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RESEARCH ARTICLE

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Supporting the revision of the health benefits package in Uganda: A constrained optimisation approach

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Abstract

This study demonstrates how the linear constrained optimization approach can be used to design a health benefits package (HBP) which maximises the net disability adjusted life years (DALYs) averted given the health system constraints faced by a country, and how the approach can help assess the marginal value of relaxing health system constraints. In the analysis performed for Uganda, 45 interventions were included in the HBP in the base scenario, resulting in a total of 26.7 million net DALYs averted. When task shifting of pharmacists' and nutrition officers' tasks to nurses is allowed, 73 interventions were included in the HBP resulting in a total of 32 million net DALYs averted (a 20% increase). Further, investing only \$58 towards hiring additional nutrition officers' time could avert one net DALY; this increased to \$60 and \$64 for pharmacists and nurses respectively, and \$100,000 for expanding the consumable budget, since human resources present the main constraint to the system.

KEYWORDS
constrained optimization, cost-effectiveness, health benefits package, linear programming, resource allocation

JEL CLASSIFICATION
C610, I180

1 | INTRODUCTION

All public health systems are faced with the crucial question of how best to allocate their limited resources in order to maximise the benefits they produce. This question is particularly pressing in low- and middle-income countries (LMICs) where the resource constraints, financial and other, mean that many health services cannot be provided to all those in need (Glassman et al., 2017). It is widely recognized that there is a considerable gap between the aspirational health plans of LMICs and actually available resources (Glassman and Chalkidou, 2012; Ochalek et al., 2018). Health Benefits Packages offer a potential solution to the implicit sub-optimal rationing of resources (Keliddar et al., 2017) which occurs as a result of this mismatch. By changing from ad hoc or implicit priority setting and rationing of services, to systematic, evidence-based and transparent priority setting based on cost-effectiveness analysis (CEA), countries can substantially improve health outcomes, improve access to important high-quality services and achieve national and global sustainable development goals (SDG) targets (World Health Organisation (WHO), 2021).

In the context of HBPs, CEA is concerned with maximizing the population health benefits (considering other priorities such as equity) obtained from the services in the package, given the resources available. This can be characterized in the form of a constrained optimization problem (Sculpher et al., 2017). The approach has previously been applied in studies optimizing the distribution of a specific intervention among the eligible population (Buhat et al., 2021; Han et al., 2021; Standaert et al., 2020), studies optimizing the choice of interventions within a single disease area or programme (Barnum and Barlow, 1984; Sauboin et al., 1080), and theoretical analyses (Zon and Kommer, 1999; Becker and Starczak, 1997; Stinnett and Paltiel, 1996; Heffley, 1982; Zaric and Brandeau, 2001; Gandjour, 1586). The approach has also been discussed in broader methods guidelines (World Health Organisation (WHO), 2021; Crown et al., 2017; Crown et al., 2018; Earnshaw and Dennett, 2003; Kaplan and Pollack, 1998). Among the empirical studies, those which took a more comprehensive view of the health sector rather than a specific disease or programme only applied an "overall" financial constraint facing a health system reflecting the financial cost of all resource inputs (Lofgren et al., 2021; Varghese et al., 2020). While such an approach may be suitable over the long run over which all resources are potentially flexible, in the short run, there are multiple constraints on care both financial and non-financial (vanBaal et al., 2018; Walker et al., 1177; Revill et al., 2018). There is a need, therefore, for empirical research to demonstrate how other resource constraints can be captured in conjunction with the public health budget constraint to arrive at an optimal HBP.

This study demonstrates the use of a linear constrained optimization approach to develop a health benefits package which maximises the net health impact (or net disability adjusted life years, DALYs, lost averted) given the financial and physical resource constraints of Uganda's public health sector. Recognising the "human resources for health crisis" in the region, this study focuses on the size and composition of the workforce in Uganda to capture physical resource constraints. However, the analytical framework offers the flexibility to include other health system constraints and can be applied to answer some of the most pressing resource allocation decisions facing ministries of health, for example, – which interventions represent "best buys" within the health system; where investments in health systems strengthening should be made and how much the government can afford to pay for health systems strengthening; implications of donor funding conditionalities; and the impact of task shifting among health workers.

