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Cost-Effectiveness Analysis of HIV/AIDS Programme for Policy Decision in Nigeria: An Appraisal of Evidence Using the Drummond Checklist

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Abstract

Amidst declining access to funding, the HIV/AIDS pandemic remains a confounding health issue in sub-Saharan countries, especially Nigeria. The selection and sustainability of numerous programmes aimed at encouraging and upscaling uptake and adherence to intervention have become more critical. Hence, the assessment of evidence on the economic evaluation of programmes' effectiveness to inform decisions on scale-up has become inevitable. While several approaches to valuation exist, cost-effectiveness analysis (CEA) is widely used by many researchers. In this study, an evaluation of research evidence on the cost-effectiveness analysis of a HIV/AIDS programme was undertaken. The weaknesses, and the need to incorporate other considerations, such as long-term utility cost measures (QALYs/DALYs) and forecast, as well as equity, diversity and inclusion, were discussed using the Drummond 10-question checklist. The author recommends the use or inclusion of a cost-utility analysis (CUA) or cost-benefit analysis (CBA) in the economic valuation of HIV/AIDS programmes for policy decision-making in Nigeria

Keywords: Cost-Effectiveness Analysis, Cost-Benefit Analysis, Cost-Utility Analysis, HIV/AIDS, Economic Evaluation, Drummond checklist

1. Introduction

Acquired immune deficiency syndrome (AIDS) is a severe condition caused by the human immunodeficiency virus (HIV). About 80% of the world's HIV population lives in sub-Saharan Africa (Ekwunife *et al*., 2018). The high burden of HIV/AIDS in sub-Saharan Africa remains a serious public health concern, and several interventions have been proposed and implemented at huge costs to reduce the burden of the disease. Within the past two decades, global organs such as Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organisation (WHO), and other donor organisations have committed huge financial resources to mitigate the transmission and adverse effects of the disease, especially in low- and medium-income countries (UNAIDS, 2016 and 2023). Despite the enormous resources deployed on interventions to reduce related morbidity and mortality, very little progress has been made, with adolescents mostly affected on account of nonadherence to antiretroviral therapy (ART) and poor retention in care. Huge resources are being spent on (i) screening to identify status, (ii) ART drugs for treatment, (iii) medications for opportunistic diseases and care, (iv) counseling and education for

voluntary screening, and behavioural change, (v) monitoring of treatment adherence, (vi) sensitization for community awareness to reduce exposure and transmission, support for programmes and lifestyle change, and reduce stigmatization of people living with HIV (PLHIV) (Philbin *et al*., 2014). Amidst emerging global and regional public health challenges of new and re-emerging infectious diseases like COVID-19, Ebola, Lassa fever, Mpox, etc., and the prolonged global economic downturn, the funding for HIV intervention has continued to dwindle (Gwandure and Mayekiso, 2013; Oladele *et al*., 2015; Serieux *et al*., 2015; WHO, 2024). The sustainability of new HIV interventions depends on the perceived net benefits amidst limited and scarce resources. Hence, the use of economic evaluation models such as cost-effectiveness analysis (CEA), cost-benefit analysis (CBA), cost-utility analysis (CUA), cost-consequence analysis (CCA), and cost-minimisation analysis (CMA), to determine the actual and potential net-benefits of programmes, as well as the opportunity cost of forgone alternatives as a result of any incremental cost, and to guide policymakers in selecting a more cost-effective programme has become an imperative (Alfirevic *et al*., 2016; Turner *et al*., 2021). This has become even more imperative with the funding challenge worsened by the United States review and restriction policy on foreign aid since 20 January 2025 which has been forecasted to adversely affect the HIV/AIDS programme under USAID and PEPFAR (KFF, 2025; NACA, 2025; Nigeria Health Watch, 2025).

