

Research Title: The Role of Health Economic Evaluations in Resource Allocation and Healthcare Spending in Nigeria

Introduction

As a developing nation, Nigeria faces numerous challenges in its healthcare system. One of the key challenges is the scarcity of resources, including financial, human, and infrastructural resources (Onwujekwe *et al.*, 2019). Limited funding poses a significant barrier to providing equitable and accessible healthcare services to the populace. The allocation of limited resources and effective healthcare spending are vital for achieving optimal health outcomes. Given the diverse healthcare needs and the scarcity of resources, it becomes imperative to employ health economic evaluation techniques as a guiding framework for decision-making in Nigeria. Health Economic evaluation provides a systematic approach to assessing the value of healthcare interventions, enabling policymakers to make informed decisions in the face of scarcity.

Economic evidence is increasingly being used for informing health policies. However, non-health economists do not always fully understand the underlining principles of health economic analyses, and inappropriate analyses and inconsistent methodologies may be used to inform health policy decisions (Turner *et al.*, 2021). In addition, there is a lack of open-access information and methodological guidance, particularly in low- and middle-income country (LMIC) settings. In Nigeria, there is a paucity of evidence on health economics research, and there are concerns that health economic evaluations are not being used for decision-making processes, especially in LMIC settings where this field of research is less well-established (Luz *et al.*, 2018).

The objective of this review is to provide a comprehensive and accessible introduction to economic evaluations for public health professionals, researchers, and policymakers in LMICs. By doing this, we aim to increase the overall understanding of

the key concepts underlining the different types of economic evaluations commonly used in the context of priority setting in healthcare, focusing on LMIC settings. This review will address currently used core methods of health economic evaluation and discuss how they can be used for resource allocation and healthcare spending, with a focus on Malaria interventions and emphasizing the potential benefits they can bring to the Nigerian healthcare system.

2.0. Discussion

2.1. Introduction to the main types of economic evaluations

Healthcare demand continues to grow; however, the resources available for healthcare are explicitly limited. As a result, obtaining the best value for the money spent on healthcare has been a top priority for governments worldwide, with economic factors playing an increasingly important role in the planning, management, and evaluation of health systems (Rabarison *et al.*, 2015). Health economic analyses can assess a health intervention's value for money and support the optimal allocation of the limited resources available for healthcare. Over time, health economic evaluations have become more important in guiding health policy (Hayati *et al.*, 2018).

What is Economic Evaluation

Economic evaluation aims to identify, measure, value, and compare the costs and consequences of several alternative programs or interventions. Economic evaluation is remarkably used in priority setting and allocating scarce healthcare resources, where policymakers are obliged to choose from alternative programs with different effects due to limited resources (Mosadeghrad *et al.*, 2022). Economic evaluation contributes to evidence-based decision-making in public health by helping leaders and the community identify, measure, and compare activities with the necessary impact, scalability, and sustainability to optimize population health.

Types of Economic Evaluation

There are different approaches used for health economic analyses. Some types of analysis only examine the costs of an intervention or a disease (e.g., cost of illness studies) independently. In contrast, other types of analysis evaluate both the costs and consequences of an intervention.

Full Economic Evaluations vs. Partial Evaluations

Full economic evaluations are a specific type of health economic analysis that explicitly compare the costs (use of resources) and consequences (effects) of the health intervention(s) in question to an alternative course of action, known as the comparator. Therefore, even when simply examining one health intervention or policy, full economic evaluations formally evaluate at least two different courses of action. In the context of an economic review, the comparator, also known as the counterfactual or baseline scenario, is often chosen to reflect accepted practices or standards of care. For example, an economic evaluation of introducing the human papillomavirus vaccine in the UK would use the pre-existing cervical cancer screening program as the comparator (Turner *et al.*, 2021).

