

## **2021 iHEA Organised Session Proposal**

**Session Title:** The Economics of HIV Self-Testing in Six African Countries- Insights from a Large Multi-Country, Multi-Year Economic Analysis Project

**Session Description** (778 words):

The global HIV/AIDS agenda is to end the AIDS epidemic by 2030 using innovative and targeted approaches for populations left behind by conventional testing and treatment interventions. HIV self-testing (HIVST), a process in which a person collects their own specimen, performs an HIV test, and interprets their own results in private, offers an opportunity to speed up the global agenda by effectively reaching men, young people and first-time testers. Between 2016 and 2020, the Self-Testing Africa Consortium aim to distribute 4.8 million HIVST kits in six countries in Southern Africa (Eswatini, Lesotho, Malawi, South Africa, Zambia and Zimbabwe). Alongside, a number of researchers analysed the uptake, acceptability and cost-effectiveness of the different distribution modalities in the region.

With this session, we aim to provide lessons on the economics of HIVST and on how such information can be used in implementation. We also provide exceptional results of economic evaluation along the cascade of care for HIV, including new data on the linkage to confirmatory testing at the clinic level and to HIV treatment initiation, which is an uncommon analysis for self-administered diagnostics conducted in private. Working off these findings, we have organised this session to inform economists conducting economic evaluation of diagnostic interventions generally, by exploring how data collected alongside large-scale piloting of a novel intervention can be used to inform decision making, budgeting and implementation. All economic evaluations to be presented in this session were conducted alongside a multi-country and multi-year implementation project with the aim of informing local Ministries of Health on HIVST integration into their existing HIV testing services.

We organised this session into 3 presentations building up from costing the HIV cascade to modelling costs of scaling-up distribution and finally, cost-effectiveness analyses of the distribution modalities of HIVST.

The first presentation summarises the costs of distributing HIVST and linking to care after a positive HIVST result for 13 distribution models and sub-models implemented in Eswatini and South Africa. It shows that incorporating onward care, while increasing the cost per outcome by several orders of magnitude over the simple cost per HIVST test distributed, makes it easier to compare the outcomes and cost effectiveness of HIVST to traditional HIV testing modalities. These findings are important for planning of nationwide HIVST adoption and decisions on affordable integration of HIVST into existing testing services.

The second presentation is a methodological piece exploring common approaches to modelling costs to inform scale-up budgets. This abstract can be considered as a validation exercise comparing accounting, econometric cost functions and simple cost multipliers with the aim of informing the appropriate model for scale-up costs. Modelling the costs of intervention scale-up especially for novel interventions is informative to budgeting for national-level implementation.

The final presentation compares the results of cost-effectiveness analyses performed with three distinct mathematical models applied to the distribution modalities and countries. As countries approach the last mile in reaching the undiagnosed, the resource allocation question has evolved from general cost-effectiveness of HIV testing to which testing approach is the most cost-effective and whether and how

much countries might have to pay for additionally in order to close the last testing gaps. Determining such cost-effectiveness is critical to informing HIVST distribution approaches and targeting and thereby efficiently meeting the demand for testing. Additionally, this abstract is a synthesis of the different cost-effectiveness models that have been applied across the STAR implementation phases and countries.

Each presentation will be 15 minutes long, with 5 minutes for questions from the audience at the end. After the presentations, we will have two discussants offer independent and distinctive perspectives and reflection for 10 minutes each.

The first proposed discussant is Dr Thato Chidarikire who is Director of HIV Prevention Programmes at the National Department of Health in South Africa. Dr Chidarikire will offer a perspective on how Ministries of Health can use these findings and comment on any additional aspects of information they would find useful. The second proposed discussant is Professor Paul Revill who is with the Centre for Health Economics at the University of York. As an academic with extensive experience in economic evaluation in low- and middle-income countries, Professor Revill will offer insights on the validity of the methods applied and the value of the work to the wider health economics community. Finally, we will have 10 minutes for further comments or reflections from conference participants.

This session supports gender balance and global collaborations. The organisers are both female and based, as well as resident/citizen of low-and-middle income countries.