2. Cost-effectiveness of HIV/AIDS intervention programmes

Several studies have examined the cost-effectiveness of some HIV/AIDS interventions in adolescents across the world with positive net benefits. However, the majority of such studies were in high-income countries (Mac-Pherson *et al*., 2015), with very few studies in low-income high-burden countries (Ekwunife *et al*., 2021). Economic evaluations of HIV/AIDS programmes to determine feasibility and effectiveness relative to costs have become imperative for the selection of more appropriate interventions for implementation. It is in light of the above construct that the economic evaluation work of Ekwunife *et al*. (2021) on the "Cost-effectiveness and feasibility of conditional economic incentives and motivational interviewing to improve HIV health outcomes of adolescents living with HIV in Anambra State, Nigeria" is being discussed using the Drummond 10-question checklist (Drummond *et al*., 2015).

2.1 The HIV/AIDS Intervention Cost-Effectiveness Study by Ekwunife et al. (2021)

The study was conducted as a cluster-randomised controlled trial (c-RCT) of the importance of an adolescent-centered intervention based on the published protocol of Ekwunife *et al*. (2018). The study sought to determine if there was any economically justifiable basis for such incentive-based intervention given the limited resources available for HIV programmes (Ekwunife *et al*., 2021, p. 2). The study aimed to evaluate the cost-effectiveness of an incentive-based intervention on the health outcomes of adolescents living with HIV in Anambra State, Nigeria (Ekwunife *et al*., 2021, p. 3). The primary outcome was the percentage change in the number of participants with an undetected viral load (VL) of <20 copies/ml, between the intervention and control arms in the 12th month. The secondary outcomes were adherence to ART and hospital appointments, CD4+ count, and retention in care.

The study had two arms - an intervention arm and a comparison (control) arm. The intervention arm received conditional economic incentives and motivational interviews, while the control arm received only the routine standard-of-care treatment. The targeted population was adolescents aged 10-19 years (Ekwunife *et al*., 2021, p. 3). The conditional economic incentives for the intervention arm were cash rewards of US$5.6 when the viral load was <20 copies/ml for the first 3 months, US$2.8 if the viral load remained suppressed for the subsequent 3 months and the following 6 months, and then US$5.6 if the VL remained <20 copies/ml for another 1 year (Ekwunife *et al*., 2021, p. 3).

The costs and efficacy of the intervention were determined based on the 2019 base year. The cost-effectiveness of the intervention over the standard of care was assessed using the incremental cost-effectiveness ratio (ICER) index, expressed as cost per additional patient who achieved an undetectable VL. The study found the ICER of the intervention compared to the standard of care as US$1419 per additional patient with undetected VL and concluded that it was not cost-effective based on Woods *et al*. (2016) recommendation of ≤US$1137 (i.e. 51% of the GDP per capita of Nigeria in 2019) per QALYs gained. The ICER threshold range for low- and medium-income

countries is 1-51% of GDP per capita (Woods *et al.* 2016). The authors however, pointed out that reducing the number of VL and CD4 tests by ≥1 in the intervention arm will make it cost-effective.

2.2. Drummond's checklist critical appraisal of the study

Using the Drummond 10-question checklist (Appendix 1), the study was well conducted as a c-RCT, with a clear aim (Doran, 2010; Drummond, 1987). The primary and secondary outcomes were well outlined to enable the identification of inputs of effectiveness (efficacy of intervention) and costs, and the conduct of the cost-effectiveness analysis (CEA). The costs and effects were activity-based and were appropriately identified and obtained from the right sources. The financial incentives used were based on the protocol, although other incentives such as free hospital meals/snacks, food items, household gift items, and socio-ecological skills would have been possible.

As acknowledged by Ekwunife and colleagues, studies have shown that cash incentives are not sustainable in the long run and usually do not produce a long-lasting behavioural change effect (Ekwunife *et al.*, 2021, p. 9). A "do nothing" alternative was not considered, probably because HIV conditions require care and treatment to achieve and maintain viral suppression in PLHIV and prevent progression to AIDS. Thus, the control arm received the standard of care without any incentives. The targeted adolescent population was not stratified into sub-groups by sex, age, location, or socioeconomic status after the cluster-randomisation. The protocol reflected what happens in regular practice when funding is provided for identified activities. Costs were adjusted to 2019 prices using the implicit price deflators - gross domestic product (GDP) deflators. There was no specific justification for the base year other than the year of study completion as specified in the protocol. An in-depth interview (IDI) was used to assess the perception of effectiveness and the feasibility (generalizability) of the intervention in hospitals in Nigeria from health care providers' perspectives.

