment coverage and often declining HIV incidence overall, the role of these sub-epidemics is changing, and understanding HIV transmission among populations who carry a disproportionate HIV burden is crucial for reaching a sustainable path towards "ending AIDS." However, effective outreach and targeting is compromised not only by stigma and other barriers, but also by lack of reliable data on the size of and transmission patterns among these sub-populations (Policy brief #9). **On this issue of data availability, there is no obvious fix – challenges of access are linked closely to the status of key population-, although intentional oversampling of these population groups in surveys of risk and service coverage might be a first step.**

The third major research challenge in connection with the changing shape of the epidemic arises from the survival effects of increased access to treatment, and the resulting aging of the population living with HIV. This aging has consequences for the health needs of the population living with HIV which are in part well-researched and predictable. Because the prevalence of important NCDs, including diabetes, cardiovascular disease, and cancer, increases with age, the aging of the population living with HIV means that the prevalence of NCDs in this population will increase, and people living with HIV increasingly suffer from multi-morbidities.

Beyond this age link, which applies to the general population as well as to people living with HIV, there are important unresolved questions. One is the **contribution of HIV and a history of long-term treatment for HIV to the incidence of NCDs**. Some evidence suggests that HIV has been a contributing factor to the increase in diabetes and cardiovascular disease in LMIC (see Haacker, Bärnighausen, and Atun (2019) for an overview). There is, however, considerable uncertainty around the relevance and magnitude of such estimates in the context of the population-level scaling-up of treatment, the role of different types of treatment, and the extent to which treatment could be adapted to mitigate such effects of HIV and long-term treatment on the occurrence of NCDs.

The growing prevalence of NCD multi-morbidities among people living with HIV leads up to the challenge of effective care. Much of the current drive towards improving effectiveness and cost-effectiveness of HIV services is about standardising and simplifying treatment for stable patients. In contrast, increasing age-related NCDs and the presence of multi-morbidities require a more individualised approach and some measure

of **integration of HIV and NCD services.** On this, there is no established template at present, as most of the experience on the integration of HIV services with other health services regards other areas (Bulstra and others, 2021; the only NCD-themed study on integration with HIV services identified in this review regards screening for NCD, but not treatment (Golovany and others, 2018)).

This is an area where conventional medical and health economic studies on HIV-NCD interactions and the implementation of effective service delivery to people living with HIV, those affected by NCDs, and the intersecting group affected by both HIV and (sometimes multiple) NCDs, are effective. However, an effective response relies on continuously building and synthesizing the empirical evidence across low- and middle-income countries.

In countries with high HIV prevalence, the increased survival of people living with HIV has important demographic consequences. The HIV epidemic plays out against a backdrop of **demographic transition and general population aging** – though with considerable differences across countries in the stage of the demographic transition. Against this backdrop, HIV initially slowed the growth of the old population as most people who contracted HIV did not reach old age. As cohorts who have benefitted from comprehensive access to treatment and, as a result, have suffered much less AIDS-related mortality reach old age, this slowdown is reversed and the HIV becomes a factor that increases the growth of the old population (see Haacker, Bärnighausen, and Atun (2019) on Botswana; and Policy brief #3 for overview). For countries with high HIV prevalence, the **increase in HIV/NCD co-morbidities** thus will coincide with **increased growth of the demand for age-related NCD services overall, the health systems and fiscal implications of which are not fully understood yet.**

Research challenges on this twin health systems burden to some extent coincide with the agenda on the intersection of HIV and NCD on the patient level or at the point of delivery, but understanding and responding to the growing health system burden requires additional modeling – taking in the stage of the demographic transition, the age and scale of the HIV epidemic, and the timing and scale of the scaling-up of treatment.

III. ECONOMIC IMPACTS OF HIV

The global response to HIV was in part motivated by concerns about the devastating economic impacts of HIV, brought about by (at least in modern times) unprecedented high mortality among young adults and the disruptions this causes to households, the economy, and society. Broadly speaking, these negative economic effects have not materialized. Countries with high HIV prevalence have not experienced markedly lower rates of economic growth (Policy brief #7), and poverty has not increased by more (or declined less) in these countries (Policy brief #8).

The comprehensive policy response to HIV, in particular the rapid scale-up of HIV treatment, has obviously played a role, by reversing the devastating health effects and mitigating the economic fallout. We thus did not wait to see the devastating economic consequences sustained horrific mortality rates could have had. This by itself is an achievement of the global HIV response and a valid response to the concerns raised in the UN 2001 Declaration of Commitment on HIV/AIDS and other policy documents at the time.

The absence of a clear economic footprint of the massive health shock posed by HIV, however, raises a number of research questions – on the limitations of economic theory and evidence, and the suitability of macroeconomic indicators as measures of the economic impact of a health shock.

Growth Effects

Economic growth theory does not offer clear guidance on the macroeconomic fallout of a health shock like HIV. The neoclassical growth accounting framework is a suitable vehicle for calibrating the growth effects based on estimates of the impacts of HIV on productivity, the health and size of the labour supply, and investment (successively discussed in Policy briefs #3 to #6, and synthesized in Policy brief #7). However, much of the academic work on economic growth over the last 30 years (under the label of "new growth theory") regards the determinants of productivity growth, and in particular of human skills, through the accumulation of "human capital" through education, training and so on.

Differences in estimates and projections based on these two strands of growth theory with regard to the impact of HIV can be large. Neoclassical growth accounting exercises typically arrive at a small and stable impact of HIV on GDP per capita – accounting for some productivity losses owing to disruptions to economic activity from increased mortality or the state of health of people living with HIV, lower investment as resources are absorbed by the HIV response, but acknowledging that available productive assets are shared among fewer people owing to AIDS-related mortality which by itself increases GDP per capita (Policy brief #7). The predicted net effect is typically small, as the effects on GDP per capita in different directions largely offset each other. Thus, HIV does not make (surviving) populations poorer in terms of GDP per capita, although GDP is smaller because the population size is smaller as a consequence of AIDS-related mortality. This finding is broadly consistent with the growth experience across countries facing high HIV prevalence, i.e., the absence of a slowdown in growth in those countries.