2 | METHODS

2.1 | Overview

A constrained optimization approach was used to identify the optimal list of services to be included in Uganda's HBP. The approach is set up as a linear programming problem (LPP) to choose the level of optimal coverage of each possible intervention in order to maximise the population health benefit while ensuring that the resources required to deliver the interventions do not exceed those currently available in Uganda. The LPP can be represented as follows:

$$maximise \sum_i x_i n_i v_i$$

$$s.t. \sum_i x_i n_i c_i \leq B$$

$$\sum_i x_i n_i l_{ij} \leq L_j \, \forall \, j \in J$$

$$0 \leq x_i \leq 1 \, \forall \, i$$

$$\sum_{i \in S_k} x_i n_i \leq \max_{i \in S_k} n_i \, \forall \, S_k; \; S_k \in S$$

$$\rho_l x_{base_l} n_{base_l} - x_{a_l} n_{a_l} \geq 0 \, \forall \, C_l = \{base_l, a_l\}; C_l \in C$$

where $\boldsymbol{x_i}$ = percentage of people receiving intervention i (decision variable)

$\boldsymbol{n_i}$ = number of patients eligible for intervention i

$\boldsymbol{v_i}$ = net DALYs averted per patient treated with intervention i

$\boldsymbol{c_i}$ = consumables cost of intervention i per patient

$\boldsymbol{B}$ = total annual budget for consumables

$\boldsymbol{l_{ij}}$ = time requirement of cadre j per patient treated with intervention i

$\boldsymbol{L_j}$ = total time available of cadre j; J is the set of all relevant cadres

$\boldsymbol{S_k}$ = set of substitutable interventions in group k; S is the set of all such substitutable sets of interventions

$\boldsymbol{C_l}$ = pair of complementary interventions, $\{base_l, a_l\}$, in group l; C is the set of all such complementary pairs

$\boldsymbol{base_l}$ = base intervention, the delivery of which is a pre-requisite for the delivery of intervention a_l in the complementary pair C_l

$\boldsymbol{a_l}$ = complement, which can only be provided to a proportion of people receiving base intervention, $base_l$, in the complementary pair C_l

ρ_l = proportion of people receiving the base intervention, $base_l$, who are eligible for intervention a_l

The following sub-sections describe the components of the LPP in further detail. The analysis was performed using the lpSolve package (Csardi, 2022) on R 4.1.2. The analysis script and input data are freely available here https://github.com/sakshimohan/uganda_hbp.

2.2 | Decision variables

The decision variables in our LPP are the level of coverage of various health interventions (as a percentage of people eligible for interventions) in the HBP, allowing for the possibility of complete exclusion of interventions from the package (i.e., 0% coverage). Interventions are assumed to be independent of each other, that is, their costs and effects do not depend upon which other interventions are provided, and costs and health effects are linear in implementation. Therefore, we do not reflect any economies of scale. A total of 275 interventions were considered for inclusion in the Ugandan HBP. This list was drawn from the 2015/16–2019/20 HBP for Uganda (Government of Uganda, 2015), as well as cost-effectiveness literature, where cos t-effective substitutes of interventions from the former were found. Of these 275 possible interventions, minimum data for the LPP could be obtained for 125 interventions, which were then considered for inclusion in the HBP. These interventions represent the majority of the disease burden in Uganda (Institute for Health Metrics and Evaluation, 2020).

2.3 | Objective function

The objective is to *maximise* the health benefit provided by the chosen set of interventions, which is measured in terms of net disability adjusted life years (DALYs). Net DALYs are measured as DALYsaverted by the intervention less DALYs averted forgone as a result of limited resources being committed to the intervention not being available for other purposes (i.e., the health opportunity cost, measured using a cost-effectiveness threshold (CET)). Net DALYs rather than DALYs alone are used in the objective function to incorporate the consequences of future, downstream costs. The choice of CET is crucial to this calculation. Based upon a study that estimates the marginal productivities of health systems—that is, the health consequences associated with changes in budget - the CET for Uganda was assumed to be $161 (Lomas et al., 2021).