In contrast, partial evaluations (also referred to as partial economic evaluations) are studies that either:

1. Only examine the costs or consequences of an intervention independently, i.e., they do not look at both or relate the costs to the consequences. For example, a costing study would evaluate only the costs associated with an intervention (but not compare these to its consequences).
2. Examine both the costs and consequences of an intervention but only evaluate a single course of action (a cost-outcome study). By doing this they are either explicitly or implicitly ignoring the comparator, which may overlook relevant

costs/consequences and does not allow for comparisons to relevant alternative policy options for that setting.

These analyses are therefore not a full economic evaluation—which has to formally compare the costs and consequences of the interventions in question to a comparator scenario. Although partial evaluations can provide useful information, they cannot alone guide decision-making as only knowing an intervention’s cost or the economic burden of a disease does not indicate an intervention’s value of money. In the context of informing healthcare decision-making surrounding resource allocation, it is vital to evaluate both the costs and consequences of the intervention in question and to compare it to a relevant alternative course of action/policy option (Turner *et al.*, 2021)

Different Types of Full Economic Evaluations

There are five main types of full economic evaluations used to inform and evaluate health interventions (outlined in Table 1). This review will focus on the most widely used types, i.e., cost-effectiveness/cost-utility analyses, and cost-benefit analyses (Mosadeghrad *et al.*, 2022). There are other types of full economic evaluations, namely cost-minimisation analysis and cost-consequence analysis but these are less commonly performed, and in the case of cost-minimisation analysis, it is only appropriate in rare circumstances (Udeh, 2020).

These different economic evaluations are based on similar principles. However, while they may first appear to be interchangeable, they differ in their fundamental methodology and interpretation. A key difference across the different types of full economic evaluation is how the outcome is expressed (Table 1). Cost-benefit analysis is a way to compare the costs and benefits of an intervention, where both are expressed in monetary units (Centers for Disease Control and Prevention, 2021).

In contrast, cost-effectiveness analyses measure the health consequences of the health intervention in a single natural unit (such as life-years gained, cases averted, or cases detected), and cost-utility analyses (a specific type of cost-effectiveness analysis) measure the health consequences using a generic measure of health status that considers the effects on both mortality and morbidity, such as DALYs and QALYs (WHO, 2003; Udeh, 2020).

There is also variation in how these different analyses consider the efficiency of resource allocation (Table 2). Cost-benefit analysis is traditionally based on a welfarist approach foundation, where the health outcomes are judged by the extent of their contribution to overall societal welfare based on the preferences of the individuals (their willingness to pay). In contrast, cost-effectiveness/cost-utility analysis is based on an extra-welfarist approach foundation, where the objective is traditionally to maximise contributions to societal health, measured as the sum of individual health status (Turner *et al.*, 2021)

Table 1. The key types of full economic evaluations (Turner *et al.*, 2021).

Type	Description
Cost-effectiveness analysis	a form of comparative economic analysis that evaluates two or more policy alternatives in terms of their relative costs and outcomes, where the outcomes are measured in a single natural unit (e.g., life-years gained, disease case averted etc.)
Cost-utility analysis	Cost-utility analysis (a specific type of cost-effectiveness analysis) is a form of comparative economic analysis that evaluates two or more policy alternatives in terms of their relative costs and outcomes, where the outcomes are expressed by a generic measure of health status that considers both the effect on mortality and morbidity (e.g., quality-adjusted life-years (QALYs) and disability-adjusted life-years (DALYs)).
Cost-benefit analysis	Cost-benefit analysis is a form of comparative economic analysis that evaluates two or more policy alternatives in terms of their relative costs and outcomes, where both the costs and outcomes are expressed in monetary terms. In principle, it should value the intervention's relevant costs and outcomes based on the preferences of those affected (i.e., the individuals' willingness to pay)
Cost-minimization analysis	Cost-minimization analysis is a form of comparative economic analysis that compares the costs of two or more policy alternatives which are all assumed to have equivalent health effects.
Cost-consequence analysis	Cost-consequence analysis is a form of comparative economic analysis that evaluates two or more policy alternatives in terms of their relative costs and outcomes, where the outcomes are not summarized in a single measure, and multiple outcomes of interest are reported.