In contrast, relevant models of "new growth theory" link economic growth to investments in human capital. Because high mortality among young adults reduce the incentives to invest in education/human capital, and other disruptions affect access to education, these models can predict a permanent decline in economic growth as a result of AIDS-related mortality. This decline, however, occurs only slowly as it largely works through education and training, but the macroeconomic consequences occur only gradually as new cohorts enter the labour supply.

On the face of it, there is little support to suggest that such predicted effects on human capital have played or (considering the lags involved) are playing a role. While "new" growth models focusing on human capital kick the can in terms of growth effects (which involve long delays), there has been no evidence suggesting that there have been large shifts in decisions on investments in education in line with drastically reduced returns to education as a consequence of reduced life expectancy (Policy brief #4). (The limited evidence there is suggests a role in household-level disruptions, e.g., with somewhat lower school enrolment rates for orphans.)

One potential reason for the **absence of an impact of HIV on the accumulation of human capital** is the role of life expectancy in measuring the expected length of the productive life span and thus returns to investments in education, for two reasons. Life expectancy – or remaining life expectancy at ages where relevant decisions are made – is defined as the projected duration of life based on current age-specific mortality. The actual life span an individual can be expected to live, however, depends on mortality rates expected in future periods. High current mortality may not affect the expected life span by much if there is an expectation that they will decline, e.g., as a consequence of treatment or as a disease may abate. Moreover, individuals' subjective expectations – the basis of their decisions – may adapt to demographic and health data only with a delay, and in case of HIV stigma could compromise the rational processing of available information. These issues, and their relevance for economic decision-making, are so far little understood and explored in the context of HIV.

Beyond these high-level theoretical and empirical considerations there are important unresolved issues around the measurement of **productivity effects of HIV** (Policy brief #6). Available empirical studies on productivity effects have been focusing on manual labour where output can most readily be measured. However, these activities are not necessarily representative for the economy overall – it is possible that productivity in less strenuous employments is less affected by health impairment. The practice observed in the scant available literature to move workers (e.g., tea pluckers; see Larson and others (2013) whose health is

impaired to less strenuous jobs suggest that productivity effects of HIV indeed are different across employments, within the agricultural section but perhaps even more across the economy.

Perhaps even more importantly, the bulk of empirical work regards data around and after initiation of treatment of symptomatic HIV patients. With the scaling-up of treatment, this situation has become less typical – patients often initiate treatment earlier, before health and productivity impairments become apparent (so they do not suffer a steep drop in productivity preceding treatment). People receiving treatment earlier also tend to enjoy better health (as evident from subsequent differences in AIDS-related mortality depending on the CD4 count at treatment initiation). And with increasing numbers of people living with HIV on treatment, often for years and even decades, the productivity effects of HIV are dominated by the long-term effects on these populations – on which evidence is weak – rather than any effects around treatment initiation.

Aside from formal education/training, skills are acquired on the job by accumulating experience. This is typically estimated using data on the profile of wages by age-controlling for other factors, and assuming that such differences in wages are a reflection of productivity. HIV, by increasing mortality across the working-age population, is reducing experience, as the average age of the working population declines (by several years in some countries highly affected by HIV). Some models calibrating the macroeconomic effects of HIV therefore include such measures of experience among the determinants of productivity. Whether this approach is appropriate to capture the consequences of a health shock like HIV, however, is debatable. While premature mortality destroys experience, it offers accelerated opportunities to acquire experience to survivors through earlier advancement. In summary, a **firm macroeconomic understanding of the impacts that HIV has had on productivity** remains lacking.

The **empirical evidence on the effects of HIV and of the HIV response on economic growth is weak** (Policy brief #7). In part, this reflects the difficulties around growth regressions in general – there are not so many data points (=countries). For HIV, this shortcoming is compounded by the fact that HIV is heavily concentrated in a few countries. HIV indicators may therefore simply reflect how these countries differ on average from comparator countries. And as many countries with high HIV prevalence share borders and are often highly economically integrated, growth outcomes across these countries are correlated, diminishing the information content of the multiple observations from these countries in growth regressions. Among explanatory variables, indicators like HIV prevalence, mortality, or treatment coverage could be endogenous (influenced by similar factors as economic growth), resulting in biased estimates. Opposed to these challenges, HIV is a large health shock which occurred over a fairly short period; with considerable variation across countries and over time, it therefore represents a good opportunity to study the growth impacts of a health shock (within the limitations of cross-country growth regressions.

Available empirical evidence on the growth effects of HIV is inconclusive (see Policy brief #7). Some studies report a significant growth effect of HIV. On closer inspection, these studies however (1) empirically link growth and life expectancy or mortality, and then (2) link life expectancy or mortality to HIV. This approach boils down to re-affirming the robust link between growth and life expectancy in the empirical growth literature, and then asserting that HIV therefore has a large impact on growth. In contrast, empirical studies linking economic growth to HIV-specific impacts (e.g., AIDS-related mortality) tend to find no impact, or a miniscule one only. Which suggests that the studies finding a link might be based on misspecification, and that any impacts of HIV on economic growth occur along different pathways than those underlying the correlation between growth and life expectancy. A third approach focuses on the scaling-up of treatment. One recent study finds large growth impacts of extending access to treatment (Tompsett, 2020), which however appear implausible in the absence of a preceding slowdown in growth as the impact of HIV unfolded.

The (lack of) evidence on the impact of HIV on economic growth raises questions on the macroeconomic consequences of health shocks. HIV – as a large health shock – offers opportunities to better understand how macroeconomic costs add to and exacerbate the direct consequences of health shocks. However, some aspects of the disease such as its concentration in a few countries compromise empirical inference, and other aspects of the disease, e.g., its transmission and mortality patterns, are highly idiosyncratic. Looking ahead, the question **what lessons can be drawn from the experience with HIV on the growth effects of future health shocks** remains open and has not been systematically addressed. However, there are three areas of work which could contribute to improving the understanding of the growth impacts of HIV and develop a more robust understanding of the economic fall-out of health shocks.

First, much of the uneven results of empirical studies on HIV and economic growth reflects differences in specification of the state of health. Empirical work could address these inconsistencies by encompassing the main approaches – capturing overall health indicators (e.g., all-cause mortality, life expectancy) as well as contributions from HIV.