**Sub-field:** Economic evaluation of health and care interventions

**Special interest groups relevance:** None

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## Papers to be presented in the session

### Abstract 1

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  - Country: United Kingdom
  - Time zone during July 2021: CET
  
- Title: The Costs and Outcomes of HIV Self-Test Kit Distribution Along the Care Cascade: Results from Two Economic Evaluations in South Africa and Eswatini
  
- Funding sources: Self-Testing AfRica (STAR Initiative), funded by Unitaid
- Has the research being presented received ethics approval: **Yes**
- Is this abstract based on research involving primary data collection: **Yes**
  - If yes, is the presenter from one of the countries which is the subject of the research, or did the presenter invest considerable time working in the country (or at least one of the countries if a multi-country study) where primary data collection took place and developing a substantial relationship with colleagues in the country during the research? **No**
    - If no, please explain the circumstances under which this research was undertaken and your role relative to that of researchers based in the country where the primary data was collected.
      - *South-Africa study: All authors are South-African citizens or residents*
      - *Eswatini study: Due to COVID related-restrictions, travel to country was canceled and costing approach was adjusted from bottom-up to top-down approach. All data collected by local M&E team and all expenditure reports was sent to author for analysis, and weekly skype calls were conducted between author and local study team.*
- Would you like to make your presentation publicly available through posting on the website after the congress? **Yes**
- Does the presenter require financial assistance to participate in the conference? **No**
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- For presenter only, In what year did you graduate with your highest academic degree? **2020**

## Abstract

**Background:** Countries are looking for innovative and cost-effective measures to close the remaining gaps towards the 95-95-95 targets for the effective diagnosis, treatment, and viral suppression of people living with HIV/AIDS (PLHIV). Offering HIV self-testing (HIVST) kits across multiple distribution channels may help countries with high HIV prevalence achieve these targets. Measuring both costs and outcomes of providing HIVST kits along the client care cascade can further inform countries of the value offered by adding HIVST distribution to their existing HIV testing programs.

**Methods:** Data were collected over a 1-year period in South Africa (2018-2019) and Eswatini (2019-2020) alongside primary and secondary distribution of HIVST kits, across community-, facility-, and workplace-based models. Community-distribution further consisted of 6 sub-models, including fixed-point distribution, flexible distribution, mobile integration, transport hubs, key populations and sex worker networks.

Outcomes were based on distribution data and telephonic surveys of 5% and 21% of recipients in South Africa and Eswatini, respectively. Costs were calculated based on project expenditures, as well as, in South Africa, micro-costing and time-motion analyses. Costs were calculated from the provider's perspective in 2019/20 US dollars, as incremental costs in integrated and full costs in stand-alone models.

**Results:** Over 2.2 million HIVST kits were distributed in South-Africa and Eswatini. Screening positivity or reactivity estimates across models ranged between 4 and 6%, linkage to confirmatory testing at the clinic between 19% and 96%, and ART initiation between 2% and 83%. Average cost per kit distributed varied from \$4.18 to \$17.68, with kit volumes driving most of the difference. Average cost per client with a reactive self-test ranged from \$24 to \$521, cost per client confirmed positive from \$52 to \$1,176, and cost per client initiating ART from \$104 to \$4,612. In South-Africa, the sex worker network model was the most cost-effective distribution model across all cascade outcomes and, together with the index testing at facilities, identified the largest number of PLHIV for the least cost. The large-volume models, such as workplace, transport hub or fixed-point community distribution models achieved greater demand but did so at the cost of smaller HIV positivity - in some cases augmented by lower linkage to onward care. In Eswatini, community and workplace distribution models had comparable costs, though the latter presented smaller cascade costs as clients had higher screening positivity. Personnel and HIVST kit costs were the largest cost items across models and countries.

**Conclusion:** In both countries, HIVST distribution models varied along four characteristics: distribution volume; screening positivity; linkage to care; and costs. Cost per outcome increased by one to three orders of magnitude once positivity, linkage to care, and ART initiation rates were evaluated, demonstrating the importance of including successive cascade outcomes when comparing HIVST cost and cost effectiveness with other testing modalities. Identifying the remaining HIV-positive cases will cost more as countries draw closer to reaching the first 95 target and testing yields continue to decrease. Efficient delivery and effective linkage to care strategies are paramount to improving the cost effectiveness of HIVST distribution.