2.4 | Constraints

The constraints represent the capacity of the health system to deliver health interventions. In our analysis, we consider the following health system input constraints—*i. the size of the resource envelope to purchase consumables*, and ii. *the size of the health workforce sub-divided among five cadres (doctors and clinical officers, nurses, pharmacists, nutrition officers, and mental health officers).*

Further constraints were installed to ensure that the sum of coverage of interventions which were substitutes did not exceed the size of the eligible population (see supplementary Table S7 for the list of substitutable interventions). Substitutable interventions are those among which only one needs to be provided to the eligible population to avoid duplication.

Finally, constraints were also added to represent complementarity between interventions. This was done by ensuring that the number of cases of the "complement" (which can only be included in the package if the base intervention has been included) was less than or equal to the appropriate proportion (ρ) of optimal number of cases covered by the base intervention (the delivery of which is a pre-requisite for the delivery of the complement). See supplementary Table S8 for the list of complementary interventions.

2.5 | Data

Data for the specification of parameters for these interventions were obtained from a range of sources for the year of analysis (2020) (see Table 1). For the objective function, DALYs averted per case and full healthcare cost estimates were obtained from existing cost-effectiveness literature. In the first instance, we searched for the intervention in the Global Health Cost-effectiveness Registry (GHCEA) (Center for the Evaluation of Value and Risk in Health (CEVR) Tufts Medical Center) data. Where cost-effectiveness evidence was available from multiple sources, we applied the following criteria to choose the most relevant study in order of priority—*i*. comparator is null, ii. the study was conducted in Uganda, iii. the study was conducted in Sub-Saharan Africa, iv. CEVR-assigned quality score. Where relevant CE evidence was not found in the GHCEA, we carried out a search on Pubmed. Estimates of the size of the eligible population for each intervention were obtained using inputs into the OneHealth Tool (OHT) (World Health Organisation (WHO)) used to cost the Health Sector Development Plan (HSDP) II 2020/21—2024/25 (Government of Uganda, 2019). Where this information was missing or incorrect, estimates were obtained from published literature and reports, including but not limited to the Global Burden of Disease (GBD) 2017 study (James et al., 2020).

The cost of consumables required for interventions was primarily derived from the OHT and, where this information was not available, we extracted consumables cost data from the relevant cost-effectiveness study or other literature using a Pubmed search, when the cost-effectiveness study did not provided disaggregated costs. Estimates of health worker time required to deliver interventions came from the Workforce optimization model (WFOM) exercise carried out for the Malawi human resources for health strategic plan, 2018–2022 (Government of Malawi, 2018) which captured the number of minutes required to provide common health services based on time-motion observations and expert opinion. In the absence of local data, we assumed that the health worker time requirements in Uganda would be identical to those recorded in Malawi. Where specific interventions were not found in the WFOM, we drew estimates from the intervention input assumptions manual for the OHT (Avenir Health, 2016) and expert opinion from Uganda MOH.

The size of the current health workforce (2020) and average annual patient-facing time available per health worker was established through consultations with the Ministry of Health, Uganda. The consumables budget was assumed to be the same as that in 2020, obtained from the government's budget records. These constraints were established based only on the public healthcare sector as well as the private not-for-profit sector supported financially by the government, both of which provide free

TABLE 1 Data sources for model parameters.

Model parameter	Data source
Cost-effectiveness of interventions (DALYs averted per person, cost per person)	Literature search, including but not limited to the global health cost-effectiveness registry (Center for the Evaluation of Value and risk in Health (CEVR) Tufts Medical Center) and WHO-CHOICE (World Health Organisation)
Eligible population	OneHealth tool (OHT) (World Health Organisation) used to cost HSDP II 2020/21-2024/25 (Government of Uganda, 2019); The global burden of disease (GBD) 2017 study (James et al., 2020)[a]
Consumables cost	OHT (World Health Organisation) used to cost HSDP II 2020/21-2024/25; Relevant cost-effectiveness study[a]
Health worker time required	Workforce optimization model exercise for the Malawi human resources for health strategic plan, 2018–2022[b] (Government of Malawi, 2018); Intervention input assumptions manual for the OHT (Avenir Health, 2016); Expert opinion
Health opportunity cost	Lomas et al. (2021)
Consumables budget	Government of Uganda (GoU) budget records
Health worker capacity	MoH HR records, consultation

[a]The data obtained from these sources was complemented with a literature search.