Second, address the absence of an impact of HIV on the accumulation of human capital. What lessons can be learned on how expectations on the life outlook and returns to investment in human capital are formed? To the extent that investments in human capital are driven by expectation of life prospects, the experience on HIV suggests a need for better understanding of the process through which relevant expectations are formed, and what role stigma of death and HIV may (have) play(ed). Much of this cannot be addressed ex post, but the experience with HIV suggests that this is an important knowledge gap going ahead.

As with the issue on expectations of life outlook, the opportunity to substantially improve the evidence base on the productivity impacts of HIV has passed. This knowledge gap (and corresponding knowledge gaps in aggregate indicators like disability weights incorporated in DALYs), however, could be addressed by building and systematically reviewing evidence on productivity impacts of bad health across professions. And the experience on HIV suggests raising the bar for extrapolating results on productivity across unrelated types of work, which might also contribute to encouraging more work.

Poverty

Concerns about the impacts of HIV on poverty, by reversing development gains and through the adverse economic impacts for households of people living with HIV, have played a prominent and integral role in the policy discourse on HIV. The evidence on such effect, however, is mixed (Policy brief #8). There is considerable evidence on the adverse economic effects of HIV on household of people living with HIV. However, HIV has not had the devastating macroeconomic consequences feared to trigger an increase in poverty across the population (Policy brief #7), and high HIV prevalence has not been associated with increasing poverty, or – as poverty declined overall over the last decades – a lesser decline in poverty than in other countries.

One plausible explanation for these discrepancies is the difference between household-level effects and aggregate effects which arises if losses of households affected by HIV to some extent result in gains in other households. The most obvious such mechanism is the loss of an employment and of income by a person affected by HIV, which then is taken up by a member of another household and results in an income gain there. This mechanism has been shown to be powerful in mitigating impacts of HIV on poverty. One rare study addressing this point suggests that the household-level effects of HIV are essentially nullified when the interactions through the labour market are taken into account (Cogneau and Grimm, 2008). And the macroeconomic growth models discussed above also include such an effect – as people die because of AIDS (and cease earning income), the capital they used does not remain idle, but is reallocated and adds to income elsewhere. The findings that HIV has not has an obvious impact on GDP per capita and the finding that high HIV prevalence has not resulted in higher poverty are consistent and related.

Another challenge with regard to the impacts of HIV on poverty links back to the discussion of socio-economic differences in the socio-economic gradient of HIV and of access to treatment. If HIV is tilted towards poorer population groups, and especially if the poor are facing barriers in access to treatment, then more poor people die because of HIV. If this is the case, there are consequences for the HIV-poverty link. First, HIV (at least through this effect) would contribute to poverty reduction, by killing moor poor people. This result, in isolation, of course is obnoxious and in fact masks a deepening of poverty – as the consequences of poverty are exacerbated. Cross-sectional poverty indicators, in the context of HIV, are thus potentially misleading, as they (similar to the ambiguities in the cascade of care, discussed above) are subject to selective mortality bias. The same challenges apply to the socio-economic gradient of HIV – while evidence, largely from DHS data, is inconclusive regarding the socio-economic gradient of HIV, these results do not take into account attrition bias which would result in an under-counting of disadvantaged populations less likely to obtain timely effective treatment.

A **firm understanding of socio-economic differences in access to treatment** (not only on a cross-sectional basis, but also in terms of progression along the cascade of care) would help resolving these ambiguities, and align the evidence on HIV and the policy dialogue on extending access to HIV services more effectively with challenges on poverty reduction and universal health coverage.

Addressing these knowledge gaps in part is a subset of the agenda on improving evidence on gaps in service coverage across sub-populations, and the notes on data availability and attrition bias made there apply to gaps according to socio-economic factors or poverty status as well. However, there are two important additional knowledge gaps.

First, poverty is endogenous, and a consequence of HIV, other health shocks, and economic factors and processes. Assessing the impacts of HIV on poverty therefore requires modeling on the dynamics of household poverty over time and across the economy, including the effects across households described above. The available evidence – especially the puzzle of the missing effects of HIV on aggregate poverty rates – suggests that these economic factors – in addition to the direct effects on households affected by HIV - are integral to the understanding of HIV-poverty links.

Second, HIV is an aspect of the issue of poverty as a barrier in effective access to health services overall. These challenges have been driven home by the ongoing fall-out of the economic disruptions encountered over the last years (Covid-19, commodity prices). The health consequences of the economic fall-out of Covid provide significant learning opportunities on poverty-related health vulnerabilities, and contribute to the impetus for creating more resilient health systems and progress towards UHC.

IV.
A FISCAL PERSPECTIVE

The fiscal perspective in a sense encompasses all other aspects of economic analysis, as economic analysis is geared towards decision support on HIV policies, i.e., it informs decisions on spending allocations (Policy brief #11). In this sense, the most important research gap is the gap between the menu of economic analytical tools and how findings are most commonly packaged on one hand, and the information needs and attention span of high-level policy makers on the other hand: What is – in a nutshell – the point of investing specifically in HIV/AIDS, at the expense of other policy priorities? [1]

The need to "speak to" the perspective of a Ministry of Finance raises a number of more specific questions:

- **How to summarize the impacts of HIV and of the HIV response in a way that speaks to the mindset of officials in a Ministry of Finance** (or at key donor agencies)?
- How to **understand and communicate the funding needs for HIV programs, and how these are shaped by the design and effective implementation of HIV policies?**
- **To what extent do HIV policies create long-term spending obligations** (e.g., financing the provision of treatment), and how do current HIV add to or help mitigating these obligations?
- Relatedly, **what are the boundaries – in terms of spending categories - of the fiscal costs and consequences of HIV?** The health consequences of the aging of the population living with HIV – discussed above – are mirrored in spending needs, but other categories of spending are also affected.
- The financing of the HIV program raises some issues, regarding any **specific financing instruments or linkages to achieving universal health coverage and financial protection.**

"Speaking to" the Ministry of Finance is integral to the agenda on the *Economics of HIV,* as our collaboration was in part motivated by the desire to develop more effective tools, or using existing tools more effectively, in order to improve the policy dialogue with the Ministry of Finance. For this reason, we have discussed earlier

1 The nitty-gritty questions on HIV program design and on interactions between HIV services and the health systems are addressed separately, further below.

how the perception of the economic fall-out of HIV has changed over the last two decades, and discuss aspects that a Ministry of Finance may care about above (e.g., "economic impacts") separately below.