2.3. Biases and weaknesses in the study

The outcome of the study may have been weakened by some factors such as sample size, omission of utility inputs and some of the shared resources in the calculation of CEA, and professional biases of IDI respondents. Limitations and potential bias may have arisen from cost variation between centers, small sample sizes, and selected measures of effectiveness (primary and secondary outcomes). The sample size was inadequate, which affected baseline viral suppression data between both arms, and this may have caused effect modification (Ekwunife *et al.*, 2021, p. 9). Long-term costs and consequences or extended CEA were generally not considered. The measured effectiveness was only restricted to the primary and secondary outcomes, which did not include utility inputs such as quality-adjusted life years (QALYs) gained measured by Life-5 Dimensions (EQ-5D™) instrument, and disability-adjusted life years (DALYs) averted (Alfirevic *et al.*, 2016). This affected the range of the costs and effects analysed. The IDI presented only the viewpoints of the healthcare providers (Doctors, Pharmacists, Nurses, and Medical Laboratory Scientists) and did not cover the perspective of other relevant parties such as the patients and community. Furthermore, capital costs covering hospital facilities (building and equipment), data collection costs, and indirect costs from patients and families were excluded (Ekwunife *et al.*, 2018, p. 6). Only operating costs covering items or components of the intervention (laboratory investigations, personnel costs for motivational interviewing, economic incentives, inpatient/outpatient costs, phone calls, and transportation) were included in the CEA (Ekwunife *et al.*, 2021, p. 4-5). The study did not specify the use of joint resources or shared costs, and no identified cost item was specified in the protocol that was omitted from measurement. Costs that did not reflect market values were also not identified or included.

The sources of resources were justified, and the costs were activity-based. Personnel costs were based on the salaries of hospital staff, while costs of medications (ART) and consumables were based on Global Fund Pooled Procurement Mechanism Reference Pricing for ART, and the buyer's median price of the International Medical Products Price Guide, respectively. Other costs were obtained directly from the hospital (out/in-patient cost), and activities (laboratory tests, phone calls, transportation) or as provided by previous survey studies (Ekwunife *et al.*, 2021, p. 3). All costs were adjusted to the 2019 base year. The analysis did not include discounting or the use of discount rates, because long-term projections were not considered.

The valuation of effects was appropriately done for a CEA. The study did not focus on the allocative efficiency question, which would have at best been evaluated by cost-benefit analysis, but on the technical efficiency or feasibility of the intervention. The effectiveness measures were based on the percentage of participants with viral suppression of ≤20 copies/ml, which is appropriate for incremental cost-effectiveness analysis (ICEA).

The statistical analysis was conducted at a 95% confidence interval (CI) with available patient data. The % difference between both arms in participants with undetected viral loads was statistically determined as 11.7% while it was 8.9% after adjusting for participants who changed regimen to a Dolutegravir-based combination. The intervention's incremental cost-effectiveness ratio (ICER) compared to the standard of care was US$1419 per additional patient with an undetected viral load. A sensitivity test conducted by varying the cost elements over +/- 25% did not translate to positive cost-effectiveness of the intervention. The sensitivity test indicated that the intervention was not worthwhile based on Woods *et al*. (2016) ICER threshold of US$1137 per QALYs for Nigeria. Only a reduction in the number of tests for VL or CD4 in the intervention arm could improve the cost-effectiveness of the intervention (Ekwunife *et al*., 2021, p.5 and 8).