Key Application of Economic Methods for Resource Allocation in Nigeria (with a focus on Malaria Interventions).

According to the World Health Organization (WHO, 2023), Nigeria accounts for 31% of the four countries that accounted for over half of malaria deaths globally. Several studies have reported the high-cost burden of malaria on households and healthcare facilities in Nigeria (Onwujekwe *et al.*, 2013; Adekanye and Ajiboye, 2020).

A study by Onwujekwe *et al.*, (2013) estimated a recurrent provider cost per case of malaria treatment with results showing a high cost of treatment in the health facility. Similarly, results from (Ezenduka *et al.*, (2017) showed that the annual cost of treating uncomplicated malaria through a public health facility represents 25% of the hospital's total expenditure. According to the (Federal Ministry of Health, 2015), the disease is estimated to retard Nigeria's gross domestic product (GDP) by 40% annually and cost approximately 480 billion naira (approximately US\$1.5 billion) in out-of-pocket treatments, prevention costs, and loss of man-hours.

Cost-effectiveness analysis:

According to reports, malaria investments worldwide fall short of the expected resources required to meet progress goals (Fachem *et al.*, 2019; Rannan-Eliya, 2022). There are many highly affordable measures that can be used to lessen the impact of malaria. Long-lasting insecticide-treated nets (LLINs), indoor residual spraying (IRS), and larval source management (LSM) have all been shown to be highly successful in lowering infection and mortality in numerous trials and in various settings (Chimbari and Gunda, 2017; Conteh *et al.*, 2021).

Existing malaria modelling tools enable policymakers to estimate the epidemiological impact of scaling-up combinations of programmes or to estimate the requirements to achieve global targets (Hamilton *et al.*, 2017; Runge *et al.*, 2020). However, many countries, particularly in sub-Saharan Africa, are far from malaria

elimination and require practical advice on how to allocate their current or projected budgets at the state and country level in a way that achieves maximum impact (WHO, 2017). 'Optima' is an analytic approach to assist decision-making around allocative efficiency. Allocative efficiency refers to the maximization of health outcomes using the most cost-effective mix of health interventions. It was developed by the Burnet Institute and the University of New South Wales in partnership with the World Bank to assist in optimizing resources for reducing the burden of diseases, particularly HIV/AIDS (Fraser *et al.*, 2015; Kerr *et al.*, 2015).

Optima has been used to successfully shift the allocation of actual budgets towards programmes with greater cost-effectiveness to improve health outcomes in over 40 countries (Scott *et al.*, 2017). (Scott *et al.*, 2017) employed the use of the "optima" model to suggest how shifting funds between geo-political regions in Nigeria can target resources to where they are most needed. The model can determine the optimal allocation of a given budget across a range of malaria interventions, geographical areas and risk populations, to minimize a user-defined objective (e.g., incidence, mortality). The study showed that using "optima" (allocative efficiency gains) in Nigeria could avert approximately 84,000 (15% of deaths) and 15.7 million (51% of malaria cases) over 5 years. The optima model suggests that optimizing the allocation of scarce funding in targeted geographical regions according to epidemiological reports to maximize reductions in malaria morbidity and mortality is a priority for malaria control programmes in Nigeria and globally.