The Ministry of Finance, however, is a government agency with experience in supporting decisions on spending allocations across the areas of government activity, which involves setting priorities and making choices across different programs and intended outcomes. As such, it is capable of evaluating the projected outcomes of an HIV program against its cost, and support spending decisions across different types of outcomes (e.g., health – education – infrastructure). Economic analysis is useful in supporting such decision processes if it provides genuine insights which effectively improve the information base of decision-making, and are connected with the outlook of the Ministry of Finance and others high-level decision makers (Policy brief #11).

One such area is the impact of HIV and of the HIV response on GDP and GDP per capita (discussed above). On the face of it, this is relevant because in numerous countries, the national development strategy is built around economic growth, and additional economic resources generated by the HIV response conceivably offset some of the resources absorbed by the HIV response. However, there is no evidence that estimates of the growth impacts of HIV have substantially contributed to decision-making on HIV. Relatedly, estimates of the economic returns of the HIV response in terms of "full income" or incorporating the "value of statistical life" are dominated by the valuation of health gains rather than any production gains, and so do offer little economic insights beyond interpreting the health gains. So **what role have estimates on impacts of HIV on economic growth played in informing funding decisions**, and what are the lessons for framing the case for investments in health, in different situations (e.g., from acute disasters to long-term challenges)?

In making decisions on funding allocations, it is important to understand the fiscal net costs of investments in HIV. HIV and investments in HIV are potentially associated with significant "unrelated" medical costs and affect other categories of government spending (discussed below). The more complex challenge arises from the fact that the fiscal consequences of HIV and of the HIV response are spread over decades (see points on communicable chronic diseases, below). However, there is little work on how to incorporate such sustained current costs or future costs in policy analysis. In this area, the research gaps arise in two directions: (1) **Improve the understanding of the life-time consequences of HIV, the medical needs and demand for health services, and the health systems consequences** this will have (see discussion above, also Policy brief #2); (2) **Develop better and readily deployable tools capturing the long-term consequences of HIV** (life-cycle perspectives, spending commitments implied by policy decisions), and develop an **empirical understanding of how such insights and expectations are utilised by policy makers** (e.g., effective time horizons, discount rates applicable to or applied across low- and middle-income countries).

The question of valuing costs over time leads up to the challenges of an integrated valuation of health gains and the costs of achieving them, and of applying such analysis in decision support. Applying estimates of the value of statistical life (VSL) across low- and middle-income countries faces considerable challenges, notably owing to the paucity of relevant empirical evidence from these countries (Policy brief #2 and #10). Applications of the VSL in low- and middle-income countries therefore rely on extrapolation of estimates from advanced economies. Because of limited evidence on how the VSL changes with the level of income (the income elasticity of the VSL), however, VSL estimates thus generated are subject to very high uncertainty (Robinson, Hammitt, and O'Keeffe, 2019). Filling this knowledge gap will require **substantially more evidence on valuations of life from low-and middle-income countries**, a point well recognized in the literature on benefit-cost analysis, and an area where the evidence is slowly improving.

Relatedly, there is little established practice on utilising benefit-cost or cost-effectiveness analysis on deciding whether interventions should be implemented in a particular context. The limitations of the common practice of benchmarking against GDP per capita (the one- and three-times GDP per capita thresholds) are well recognized (Policy brief #13). However, there is little **country-level evidence on cost-effectiveness thresholds applied in actual policy decisions** (but see Ochalek and others (2018) on Malawi, Meyer-Rath and others (2017) on South Africa), and extrapolations based on well-documented threshold from advanced economies run into the same challenges as extrapolations on the VSL and are therefore subject to very high uncertainty when applied to low- and middle income countries (Woods, Revill, Sculpher, and Claxton, 2016; Policy brief #13 and #16).

Spending Needs

The design of HIV programs affects spending needs in two ways. Most directly, effective spending allocations contribute to containing the costs of the program, improving cost-effectiveness and – by offering better value for money – making investments in HIV more compelling (Policy brief #16). For these aspects, there is well established body of cost-effectiveness analysis available (see discussion on health sector, below). The more complex challenges arise from the transition of HIV into a chronic disease, but one that is also communicable – compounding analytical challenges associated with either type of disease.

With chronic disease, a life-cycle approach is usually appropriate to capture cost-effectiveness of approaches on prevention and care, and it may be necessary to include "unrelated costs" (van Baal and others, 2018) in policy evaluations. This means concretely that if people living with HIV survive into old-age, the increasing years of survival are associated with increasing medical costs unrelated to HIV, and counting only HIV-related treatment costs but the full survival gains biases estimates of cost-effectiveness. Moreover, HIV itself or a history of long-term antiretroviral therapy may increase the prevalence of some non-communicable diseases.

With communicable diseases, it is necessary to take into account population-level effects which arise through disease transmission. This is well known and reflected in standard epidemiological models. It is, however, not well-captured in most cost-effectiveness analyses. The 10- to 20-year horizons adopted in most HIV policy analyses may have been appropriate when HIV interventions were averting imminent deaths and HIV prevention interventions would result in adverse health consequences within a few years. (Even then, the health consequences of prevention outcomes late in the policy period did not get captured, resulting in some bias.) These issues have become exacerbated through the transformation of HIV into a chronic disease. As a result, cost-effectiveness analyses especially on prevention efforts that rely on deaths averted (or the resulting loss in DALYs) within the policy period have become an increasingly blunt and misleading tool (Haacker, Hallett, and Atun (2020)), and results are highly sensitive to the time horizon applied (White and others, 2008). **These challenges on time horizons have rarely been acknowledged or addressed explicitly in HIV research, and a consensus on best practice for capturing the health and economic consequences of HIV interventions over time is lacking.**