3. Discussion

The inference reached by the authors seemed appropriate and was based on the incremental cost-effectiveness ratio (ICER) index, which was interpreted intelligently with reference to Woods *et al*. (2016, p. 933) percent GDP per capita-based cost-effectiveness threshold (CET). The authors also discussed the results in the context of similar studies and found to align (Ekwunife *et al.*, 2021, p. 9). Opportunities for methodical modification were identified, for instance, the use of skill acquisition incentives instead of economic (financial) incentives for a more sustainable outcome. Study limitations were identified as inadequate sample size, the significant difference in baseline viral suppression between the arms, exclusion of utility benefits in terms of QALYs, exclusion of some costs (capital and data collection), and lack of inclusiveness in the IDI. The generalizability of the intervention to other hospital settings in Nigeria was, however, under-discussed. Capacity building for client-centered counseling skills and increased remuneration of the team of dedicated care providers were identified as factors for successful implementation in real-life settings. Ethical issues of equity and equality among individuals in the population were unexpectedly not discussed.

The study established that in real-life scenarios, other excluded costs may arise. Additionally, substituting economic incentives with social incentives, such as skill acquisition, may reduce costs in the long run, but more studies will be needed to evaluate their cost-effectiveness. The study addressed issues of technical efficiency but not allocative efficiency because it did not compare it to another intervention. A projected long-term CEA may indicate better cost-effectiveness in comparison with similar studies for allocative efficiency decisions.

The study by Ekwunife *et al*. (2021) is similar in objective and scope to the study by Tozan *et al*. (2019) on the family economic empowerment intervention through BRIDGES and BRIDGES-plus programme, an incentives-based intervention, targeted at adolescents orphaned by HIV/AIDS in Uganda. While Ekwunife's intervention was not cost-effective with an ICER of US$1419, Tozan's Bridges and Bridges-plus intervention with an ICER of US$289 was adjudged cost-effective. However, the different conclusions from the two studies may have been due to approaches to cost items identification and inclusion as well as cost valuation. The stratification of participants into sub-groups in Tozan's evaluation may also have affected the CEA and ICERs obtained.

4. Implication

The intervention in Ekwunife *et al*. (2021) study was not cost-effective based on recommended thresholds and therefore, may not appeal to policymakers for population rollout unless other considerations are involved. Unfortunately, the long-term projection of effectiveness, and other measures of effectiveness, for instance, utility measures such as QALYs gained and DALYs averted, the impact on care providers, family, and associates, are not considered in CEA. The cost sensitivity from the number of laboratory tests, which could potentially lower the ICER to ≤US$1086, indicated that the study could be easily modified to become cost-effective. The potential net

benefits accrued from QALYs (and/or DALYs), and from other related sectors, could add to overall net benefits in CUA and CBA for policy decisions.

A cross-sectoral cost and benefits comparison involving sectors outside health is always a challenge in CEA, hence CEA analysis alone may not present the required economic evaluation framework needed for an appropriate policy decision (Cohen and Reynolds, 2008; Turner *et al.*, 2021, p. 10-13). A combination of analysis and ethical consideration is usually needed for an effective policy decision (Vlaev *et al.*, 2019). For instance, amidst scarce resources, the question of equity (and equality) among social-demographic gradients is also a necessary consideration in selecting programmes to be implemented (Sassi *et al.*, 2001, p. 19-21). Studies have indicated that economic incentives do not always produce a long-lasting behavioural change effect in young people and have to be supplemented with other social incentives for sustainability (Kavanagh *et al.*, 2010). Moreover, the ethical issue of equity, personal preferences, and socioeconomic status are determinant factors in the effectiveness of incentives as income levels and personal preferences determine the perceived value of financial incentives to an individual. Hence, a more tailored incentive scheme, which may not be financial, could be more effective (Vlaev *et al.*, 2019). A good alternative to the economic incentives used by Ekwunife *et al.* (2021) could be social-ecological incentives which can be material supports, social skills, and industrial-skills acquisition such as information technology communication (ICT), fashion designing, household consumer products (soaps and detergents, candles, confessionary) production, catering, baking, public speaking, community mobilization, sports, etc (Mercy Corps, 2020). These social and industrial skills, which are more population-goals specific or values-oriented, may cost a little more but will usually produce long-lasting behavioural change effects, and are more cost-effective in an extended CEA (Durantini and Albarracín, 2009; Kullgren *et al.*, 2016).