Cost-utility Analysis:

Systematic reviews on the cost-effectiveness of malaria interventions show that most malaria interventions are cost-effective in terms of cost-per-DALYs averted per each malaria intervention (White *et al.*, 2011; Chimbari and Gunda, 2017) and that the combination of malaria interventions was more cost-effective than single interventions. For instance, While ITNs have been highly effective at reducing prevalence and

incidence across the continent, sustaining and increasing access to these interventions remains a concern. Combined malaria interventions have been shown to deliver substantial efficiency gains compared to single interventions. For instance, ITN distribution was shown to be a more cost-effective intervention when added to antenatal services (Scates *et al.*, 2020)

Cost-benefit analysis:

Cost-benefit analysis has been referred to by experts as the gold standard economic evaluation approach and it is also used within other public sectors (Rabarison *et al.*, 2015; Chang *et al.*, 2017; Turner *et al.*, 2021). Cost-benefit analyses can be used to consider the optimal allocation of resources in its broadest sense because once the benefits have been converted into monetary terms then the net economic benefit of different activities can be compared (including to those outside of the healthcare sector). It can therefore consider allocative efficiency across different sectors/across society.

In the case of malaria interventions, CBA can be used to

- Identify and quantify the costs associated with implementing the malaria interventions. This may include expenses such as procurement of bed nets, insecticides, diagnostic equipment, training of healthcare workers, distribution logistics, and ongoing monitoring and evaluation.
- Quantify Benefits: Estimate the potential benefits resulting from the malaria interventions. It is crucial to consider factors such as reduced malaria-related mortality and morbidity, decreased healthcare costs, improved productivity, and enhanced quality of life, and to gather data from reliable sources, such as epidemiological studies and health records, to estimate the impact of interventions on these factors.
- Monetize Benefits: Assign monetary values to the benefits to enable comparison with the costs. This can involve estimating the economic value of a statistical life

(VSL) to assess mortality benefits and using economic indicators such as productivity gains and healthcare cost savings. This would require using existing research, country-specific data, and expert opinions.

- **Discounting:** Apply discounting to both costs and benefits to account for the time value of money. Future costs and benefits are typically discounted to present value using an appropriate discount rate. This step ensures that future costs and benefits are adjusted for their relative value compared to immediate costs and benefits.
- **Calculate Net Present Value:** Calculate the net present value (NPV) by subtracting the discounted costs from the discounted benefits. A positive NPV indicates that the benefits outweigh the costs, while a negative NPV suggests that the costs exceed the benefits.
- **Sensitivity Analysis:** Conduct sensitivity analysis to assess the impact of varying assumptions and parameters on the results. This helps to evaluate the robustness of the findings and understand the uncertainties associated with the analysis.
- **Decision-Making:** Finally, the results of the cost-benefit analysis can be used to inform decision-making. The NPV of different interventions could be compared to determine which ones provide the greatest net benefits. Also, budget constraints, implementation feasibility, and other factors alongside the economic analysis should be considered when making decisions.

Studies around the cost-benefit analysis of malaria interventions in Nigeria are scarce, however, a study undertaken in Ghana showed that scaling up LLINs distribution in the country, so that household coverage of LLIN is sustained at 90 per cent will avoid 40,390 deaths between now and 2030. Because providing bed nets is relatively inexpensive compared to other interventions (Nketiah-Amponsah *et al.*, 2020). It is important to note that cost-benefit analysis provides a framework for

evaluating interventions based on their economic efficiency. However, other factors, such as equity, and sustainability, should also be taken into account during the decision-making process to ensure a comprehensive evaluation of malaria interventions.

TABLE 2 | A summary of how the different types of analyses consider the efficiency of resource allocation and examples of their use
(Turner *et al.*, 2021)