Relatedly, HIV policies are often motivated in terms of permanently shifting the trajectory of the epidemic, that is, in terms of "ending AIDS." Such policies have long-term consequences beyond the period during which they are implemented. **There are methods available to evaluate the effects of such a permanent shift in the trajectory of an infectious disease,** as the disease settles on a new steady state (e.g., a constant incidence rate). These methods have been applied in the context of immunization programs (Ultsch and others (2016), Mauskopf and others, 2018), **but so far they have not been adapted to HIV and "ending AIDS."**

The scope of costs beyond the health sector which are relevant to evaluating the fiscal consequences of HIV and HIV policies also deserves some more attention (Policy briefs #10 and #11). Good practice in cost-effectiveness analysis involves adopting a broad "societal" perspective, capturing all fiscal or societal costs caused by a disease or affected by an intervention (Sanders and others, 2016). Significant fiscal costs outside the health sector can arise especially in the area of social security – as a result of increases in morbidity and mortality the costs of disability payments or in support of orphans go up, while fewer people reach old age and would qualify for pensions and other grants linked to old age as a consequence of HIV. These fiscal costs can be significant – in the case of South Africa, it was estimated that fiscal savings owing to reduced old-age grants were of a similar order of magnitude as the immediate costs of the HIV response (Haacker and Lule, 2012). Some of these repercussions (e.g. disability payments), though, have diminished as HIV has transformed into a less severe, chronic disease.

The knowledge gaps described in the preceding three paragraphs are largely linked to the transition of HIV into a chronic disease. Addressing them will require methodological innovations drawing on the literature on chronic diseases (life-cycle horizons capturing the changing needs over time, supported by the specific evidence on the needs of the aging HIV population and HIV-NCD intersections, discussed further above), life-cycle approaches in public finance, as well as methods

designed to capture a shift in the trajectory of a disease (drawing, e.g., from immnunisation economics).

The question on the scope of fiscal costs and cost savings linked to the impact of HIV and the HIV response leads up to the question of how much of any economic gains (in GDP etc.) can be counted as offsets against the fiscal costs of HIV. Output gains increase the tax base, a proportion of these gains thus yields additional fiscal revenues. The tax-GDP ratio, typically in the range of 15-25 percent of GDP, is a useful benchmark on the magnitude of revenue gains as a consequence of higher GDP. However, many public services are linked to the size of the population (including some of the "unrelated" medical costs discussed earlier) and economic activity, so some of an increase in revenues from higher GDP is absorbed by higher non-HIV spending and not available for refinancing the HIV program or other spending priorities.

Additionally, public spending could be refinanced by higher taxes or national insurance contributions. This is relatively straightforward when HIV investments result in higher GDP per capita. If some or all of this gain is taxed, households are on average not worse off in terms of income and still benefit from the health gains. However, the bulk of GDP gains comes from (and is largely absorbed by) increased survival and not from GDP per capita, so there is little scope for actual or potential taxation of survival gains leaving households not worse off in terms of income.

However, household benefit from and value reduced mortality risks, and this valuation is estimated on an aggregate level applying the value of statistical life or "full-income." While these valuations include survival gains (so the same issues as discussed above apply), they are dominated by the valuations of health. To the extent that households are willing and able to pay for improvements in the health outlook, estimates of "full-income" gains thus point to a potential for refinancing HIV investment through higher taxes or contributions.

In summary, while there is a considerable amount of work on the direct cost consequences of HIV and investments in the HIV response over time, and broad understanding on the macroeconomic consequences, **the fiscal implications of HIV – in terms of the scope of costs and actual or potential revenue gains – and the interpretation of economic gains from a fiscal perspective are much less understood. Addressing this gap will require more explicit economic modeling beyond the growth effects of HIV, that also takes into account how much of the additional output accrues to the government through increased revenues, and how much of these additional revenues are absorbed by increased population-driven spending needs across the board.**

Financing

HIV programmes around the world are almost entirely funded from external and domestic public resources – a reflection of the consensus that HIV is an infectious disease for which a public health approach is appropriate (Policy brief # 15). Where significant contributions from private spending are reported in spending assessments, these are typically estimates of the private costs of accessing care or of private spending on items like condoms which contribute to HIV prevention.

In light of this, most of the policy discourse on HIV financing involves convincing the domestic government or donors to commit sufficient funding – from general resources or ODA budgets, respectively – for supporting and attaining the program's objectives, as described in costed strategies or "investment cases." Nevertheless, part of the policy discussions on sustainable financing have regarded dedicated funding instruments – e.g., through (portions) of taxes dedicated to the HIV program and administered through a special fund, or "development bonds" the proceeds of which are contributing to specific objectives. However, so far there is only one functioning example of an HIV trust fund – the "AIDS levy" (a surcharge on income tax) in Zimbabwe (Policy brief #11), while efforts to establish a fund have stalled in other countries (e.g., Kenya) or the funds play a marginal role so far (Tanzania). To focus the policy discourse on "innovative" financing, it would be useful to **assess this experience, the additionality of such specific funding instruments, the purposes they serve, and the extent to which they have met these objectives.**

The other area in which considerable research and policy gaps exist is the **integration of HIV programmes into national health insurance schemes, and especially their role in attaining universal health coverage**

(Policy briefs #12, #15). HIV programmes have been important contributors to progress towards universal health coverage, in terms of extending coverage to essential health services, providing access to high-quality care, and financial risk protection (through public provision of treatment and other services). The drive towards universal health coverage, and introducing national health insurance, raises two types of questions. Firstly, **what are the implications for any integration of HIV services and other health services of a wider transformation of the health system?** Secondly, if HIV services are integrated into the benefit package offered by a national health insurance, **does this open the possibility of raising domestic funding from private sources (through contributions) for funding HIV services?** In part, this research challenge is part of the wider agenda in support of progressing towards universal health coverage. There are, however, three HIV-specific considerations which need to be taken into consideration. (1) Any arrangement would have to be consistent with the public health approach to HIV, i.e., not introduce barriers in access to treatment. (2) Compulsory national insurance contributions are similar to taxes, and the distributional effects of switching from public (=tax) financing to funding by compulsory private contributions need to be taken into account. (3) Using national health insurance as an instrument to attain universal health coverage typically involves subsidies to enable lower-income households to participate within their means. The objective of attaining high coverage imposes constraints on how much of the costs of a medical benefits package can be funded from contributions.