- Conflicts of interest: **None**

## Abstract 2

- **Presenter**

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Title: Characterising methods to project health care costs at scale in low- and middle-

income countries: A case study of scaling up community-based HIV self-testing programme in Lesotho

- Funding sources: **Self-Testing Africa (STAR) Initiative, funded by Unitaid**
- Has the research being presented received ethics approval: **Yes**
- Is this abstract based on research involving primary data collection: **Yes**
  - If yes, is the presenter from one of the countries which is the subject of the research, or did the presenter invest considerable time working in the country (or at least one of the countries if a multi-country study) where primary data collection took place and developing a substantial relationship with colleagues in the country during the research? **No**
    - If no, please explain the circumstances under which this research was undertaken and your role relative to that of researchers based in the country where the primary data was collected.
    - *The presenter is not from one of the country which is the subject of the research. The presenter designed the study, and conducted data collection and analysis in Lesotho (our case study) where there were no local research team, only the local implementing team. The implementer focal point is Basotho and co-author on this study (Molemo Makhetha). Data from Malawi, Zambia, Zimbabwe and South Africa used for the econometric component of this analysis were collected and analysed by local researchers (all co-authors – Linda A. Sande, Lawrence Mwenge, Collin Mangenah, Gesine Meyer-Rath). The presenter supported data collection/analysis in these countries and played a coordination role for cross-country collaboration throughout the project (2016-2020).*
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### **Abstract**

**Background:** There is a dearth of evidence on methods for projecting costs at scale for programming and planning. Accounting cost functions (ACF) identify fixed and variable costs through stepwise analysis of a production process; econometric cost functions (ECF) apply statistical inference to project costs; and simple cost multipliers (SCM) multiply a single unit cost by quantities of outcomes such as patient years covered. While ACF and ECF estimate production costs at scale while accounting for variable returns to scale, in most cases we do not have the luxury of collecting large amounts of location-specific cost data, and SCM is commonly used. This study compares and contrasts these approaches, and identifies factors guiding the selection of a cost projection method fit for purpose. We use site level cost data for community-based HIVST programmes across five countries in Southern Africa, including Lesotho as our case study.

**Methods:** Under the STAR project, we estimated the incremental economic costs of community-based HIVST kit distribution in 79 sites between June 2016 and June 2019. For SCM and ACF we used cost and programme data from Lesotho only, for ECF we used data from Malawi, Zambia, Zimbabwe, South Africa and Lesotho to allow for a sufficient sample size. For Lesotho, we analysed differences between observed scale-up costs and costs projected through cost function approaches at different levels of scale-up, accounting only for scale economies. In addition, we conducted a series of scenario analyses using ACF and ECF to assess the cost impact of contextual factors changing at scale-up (e.g. need for additional human resources, transition from international to local programme ownership), thus accounting for variable returns to scale.

**Results:** Overall for Lesotho, all three projection methods gave highly accurate scale-up cost estimates compared to observed scale-up expenditure records (with <50,000 kits distributed yearly), but were much less consistent for cost projection at larger scale. While SCM costs are increasing steadily, ACF costs capture increasing returns to scale. ECF first exhibit scale economies, then costs grow exponentially at larger scale, however, this is highly dependent on the scale functional form chosen. ACF and ECF can be adjusted to various (and distinct) scale-up factors, making difficult the comparison of projected costs. However, the use of the three complementary approaches is informative and can help to estimate a reliable range of projected costs.

**Conclusion:** In summary, the choice of cost function should account for the intended use of cost estimates and the characteristics of the intervention being evaluated. Factors to consider for method selection are (1) the policymaker's interest for assessing constant vs. variable return to scale and whether there is information on the expected functional form of the scale component, (2) an interest in the variation of cost composition during scale-up (fixed vs. variable costs and inputs), (3) the intervention level of analysis (national, regional), (4) the determinants of scale-up costs and whether they are related to programme design (change of funders), and/or to contextual determinants (characteristics of the population reached), and (5) the expected magnitude of scale-up.