5. Conclusion

The challenge of HIV/AIDS programme adherence among adolescents in sub-Saharan is a serious public health issue. Several incentive programmes have been developed and implemented to promote the uptake of and adherence to interventions. The cost-effectiveness and sustainability of these programmes amidst declining financial allocations are important considerations for programmes selection and implementation among donors and policymakers. Hence, Ekwunife *et al.* (2021) examined the cost-effectiveness of an incentives-based HIV intervention among adolescents in Anambra State of Nigeria. The study showed that the intervention was not cost-effective based on the recommended ICER threshold and could become cost-effective if the number of laboratory tests for viral load and CD4 were reduced to ≤3. The study only considered the costs of activities and did not consider the shared costs, capital costs, and patient/family personal costs. The effectiveness measures did not include QALYs gained, DALYs averted, and social benefits from related sectors, such as, averted transmissions and deaths, lost manhours, etc. These excluded measures may have added to the cost-ineffectiveness and limitation of the study. Although the study was similar to that by Tozan *et al.* (2019), the computation of costs and effectiveness differs significantly due to the disaggregation of participants into subgroups in the latter. This may have influenced the "cost-effective" conclusion of Tozan's study. Ethical issues of accessibility from the perspective of equity and socioeconomic status are important factors that can influence policymakers' decisions, irrespective of the CEA. For programme long-term sustainability, material and socio-ecological incentives may be a more cost-effective alternative intervention. The Drummond checklist (Appendix 1) effectively identified and discussed the strengths and weaknesses of the evidence by Ekwunife et al. (2021), which could be helpful in policy decision-making, prioritizing HIV/AIDS programmes, and guiding future research directions.

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Supplementary Materials

Appendix 1: Drummond 10-question checklist assessment of Ekwunife *et al.* (2021)
Drummond (1987) 10-question checklist is used to identify key elements in published public health interventions for sound economic appraisal. The appraisal of Ekwunife *et al.* (2021) based on the checklist questions is presented below.

1. Was a well-defined question posed in answerable form?
   • Did the study examine both costs and effects of the service(s) or programme(s) over an appropriate time horizon? Yes (2019 base year)
   • Did the study involve a comparison of alternatives? Yes. The intervention was compared with the routine standard of care.
   • Was a perspective for the analysis stated and was the study placed in any particular decision-making context? Yes. (To assess the Cost Effectiveness of conditional economic incentives in HIV/AIDS programme toward informing policy)
   • Were the patient population and any relevant subgroups adequately defined? Yes – The patient population was adolescents age 10-19 year (Ekwunife *et al.*, 2018, p. 3; 2021, p. 3)
2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)?
   • Were any relevant alternatives omitted? Possibly – alternative forms of incentives such as skills (social and industrial) acquisition, and material supplies (free hospital meals, food items or household goods), may be good alternatives.
   • Was (should) a 'do nothing' alternative (be) considered? No, HIV requires treatment to achieve and maintain viral suppression in PLHIV. However, the control or comparison arm was subjected to only the standard of care without the intervention incentives.
   • Were relevant alternatives identified for the patient subgroups? No. There were no subgroups. The intervention was targeted at just one group, the adolescents, aged 10-19 years.
3. Was the effectiveness of the program or services established?
   • Was this done through a randomized, controlled clinical trial? If so, did the trial protocol reflect what would happen in regular practice? Yes. Data from cluster-randomised controlled trial were used in the cost-effectiveness analysis (CEA).
   • Were effectiveness data collected and summarized through a systematic overview of clinical studies? If so, were the search strategy and rules for inclusion or exclusion outlined? No, and not applicable because it was not a systematic review. The data for the CEA was based on a single c-RCT study.
   • Were observational data or assumptions used to establish effectiveness? If so, were any potential biases recognized? No observational data or assumptions were used to establish effectiveness. However, an in-depth interview was used to assess the perception of effectiveness from health care providers' perspectives in order to assess the feasibility of the intervention in Nigerian hospitals.
       If so, were any potential biases recognized? Possibly. All costs were corrected to the 2019 base year. However, there may have been errors due to cost variation between centers as detailed information on the hospital cost calculation was not provided. The sample size was also inadequate, which affected baseline viral suppression data in both arms, and this may have resulted in statistical interactions or effect modification.
4. Were all the important and relevant costs and consequences for each alternative identified?
   • Was the range wide enough for the research question at hand? No. long-term costs and consequences after the intervention year were generally not considered. Capital cost, personal cost from patients and families, were not included. The consequences (benefits) were only restricted to those stated in the primary and secondary outcomes, which did not include improvement in utility measures such as quality-adjusted life years (QALYs), disability-adjusted life years (DALYs), reduction in morbidity and mortality, etc., and benefits from related sectors.
   • Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers; other perspectives may also be relevant depending on the