V.
A HEALTH-SECTOR PERSPECTIVE

In this section we describe research gaps relating to decision-support and trade-offs within the health sector, building on Policy briefs #12, #13, #15, and #16.

In addition to securing additional funding, resources for the HIV response can also be unlocked through improved efficiency (Policy briefs #16, #11). Improved efficiency, in turn, contributes to the value-for-money proposition and helps improving the case for additional funding. Assessments of program efficiency, and opportunities for efficiency gains, have been integral to economic analyses in support of HIV strategies. Methodologically, it is useful to distinguish the issue of technical efficiency (how effectively and cost-effectively specific services are delivered, and how this effectiveness can be improved) and allocative efficiency (how best to allocate financial resources across program components). In practice, though, the two issues are inter-related, as technical efficiency drives funding needs, and optimal allocations across interventions reflect their technical efficiency.

Technical Efficiency

Capturing technical efficiency is conceptually straightforward as long as it regards specific services and concrete outcomes, and is adequately addressed through analyses of unit costs. Identifying scope for improving cost-effectiveness, though, also requires comparisons – between sites, across countries, or against some derived benchmark. Much of the literature in this area regards estimating unit costs, understanding its determinants, and separating systematic differences (e.g., according to HIV prevalence which affects the yield of testing, or the number of patients by site) from differences which can not be explained in this way and point to inefficiencies and waste.

There are two types of knowledge gaps in translating this evidence into actionable policy advice. With regards the health systems context, a remaining question is **to what extent do measured inefficiencies reflect**

health systems challenges which apply more widely and which are not adequately addressed at the (HIV) programme level- e.g., **to what extent does observed under-utilization of resources apply across health services on site or across sites? Do inefficiencies in the delivery of HIV services reflect inefficiencies across the entire health sector or the public sector overall,** e.g., insufficient equipment and supplies? **And to what extent do health workers (need to) supplement their incomes through other sources, absorbing some of their working time?** The common theme behind these questions is the need to benchmark findings on the technical efficiency of HIV services against evidence on the efficiency of health services in general, by comparison with existing evidence or including non-HIV health services in empirical studies.

Within the HIV programme, the most important challenge is that a large portion of spending is not linked to specific services but is used for **programme management.** While there is some scrutiny on such spending (e.g., through external funders benchmarking across countries), there is limited understanding on the **contributions of programme management to overall service delivery, and how management expenditure is linked to the scale of the programme.** (E.g., the leading tool on HIV program analysis – Spectrum/Goals – captures it as a simple mark-up on the costs of services, not necessarily informed by empirical data.) These uncertainties cumulate in a general **uncertainty regarding the statistical properties of average service costs (or "unit costs",** as they are often referred to), and undermine the generalization of cost estimates from one setting to another- a nonetheless common practice. These shortcomings could be addressed by reviewing and unpacking programme management costs as documented in "National AIDS Spending Assessments," empirically study how program management costs are linked to the scale and other aspects of the HIV program (to identify systematic drivers of these costs but also outliers which might point to inefficiencies and waste), and incorporating the findings of such an analysis in HIV modeling and policy analysis.

Allocative Efficiency

Capturing allocative efficiency of HIV programs is more complex, as it requires estimates on the cost-effectiveness across HIV services, and as the relevant outcomes – unlike for technical efficiency – are not unique (Policy brief #16). Outcomes of HIV policies include HIV infections averted, AIDS-related deaths averted or delayed, they target different age groups and populations, and the effects are spread over time (the lifetimes of people living with HIV, and even longer time horizons if the transmission dynamics are fully taken into account, see above). This leads up to two questions where going practice in HIV policy analysis is particularly unsettled.

One question regards the **valuation of outcomes and costs over time.** HIV policy analyses exhibit great variation in time horizons applied (Haacker, Hallett, and Atun, 2020), and are inconsistent across studies in the methods applied to capture the consequences of the policy beyond this period (survival, costs, state of HIV epidemic, see discussion under "fiscal" heading). Results regarding cost-effectiveness are sensitive to the choice of the policy period and the methods of accounting for longer-term consequences; the lack of an established practice therefore introduces an arbitrary element into these results, and compromises external validity.

Second, and relatedly, many **HIV policy analyses focus on HIV-specific outcomes like HIV infections and AIDS-related deaths,** and not standardized health metrics like DALYs. Because of the focus on HIV-specific outcomes, **much of the evidence on the cost-effectiveness of HIV interventions does not allow direct comparisons with other diseases, and therefore does not support allocative efficiency analysis between HIV and other health services.** One important illustration of this disconnect is the Global Burden of Disease III study, which – in spite of very considerable work that has been done on the cost-effectiveness of HIV interventions – identifies and includes very few studies reporting standardized health outcomes (e.g., only 3 studies on VMMC; see Horton (2017)). This knowledge gap could be addressed by encouraging/enforcing more consistent reporting of standardized health outcomes. To facilitate such reporting ex ante and ex post, reduce burden on individual researchers, and ensure consistency and quality, an authoritative study on the mapping of typical outcomes of HIV interventions and policies (not only deaths averted where it is straightforward, but also HIV infections averted or placing people on treatment) would be useful. This calculus would also need to take in research gaps discussed elsewhere, notably on the

needs of people living with HIV – realizing full DALY gains requires an ongoing financial commitment to sustain treatment.

Cost-effectiveness analysis, however, is an area in which there has been a disconnect between academic practice (which often applied GDP-based "cost-effectiveness thresholds" popularized early on by the WHO (see Commission on Macroeconomics and Health (2001), Hutubessy, Chisholm, and Edejer (2003), and – on academic application - Griffiths, Legood, and Pitt (2016)), and political practice, where these thresholds played no apparent role. This state of affairs is slowly changing, with general academic practice moving on from an unreflected use of such thresholds (Marseille and others (2014), Bertram and others (2016)), and a growing small body of work building on thresholds implied by governments' (and donors') observed willingness to pay for health improvements in low- and middle-income countries (Ochalek and others (2018), Edoka and Stacey (2020)). Research on the economics of HIV has several stakes in this agenda. Empirically, it offers a wealth of evidence on governments' and donors' willingness to pay (and their interplay, through joint funding of HIV programmes), and how this willingness may change in response to economic and health circumstances (notably the global financial crisis of 2008/09, and the ongoing disruptions from Covid and acutely from war in Europe. Looking ahead, a **consistent body of knowledge on decisions regarding funding allocations and implied willingness to pay** will be instrumental for addressing challenges posed through funding transitions, and managing the changing health needs of people living with HIV.