- Conflicts of interest: **None**

### Abstract 3

#### Title of paper: “Cost-Effectiveness of HIV Self-Testing in Southern Africa: a Comparison”

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- Country: United Kingdom
- Time zone you will be in during July 2021: BST
- Funding sources: STAR Initiative, funded by Unitaid; BGMF
- Has the research being presented received ethics approval? Cost data collection received ethics approval. In South Africa from the Human Research Ethics committees of the University of the Witwatersrand (Ref. M180379) and the London School of Hygiene and Tropical Medicine (Ref. 15408), as well as the Institutional Review Board of Boston University School of Public Health (IRB No. H-37713).
- Is this abstract based on research involving primary data collection? The cost data involved primary collection
- If yes, is the presenter from (one of) the countries which is the subject of the research, or did the presenter invest considerable time working in the country (or at least one of the countries if a multi-country study) where primary data collection took place and developing a substantial relationship with colleagues in the country during the research?
- If no, please explain the circumstances under which this research was undertaken and your role relative to that of researchers based in the country where the primary data was collected.
  - *The presenter is not from one of the country which is the subject of the research; however, the data collection and large parts of the analyses were conducted by researchers based in the countries which is the subject of the research (Gesine Meyer-Rath, Lise Jamieson, Collin Manganah, Katleho Matsimela, Leigh Johnson, Lawrence Mwenge, Linda A. Sande) or by researchers that spent a considerable amount of time there (Nurilign Ahmed), and they are all included as authors.*

Your presentation will be made available to those registered for the virtual congress.

- Would you like to make your presentation publicly available through posting on the website after the congress? Yes
- Does the presenter require financial assistance to participate in the conference? No

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## Abstract (499 of 500 words)

**Introduction:** Remarkable progress has been achieved towards HIV elimination goals, with 81% of people living with HIV (PLHIV) in 2019 aware of their status worldwide. Although the cost-effectiveness of HIV testing has decreased, due to fewer undiagnosed PLHIV remaining in the population. SARS-CoV-2 has increased costs and stressed global finances, making choices regarding which HIV testing modalities to scale-up, or scale-down urgent. HIV self-testing (HIVST) provides an attractive alternative to standard facility testing that is private, convenient, and minimises direct health worker contact. Costs, however, vary substantially by distribution model. Here, we compare cost-effectiveness analyses conducted under the STAR Initiative, covering several countries and distribution modalities.

**Methods:** Three independent groups, using mathematical models parameterised with STAR data were involved. Two used transmission models (Thembisa[T], Synthesis[S]) and one used a Markov microsimulation model [M]; two modelled specific countries (South Africa[T], Zambia[M]) while the third (S) simulated a range of HIV epidemics in Southern Africa. The HIVST distribution models considered were: community models (S,T,M); facility models (T); secondary-distribution (T,S) and workplace models (T). M and S evaluated the cost-effectiveness of introducing HIVST for one year (M) or for the next 50 years (S), while T evaluated distributing a target of 6 million HIVST (achieved by 2030) using one single distribution-channel rather than a combination over 20 years. Incremental or, for stand-alone models, full economic cost was estimated from the provider perspective. Model projections including treatment costs were run over 20 (T,M) or 50 (S) years, with cost-effectiveness evaluated in terms of cost per DALY-averted (S,M), cost per life-year saved (T), and cost per HIV infection averted (T) and using a cost-effectiveness threshold of US\$500 (S) and US\$1,430 (Zambia GDP-per-capita; M) per DALY-averted. Both costs and outcomes are presented undiscounted (T) and discounted at 3% (T,S).

## Results

HIVST interventions reaching high risk or underserved populations tend to be highly cost-effective (ranging from cost-saving to US\$345/DALY-averted). However, focusing on targeted interventions to very high-risk populations only is unlikely on its own to lead to HIV elimination, as their health benefit is relatively limited. In Zambia (prevalence of undiagnosed HIV [PUHIV]: 3.4%) door-to-door HIVST was found to be cost-effective (ICER below US\$200/DALY-averted). In South Africa (PUHIV: 0.9%), distributing HIVST in taxi ranks and through workplaces was cost-saving, while primary-distribution in PHC clinics and secondary-distribution to the partners of antenatal clinic (ANC) attendees was dominated, regardless of outcome metric. S found that community-distribution to women having transactional sex was cost-effective (less than US\$500/DALY-averted) in the context of the PUHIV being between 0.3% and 7.4% [all countries in the region], while targeting adult men was cost-effective only if the programme was limited to five years or the PUHIV was above 3% and impact was enhanced with linkage to voluntary medical male circumcision. Similarly to T, S found that secondary-distribution to partners of ANC attendees was only borderline cost-effective (US\$522/DALY-averted), while secondary-distribution to partners of FSW offered value for money (US\$345/DALY-averted).

**Conclusions:** There are HIVST distribution models that are cost-effective. The main factors influencing cost-effectiveness are: prevalence of undiagnosed HIV, size and risk of HIV in the sub-population receiving HIVST, linkage to treatment or prevention following the HIVST, and costs of HIVST distribution.

**Conflicts of interest:** None of the authors has conflict of interest