particular analysis.) No. The in-depth interview reported only the viewpoints of the health care providers (Doctors, Pharmacists, Nurses, and Medical Laboratory Scientists) were provided. That of the patients and community were not covered by the study.

• Were the capital costs, as well as operating costs, included? No. Capital costs covering hospital facilities (building and equipment), data collection costs, and indirect costs from other sectors (patients and family costs) were not included (Ekwunife *et al.*, 2018, p. 6). Only operating costs covering items or components of the intervention (lab investigations, personnel costs for motivational interviewing, economic incentives, inpatient/outpatient costs, phone calls, and transportation) were included (Ekwunife *et al.*, 2021, p. 4-5).

5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost workdays, gained life years)?

    • Were the sources of resource utilization described and justified? Yes. Personnel costs were based on salaries of hospital staff, costs of medications (ART) and consumables were based on Global Fund Pooled Procurement Mechanism Reference Pricing for ART and buyer's median price of the International Medical Products Price Guide. Other costs were obtained directly from the hospital or as provided by previous survey studies (Ekwunife *et al.*, 2021, p. 3)

    • Were any of the identified items omitted from measurement? Yes. Capital and indirect costs, and QALYs and DALYs were omitted. If so, does this mean that they carried no weight in the subsequent analysis? No.

    • Were there any special circumstances (e.g., joint use of resources) that made measurement difficult? Yes, but it was not specifically reported. Were these circumstances handled appropriately? No.

6. Were the cost and consequences valued credibly?

    • Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views, and health professionals' judgments) Yes. Activity-based costing for resources used was adopted. Personnel costs were based on salaries of hospital staff, costs of medications (ART) and consumables were based on Global Fund Pooled Procurement Mechanism Reference Pricing for ART and buyer's median price of the International Medical Products Price Guide. Other costs were obtained directly from the hospital or as provided by previous survey studies (Ekwunife *et al.*, 2021, p. 3).

    • Were market values employed for changes involving resources gained or depleted? Yes. All costs were adjusted to 2019 base year. There was no discount rate because a base year was used and long-term projections were not considered in the analysis.

    • Where market values were absent (e.g. volunteer labor), or market values did not reflect actual values (e.g., clinic space donated at a reduced rate), were adjustments made to approximate market values? No, it was not applicable. Capital and indirect costs were not considered.

    • Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? Yes. The study was not focused on the allocative efficiency question, which would have best been evaluated by cost-benefit analysis, but more on the technical efficiency or feasibility of the intervention. The effectiveness measures were based on the percentage of participants with viral suppression of ≤20 copies/ml, which is appropriate for an incremental cost-effectiveness analysis (ICEA). The ICEA or cost-utility analysis (CUA) is also appropriate for a short- to medium-term intervention consideration. A cost-benefit analysis (CBA) would have been appropriate for a longer-term and a more holistic analysis for allocative efficiency.

7. Were costs and consequences adjusted for differential timing?

    • Were costs and consequences that occur in the future 'discounted' to their present values? No, there were no future cost projections. Costs were adjusted to 2019 prices using the implicit price deflators - gross domestic product (GDP) deflators.

    • Was there any justification given for the discount rate used? No. However, the study protocol indicated the year of completion of the study as 2019. There were no long-term projections made, and therefore no discounts assumed.