Methods for Informing HIV Budget Trade-Offs

The methods used in answering research questions aimed at the optimal allocation not only of the health, but in particular of the HIV budget have increased in both use and complexity over the last decade (Policy brief #16). If the main aim in the early years was to help make the economic case for more access in particular to treatment, in recent years the focus has been on moving away from blanket programming targeting average potential clients at known and average costs and average plannable budget amounts to closing coverage gaps by targeting the underserved with more tailor-made services at, potentially, higher-than-average cost (Avanceña and others (2020), Long and others (2021); for a modelled application, see Maheu-Giroux and others (2019)). One such approach is targetting interventions to populations based on risk behaviour and/ or geography (Anderson and others (2014), optimising programmes over time (Stopard and others (2019), Shattock and others (2016)) or while considering diminishing returns to investment (Chiu and others (2017)). Recommendations from these targeted modelling applications have been criticised for being impractical when budget lines cannot be shifted easily or quickly (Stopard and others (2019)) or when recommendations go against other policy aims, including those of international organisations and funders.

In this situation, a number of empirical questions remain unanswered:

- **Is the front-loading of HIV investment net beneficial?** Higher short-term population coverage with both treatment and prevention theoretically shortens the time to epidemic control and "ending AIDS". It is however also contingent on the long-term development of costs which are unknown. Addressing this question involves methodological and practical work to better capture the long-term effects of HIV interventions, systematically exploring the timing of interventions and changing effectiveness and cost-effectiveness as the epidemic evolves, and capturing the cost-effectiveness of policies which shift the trajectory of an epidemic, and greater attention to the uncertainties of projecting HIV outcomes and costs over long periods.
- **What is the shape and determinants of local and global cost functions for HIV interventions and HIV programmes are; and how do costs evolve over time?** This involves two activities. (1) Building on and expanding evidence on unit costs and their determinants across facilities, depending on local or national characteristics, scale, and over time. (2) Empirically assessing how local or national costs of HIV services have been changing over time in line with changing input process and economic context, and developing best practice on projecting costs.
- Does the **uncertainty associated with more granular data** from household surveys (such as PHIA) and other

sources **overwhelm the benefits of more granular model types,** potentially leading to findings and resulting recommendations that are net detrimental? Addressing this question involves learning from the experience in translating results from granular modelling into policy, and incorporating uncertainty around localized data into models

An important methodological concern over the years has been how to best deal with overlapping effects of interventions aimed at the same target group or at the same underlying issue (for example, improving retention on treatment). Adding together the effects of individual interventions and their costs ignores that the same interventions would have likely been less effective if added onto an already existing interventions, and, due to integration effects, potentially less costly. One suggestion for this would be to evaluate interventions in packages to see **how packaging of interventions for particular target groups effects their costs and effectiveness.**

Additionally, the focus on budget constraints inherent in allocative efficiency models risks ignoring the presence of constraints on the supply and demand side that are unknown or hard to quantify at the time of analysis, including human resource constraints or limited global supplies with novel drugs or diagnostic technologies (Vassall and others (2016)).

This leads to the question on **the relevance of such non-monetary health systems constraints for HIV programmes and across the health sector,** and how to best incorporate such factors into allocative efficiency and other decision models by adding opportunity costs and non-monetary constraints into models and assessing the implications for cost-effectiveness and effectiveness. This question may be less pressing for HIV service delivery now (as the situation is no longer one of rapid service expansion), but it is relevant in the context of allocative efficiency across the health sector and integration of HIV services into a health system characterized by multiple resource constraints.

Generally, as the field moves towards including aspects beyond cost and effectiveness, such as overall and intra-population equity, financial risk protection, international targets or non-financial constraints, using methods such as Multi-Criteria Decision Analysis (Baltussen and others (2006) or Expanded Cost-Effectiveness Analysis (Verguet and others (2016), two related questions arise: **Which metrics and data can these additional decision criteria best be informed by,** in order to avoid additional layers of parameter uncertainty? Additionally, **what are the best methods to elicit which criteria should apply in any given decision problem, how should they be weighted in relationship to each other- and who gets to choose both criteria and weights?**

Summary: Research Gaps & Suggested Methodologies

Research gap	Suggested methodology
1. Research challenges posed by a changing HIV epidemic (Policy brief #1)	
Gaps in *effective* treatment	Routine data including viral suppression, not just treatment initiation or retention
Contribution of HIV and long-term treatment to NCD incidence	HIV transmission models including NCDs
Health systems and fiscal implications of demographic transition and general population aging	Models capturing prevalence and budget impact of NCDs (+/- HIV)
Integration of HIV and NCD services	Implementation science
Improve the understanding of the life-time consequences of HIV, the medical needs and demand for health services, and the health systems consequences	Build evidence on co-prevalence, incidence, resource use and costs from patient data on people living with HIV across low- and middle-income countries, taking account of health systems context and the most common co-existing diseases in these countries.
2. Growth effects (Policy briefs #3-#6)	
Empirical evidence on the growth effects of HIV: Weak evidence in part reflects limitations of cross-country regressions (especially as HIV is heavily concentrated in small number of countries), but differences in specification have also contributed to ambiguities	Systematically explore (and encompass) pathways addressed across prior empirical studies, distinguish "health-growth" nexus from specific impact of HIV
Productivity effects of HIV and HIV treatment, incl. macroeconomic effects	Explore wage and employment data on people living with HIV, linking wage/employment data across regions and localities with differences in HIV and service access. Systematically review evidence on productivity effects of poor health (owing to HIV or otherwise) across employments, also covering non-manual activities.
Absence of impact of HIV on the accumulation of human capital	Explore conventional measures of life expectancy (based on current mortality) vs. forward-looking measures taking in expectations on changing mortality, and processes through which perceptions and expectations adapt.
What lessons on the growth effects of future health shocks can be drawn from the experience with HIV?	Identify more clearly, calibrate, and empirically validate the channels through which HIV affects growth. Test lessons from HIV against experience from more acute and short-terms health shocks, such as Ebola, and Covid(?).
3. Effect of HIV on poverty (Policy briefs #8, #9)	
Gaps in service coverage (sub-populations by age/ sex/ geography / risk)	Larger surveys sampled to represent these sub-populations
Barriers to service access	Household surveys complemented by longitudinal data, indirect evidence from population surveys
Distribution of additional gains in extending access	Sub-stratified models
Understanding of socio-economic differences in access to treatment (and other services)	Larger surveys sampled to represent all relevant socio-economic strata. Longitudinal data to gain insights on attrition bias.
Contrast between evidence on impact of HIV on affected households and lack of impact on aggregate poverty rates	Drawing on evidence on dynamics of poverty, economic modelling to capture "general equilibrium" repercussions across economy and households.