	CEA	CUA	CBA
How do they consider the efficiency of resource allocation?	Cost-effectiveness analyses using disease or programme-specific metrics are often only concerned with how to use healthcare resources in a way that maximises their output for the cost. As such they are considering technical efficiency, identifying the option that provides the maximal health care for a given cost, or delivering a certain service at a minimal cost	Cost-utility analyses can consider the optimal allocation of healthcare resources (such as the mix of interventions) in a way that results in the maximum health gain for a given level of expenditure. In this way, it considers allocative efficiency within the health sector (i.e., it only deals with quasi-allocative assessments)	Cost-benefit analyses can be used to consider the optimal allocation of resources in its broadest sense because once the benefits have been converted into monetary terms then the net economic benefit of different activities can be compared (including to those outside of the healthcare sector). It can therefore consider allocative efficiency across different sectors/across society
Examples of when it is useful	Useful when a stakeholder is interested in a particular output metric and/or when you do not need to compare the outcome to other interventions/policy options. For example, comparing a range of different malaria interventions when investigating the cost per case averted	Useful for informing health policy decisions when directly comparing different health interventions that fall within the same budget or benefit package (such as when considering the optimal allocation of a health care budget). For example, deciding if a new vaccine or treatment should be adopted within a national health benefit package	Useful for cross-sectoral comparisons, such as looking at if other government spending should be reallocated to the healthcare sector. Also, useful when evaluating health policy/interventions where the health outcome metrics are not suitable. For example, for considering non-pharmaceutical interventions for COVID-19 control in terms of both health and non-health outcomes.

Strengths and Limitations

This literature review is among the first to provide a comprehensive overview of health economic evaluations and their applications for resource allocation in Nigeria in recent years. By synthesizing information from a variety of sources, this review provides a holistic understanding of economic evaluations of healthcare resources and interventions. Researchers can identify best practices and successful approaches to health economic evaluation. This information can inform policymakers, and other stakeholders in designing effective strategies and interventions. A major limitation of this study is the contextual limitation. The applicability of findings from other countries or settings may not directly translate to the Nigerian context considering variations in healthcare systems, however, applicability has been tailored to the Nigerian context.

Recommendations and Conclusion

1. Resource allocation: This review has demonstrated how economic evaluations provide evidence of the cost-effectiveness and efficiency of health interventions (malaria). There is a need for policymakers and health authorities to conduct economic evaluations to allocate scarce resources effectively by prioritizing interventions that provide the greatest health outcomes to areas where they can have the greatest impact on the country. Conducting economic evaluations can guide resource allocation decisions, ensuring that limited resources are directed towards interventions that yield the highest return on investment in terms of health benefits.
2. Priority setting: Nigeria faces numerous health challenges and there is a need to set priorities within the healthcare system. Conducting economic evaluations aid in priority setting by comparing the costs and benefits of different interventions across various disease areas. Prioritizing interventions based on their cost-effectiveness ensures that limited resources are directed towards interventions with the greatest potential to improve population health.
3. Moving forward there needs to be greater awareness within the public health field of the foundations, advantages and limitations of the different types of economic evaluations used for informing resource allocation decisions, especially in LMICs.

In low- and middle-income countries (LMICs), the need for health economic evaluation is paramount. Health economic evaluations provide a systematic framework for assessing the costs and benefits of different health interventions, enabling policymakers, stakeholders, and healthcare providers to optimize resource allocation, prioritize interventions, and maximize health outcomes

In addition to informing decision-making and priority setting, health economic evaluations also play a crucial role in attracting external funding. International organizations and donor agencies often require evidence of cost-effectiveness and value for money before providing financial support for health programs in LMICs. Conducting economic evaluations can help demonstrate the impact and efficiency of interventions, increasing the likelihood of securing external funding and resources to implement much-needed healthcare interventions.

However, it is important to acknowledge that health economic evaluations should not be the sole determinant of resource allocation or policy decisions. Other factors, such as equity, social determinants of health, and cultural contexts, must be considered alongside economic evidence. Additionally, capacity building in conducting and using economic evaluations is crucial to ensure that LMICs can independently generate and utilize the evidence to inform decision-making processes effectively.

In conclusion, health economic evaluation studies in Nigeria are paramount for the provision of evidence for policymakers. By employing economic evaluation techniques, policymakers can navigate the challenges of resource scarcity, optimize healthcare spending, promote equity and strengthen the healthcare system. Embracing health economic evaluation as a fundamental component of decision-making processes will help Nigeria move towards a more efficient, equitable, and sustainable healthcare system, ultimately leading to improved health outcomes for its citizens.

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