[b]The data obtained from this source was complemented with inputs from staff at the Ministry of Health, Uganda.

or heavily subsidized health care. Supplementary Table S1 provides data on all the included parameters on the 125 candidate interventions for which evidence is currently available. Supplementary Tables 2–4 provide the assumptions made on the health system input constraints.

All monetary figures are presented in 2019 US$.

2.6 | Extensions

2.6.1 | Allowing for task shifting

The acute shortage of health workers in many sub-Saharan African countries (World Health Organisation, 2021) means that gaps in workforce size and composition are often filled through task-shifting, particularly to nurses (Crowley and Stellenberg, 2015; Ugochukwu et al., 2013). In order to capture this, we consider a scenario under which nurses are able to substitute for nutrition officers and pharmacists; we assume that the nurse time required to deliver interventions is the same as that of nutrition officers and pharmacists. We refer to this scenario as the task-shifting scenario.

2.6.2 | Effect of removing health workforce constraints

We run an additional scenario excluding the non-financial constraints, that is, the size of the health workforce, from the LPP. We demonstrate the effect of this omission on the inclusion of interventions into the HBP, its health impact as well as resource use implications.

2.6.3 | Estimation of the marginal value of relaxing health system constraints

The constrained optimization approach allows for additional analyses on the effect of relaxing some of the constraints applied. In particular, we assess how much health is gained from investing an additional $1000 towards each resource, that is, towards the consumables budget and salaries of health workers (see supplementary Table S9 for salary figures used). Conversely, we also present the additional investment required in each of these health system components in order to avert a single DALY at the margin. This generates an incremental cost-effectiveness ratio (ICER) of these investments, estimated as a cost-per-DALY-averted, which can be compared to results of other cost-effectiveness studies.

3 | RESULTS

Under the base scenario, the linear constrained optimization approach provides an optimal HBP consisting of 45 interventions averting 26.7 million net DALYs, which can be feasibly delivered within Uganda's health system constraints. Table 2 provides a summary of the health impact and resource requirements of this HBP. We observe that a significant proportion of the capacity

TABLE 2 Summary of results from constrained optimization.

	Scenario	
Constraints applied	**Base scenario**	**Task-shifting scenario**
Number of interventions in the optimal package	45	73
Net DALYs averted	26,714,032	32,045,499
Total DALYs averted	34,819,184	40,508,535
Highest ICER in the HBP	122	122
Percentage of consumables budget required	60%	100%
Percentage of medical/clinical officer capacity required	38%	86%
Percentage of nursing staff capacity required	45%	100%
Percentage of pharmaceutical staff capacity required	100%	100%
Percentage of mental health staff capacity required	59%	59%
Percentage of nutrition staff capacity required	100%	100%

TABLE 3 Rate of inclusion of interventions from different disease programs in the optimal HBP.

Program	Number of interventions included in the analysis	Interventions included in the optimal package (base scenario)		Interventions included in the optimal package (task-shifting scenario)	
		Number	Percentage	Number	Percentage
HIV and other STIs	22	8	36%	12	55%
IMCI	4	0	0%	3	75%
Malaria	7	4	57%	5	71%
Mental health	6	1	17%	1	17%
NCDs	24	5	21%	6	25%
NTDs	3	2	67%	3	100%
Nutrition	10	3	30%	5	50%
RMNCH	34	18	53%	27	79%
TB	8	2	25%	6	75%
Vaccine preventable diseases	7	2	29%	5	71%
Grand total	125	45	36%	73	58%

of health workers and the consumables budget remains underutilised under this scenario due to the limited availability of pharmacists to dispense drugs. We therefore consider a more realistic case where, upon the exhaustion of pharmacist and nutrition officer time, their tasks are taken up by nurses (task shifting scenario). This results in the exhaustion of the consumables budget as well as the capacity of three out of five health worker cadres while adding 28 more interventions to the optimal HBP and increasing the number of net DALYs averted by 20%.

Further, the least cost-effective intervention included in the package under both our scenarios is "Schistosomiasis Mass drug administration (adults)" with an ICER of $122. This is lower than the CET we used of $161.