8. Was an incremental analysis of costs and consequences of alternatives performed?
   • Were the incremental costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? Yes. Although the CEA favours the intervention arm (Table 1, p. 5), but it failed the ICER threshold recommended by Woods *et al.* (2016), and therefore the intervention was considered not effective (Table 3, p. 6).

9. Was uncertainty in the estimates of costs and consequences adequately characterized?
   • If patient-data on costs and consequences were available, were appropriate statistical analyses performed? Yes. The % difference between both arms in participants with undetected viral loads was statistically determined as 11.7% while it was 8.9% after adjustment when adjusted for regimen change to Dolutegravir-based combination. The incremental cost-effectiveness ratio (ICER) of the intervention compared to the routine care was US$1419 per additional patient with undetected viral load. The confidence interval (CI) used in the statistical calculation was 95%.
   • If a sensitivity analysis was employed, was justification provided for the form(s) of sensitivity analysis employed and the ranges or distributions of values (for key study parameters)? Yes. A sensitivity test of variation of cost drivers by +/- 25% were performed to determine its effect on ICER. The sensitivity test indicated that the intervention was not viable based on Woods *et al.* (2016) cost-effectiveness threshold. Only a reduction in the number of tests for viral load or CD4 in the intervention arm could improve the cost-effectiveness of the intervention (Ekwunife *et al.*, 2021, p. 5 and 8).
   • Were the conclusions of the study sensitive to the uncertainty in the results, as quantified by the statistical and/or sensitivity analysis? Yes. The sensitivity analysis of the effectiveness due to regimen change to Dolutegravir-based combination increased the ICER to from US$ 1419 to US$1865 per additional patient with undetected viral load. Variation of cost drivers by +/− 25% varied the ICER to values between US$1169 and US$1669 per additional patient with undetected viral load.
   • Was heterogeneity in the patient population recognized, for example by presenting study results for relevant subgroups? Not applicable in terms of age group. The study population was not stratified by age, sex and socioeconomic status.

10. Did the presentation and discussion of study results include all issues of concern to users?
    • Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? Yes. The analysis and conclusion was based on incremental cost-effectiveness ratio (ICER) index, which was US$1419. The index was interpreted intelligently with reference to Woods *et al.* (2016, p.933) GDP per capita-based cost-effectiveness threshold for low/medium-income countries.
    • Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? Yes, the authors discussed the results in the context of other similar studies and aligned. Opportunity for methodical modification was also identified, for instance, the use of skill acquisition incentives instead of economic (financial) incentives for a more sustainable outcome. The limitations of the study were identified by the authors as inadequate sample size, significant difference in baseline viral suppression between the arms, exclusion of benefits in terms of QALY, exclusion of some costs (capital and data collection), and lack of inclusiveness or exclusion of patients in the in-depth interview.
    • Did the study discuss the generalizability of the results to other settings and patient/client groups? Yes, the generalizability of the intervention to other hospital settings in Nigeria was discussed. But the discussion was not exhaustive. Capacity building for client-centered counseling skills and increase remuneration of a team of dedicated care providers were identified as a factor for successful implementation in real-life setting.
    • Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? Partially. Amidst dwindling HIV intervention funds, the need for careful consideration of interventions to be included in HIV programmes was highlighted by the authors (Ekwunife *et al.*, 2021 p. 10). Ethical issues of equity and equality among individuals in the population were not discussed.

• Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' program given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programs? No. The study established that the economic incentives and motivational interviewing will only be cost-effective if the number of viral load and CD4 testing was reduced to between 1-3 time per year in the intervention arm. However, in real-life scenarios, other costs may arise from increased remuneration, and training of care providers, and the cost of data collection and analysis was excluded. Substituting economic incentives with social incentives such as skill acquisition may reduce cost, but more study will be needed to evaluate the cost-effectiveness or cost-benefit.

• Were the implications of uncertainty for decision-making, including the need for future research, explored? Yes to an extent, the study addressed issues of technical efficiency, but not much of allocative efficiency because it did not compare it to another intervention. However, factors that may determine real-life cost-effectiveness and feasibility were highlighted. The obvious limitations of the study were discussed, which could be mitigated in future research.