4. Expenditure policy (Policy briefs #11, #13, #14, #16)	
Provide evidence and build consensus on best practice for capturing the health and economic consequences of HIV interventions over time (incl. choice of time horizons)	Assess dependence of results on effectiveness and cost-effectiveness on time horizon in modelling (sensitivity analysis), and develop more robust approaches on capturing health and cost consequences.
Apply to HIV available methods to evaluate the effects of a permanent shift in the trajectory of an infectious disease	Build on work on shifting the trajectory of an epidemic permanently and valuing this shift, drawing on work, e.g., in immunization economics and economic approaches to valuing assets.
Pay more attention to the scope of costs beyond the health sector which are relevant to evaluating the fiscal consequences of HIV and HIV policies	Build on literature on "unrelated costs" in health economics, and "generational accounts" in fiscal economics
Generate more evidence on valuations of life from low-and middle-income countries	Using dedicated surveys, wage data, and indirect evidence on valuation of life implied by political or consumers' decisions.
Country-level evidence on cost-effectiveness thresholds applied in actual policy decisions	Increase body of literature deriving thresholds from specific policies and decisions, and develop cross-country knowledge base.
5. Financing (Policy brief #15)	
Assess extent to which output gains owing to reduced HIV mortality translate into additional fiscal resources	Economic modelling to capture revenue effects of increased GDP and fiscal resources absorbed by increased population-driven spending needs.
Assess experience and potential of dedicated financing instruments, such as HIV trust funds or development bonds	Simple overview on trust funds and other financing instruments (and policy processes which may or may not result in establishing one), the intended purposes, and the extent to which they have fulfilled these objectives.
Integration of HIV programmes into national health insurance schemes, and their role in attaining universal health coverage • What are the implications for any integration of HIV services and other health services of a wider transformation of the health system? • Does this open the possibility of raising domestic funding from private sources (through contributions) for funding HIV services?	Review evidence on introducing and increasing coverage of national health insurance schemes, Interpret against literature on public health approach to HIV and designing medical benefit packages.
6. Technical efficiency (Policy briefs #12, #15, #16)	
Do inefficiencies in the delivery of HIV services reflect inefficiencies across the entire health sector or the public sector overall, e.g., insufficient equipment and supplies? • To what extent does observed under-utilization of resources apply across health services on site or across sites? • To what extent do health workers (need to) supplement their incomes through other sources, absorbing some of their working time?	Integrate analysis of technical efficiency of HIV services with analysis of health sector. Do inefficiencies in HIV services replicate pattern observed elsewhere? Should we benchmark HIV against other types of services? How do constraints in HIV and health overall overlap and differ?
What are the contributions of programme management to overall service delivery, and how is management expenditure linked to the scale of the programme?	"Overhead" costs typically are a large component of HIV spending, and in modelling often represented as simple mark-up on direct costs. Using available spending data across countries and over time, explore how overhead costs change with scale of programme and other factors driving it, to identify HIV programmes where it is relatively high and provide an empirical basis for extrapolating overhead in scaling-up scenarios.

7. Allocative efficiency (Policy briefs #13, #16)	
Valuation of outcomes and costs over time, especially with regards to • methods for accounting for longer-term consequences • choice of time horizons	Address methodological challenges on HIV as a disease that is both chronic and communicable (long time horizons, transmission dynamics). More systematically address implications of choosing duration of time horizon and methods for capturing costs and consequences over time.
Generation of evidence on the cost-effectiveness of HIV interventions that allows direct comparisons with other diseases, and supports allocative efficiency analysis between HIV and other health services	Routinely report standardized outcome measures (such as DALYs, or QALYs where local quality weights exist) which allow comparisons across diseases, while taking account of challenges posed by long time horizons (including the spending needs implied by sustained treatment) and transmission dynamics of HIV.
8. Methods for informing HIV budget trade-offs (Policy brief #16)	
Is front-loading of HIV investment net beneficial?	Draw on work on allocative efficiency, build on and systematically explore results on the timing of interventions and time-varying spending allocations.
What is the shape and determinants of cost functions for HIV interventions and HIV programmes?	Compile evidence on unit costs and their determinants across facilities, depending on local or national characteristics, scale, and over time. Empirically assess how local or national costs of HIV services have been changing over time in line with changing input process and economic context, and develop best practice on projecting costs.
Does the uncertainty associated with ever-more granular data from household surveys (such as PHIA) and other sources overwhelm the benefit of more granular model types?	Incorporate error terms around survey-based model inputs into models, and review experience on use of granular data to steer HIV resources and inform localized strategies.
What is the relevance of non-monetary health systems constraints for HIV programmes and across the health sector?	Add opportunity costs or non-monetary constraints into optimisation models, and address implications for cost-effectiveness and efficiency.
In using decision criteria beyond cost and effectiveness, • which metrics and data can these additional decision criteria best be informed by? • what are the best methods to elicit which criteria should apply in any given decision problem • how should they be weighted in relationship to each other • who gets to choose both criteria and weights?	Incorporate these aspects into ongoing development of multi-criteria decision analysis; where possible, co-design these analyses in conversation with policy makers.

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