The above results can be further analysed by disease program, namely HIV and other sexually-transmitted infections (STIs), integrated management of childhood illnesses (IMCI), malaria, mental health, non-communicable diseases (NCDs), neglected tropical diseases (NTDs), nutrition, reproductive, maternal, neonatal and child health (RMNCH), tuberculosis (TB), and vaccine preventable diseases. Table 3 provides the proportion of interventions from each program included under the two scenarios. Under both scenarios, RMNCH, and HIV and other STIs together account for more than half of all the interventions in the HBP. Task shifting allows more interventions to be included from all programs except mental health. Figure 1 shows the distribution of health system resource use by program and how this changes under the task-shifting scenario. By allowing task shifting, the proportional allocation of resources towards RMNCH, NCDs and vaccine preventable diseases increases. Supplementary Tables S5 and S6 provide intervention-level detail on coverage and resource use for the two scenarios.

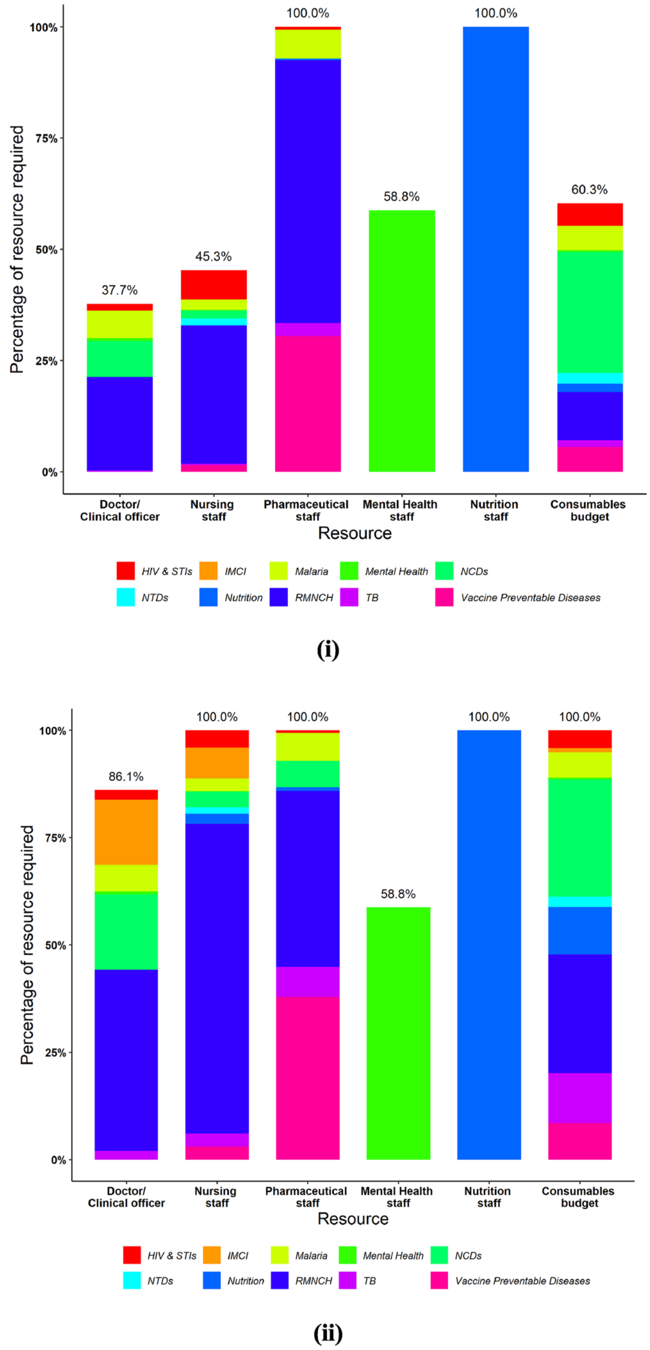
3.1 | Effect of removing health workforce constraints

Supplementary Table S10 demonstrates the effect of excluding the health workforce constraint from the LPP. We note that while this omission allows for a larger HBP and health impact, the resource requirements of the resulting HBP far exceed the capacity available in Uganda and would therefore make it infeasible to implement using the current resources available.

3.2 | Marginal value of health systems components

The marginal value of relaxing health system constraints depends on the amount of additional health generated by relaxing each constraint. Figure 2 provides estimates of the net DALYs averted if an additional $1000 were spent on each of the health system components, under the two scenarios. Evidently, constraints which are not met in both scenarios will have a null marginal value (here, doctors/clinical officers and mental health staff). Overall, investing in health worker time provides a considerably better outcome than expanding the consumables budget. Under the base scenario, hiring additional pharmaceutical time provides the biggest positive health impact. Under the task-shifting scenario, hiring additional nutrition officer time provides the biggest impact because this helps increase the coverage of a highly cost-effective life-saving intervention - management of moderate acute malnutrition (MAM) among children. Among the other health worker cadres, marginal value depends on whether task shifting to nurses is allowed. Without task shifting, nutrition officers have the next highest marginal value after pharmacists and with task-shifting, the marginal value of investing in pharmacists and nursing staff time respectively follows that of nutrition officer time. These results

FIGURE 1 Health system resource use by program: (a) Base scenario, (b) Task-shifting scenario: This figure illustrates the proportional distribution of health system resources across various healthcare programmes in the case of optimal resource use under the two scenarios.



can also be interpreted in terms of the cost per DALY averted. Under the task-shifting scenario, an additional $100,000 would need to be allocated towards the consumables budget to avert an additional DALY, net of opportunity costs. Among health workers, the cost of averting an additional net DALY is $58, $60 and $64 if invested towards hiring additional time nutrition officers, pharmacists and nurses respectively. These estimates include the administrative costs of employing additional staff and factor in the health effects and the full costs, including downstream costs, of the interventions these health workers would be able to provide.

4 | DISCUSSION

This study provides an analytical approach to inform the scope and scale of a HBP. We build upon previous work (Ochalek et al., 2018; World Health Organisation (WHO), 2021) by providing a method to explicitly account for multiple constraints which simultaneously limit the capacity of the health system to deliver services. We also show how not accounting for these constraints results in an aspirational HBP which would be infeasible to deliver. As with other approaches, the output of the above analyses is not meant to be prescriptive but rather a tool to guide decision-making as part of consultative processes (Glassman

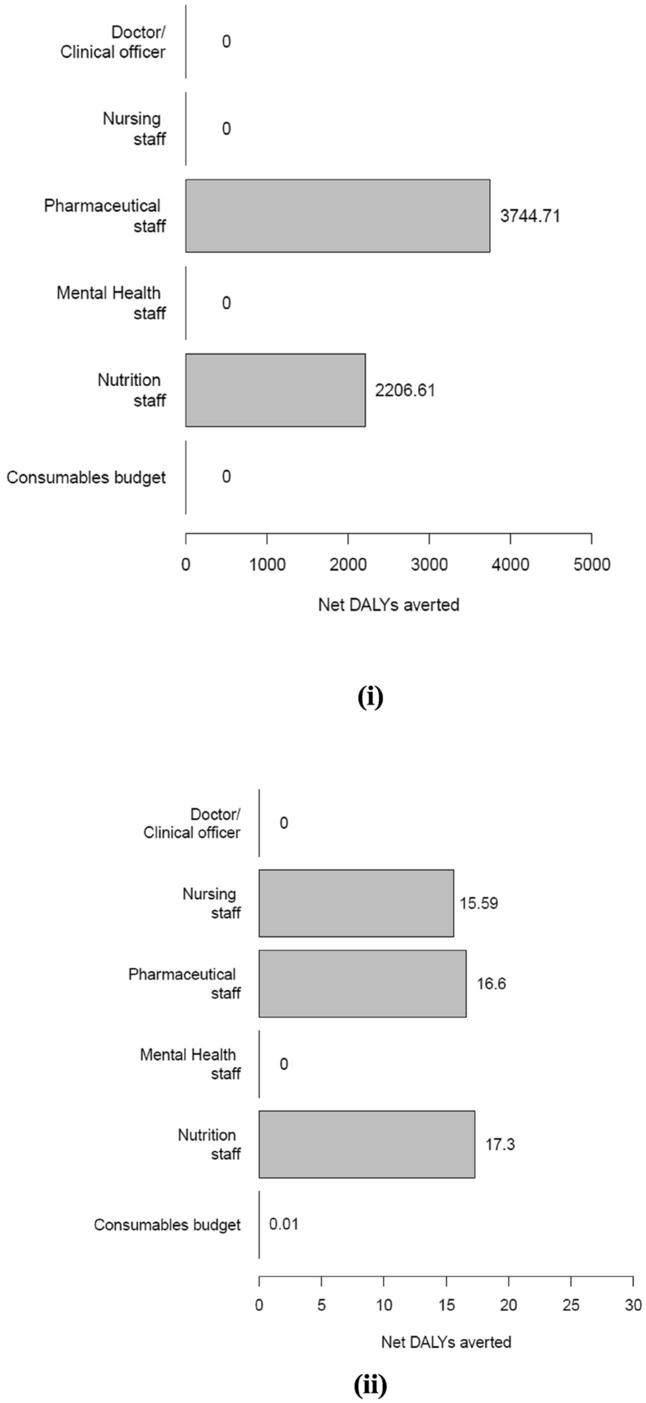


FIGURE 2 Marginal value of investing $1000 on different health system resources: (a) Base scenario (b) Task-shifting scenario: This figure illustrates the marginal increase in net health benefit resulting from a $1000 investment towards the budget for consumables or health worker salaries by cadre under the two scenarios.

et al., 2016), which demands a wider range of considerations including but not limited to the political and operational costs of adding or removing interventions from the mandate of health facilities. Recognising that there might be reasons other than the size of the net health impact for the inclusion of certain interventions in the package, our analysis script provides functionality for the inclusion of interventions regardless of cost-effectiveness considerations (called "compulsory interventions"). While we do not employ this functionality in our analysis, it would allow the model to be part of an iterative deliberative process in a real-world scenario. In the future, other objectives such as equity and financial risk protection (Lofgren et al., 2021) may also replace or be used in conjunction with the efficiency-focused objective of health maximization.

By providing a way to evaluate the health impact of relaxing explicitly modeled health systems constraints, our analytical framework also allows for the comparative evaluation of health system strengthening measures on the basis of their capacity to improve population health. This is an important contribution because while there have been important theoretical contributions in this area (Cleary, 2021; Hauck et al., 2019; Morton et al., 2016), the applied literature has been limited (Bozzani et al., 2018; Revill et al., 2018). Our results also demonstrate the interdependence between health systems components by showing how expanding the remit of nurses removes the bottleneck in drug dispensing and allows for a fuller use of the health systems capacity of the country. However, it is important to note that such task shifting needs to be accompanied by appropriate training and supportive supervision to avoid provision of suboptimal care. Further, while we assume that an equivalent amount of nurse time would be required to substitute for pharmaceutical and nutrition officer capacity, in reality the efficacy of shifting tasks from other cadres to nurses may vary by health intervention and requires further research (Mbeye et al., 2017). Our model can easily be adapted to relax the 1:1 assumption on staff time substitution.

Inevitably, this approach has some limitations. First, the objective function in the optimization framework measures health in terms of DALYs averted since comparability of the cost effectiveness metric used across health interventions was critical to the application of this approach. However, DALYs may not be the most appropriate metric to represent the health burden for all diseases (Arnesen and Nord, 1999). We use net DALYs in our objective function to account for not only health benefits but also the downstream costs and related opportunity costs associated with treatment since the resource constraints captured explicitly in the model focus only on resource requirements in a given year. This means that we have to rely upon external evidence for the opportunity cost of the health budget in Uganda in the long term (cost-effectiveness threshold) and are unable to directly use our framework to determine this value. Another important limitation is the assumption of independence of interventions. In reality, there are likely to be complementarities and interactions between interventions as well as nonlinearity in production functions (Barnum and Barlow, 1984; Zaric and Brandeau, 2001); however, quantitative evidence on these is scarce. The framework itself, however, allows for the consideration of combinations of interventions as well as incorporation of nonlinear production function through the inclusion of interventions with varying parameters at different threshold levels of coverage and may be used in this manner when better data becomes available. Furthermore, the design of the HBP and calculation of the marginal value of investing in various health systems components assumes perfect divisibility of resources and costless transition when additional funding is added to the human resources or consumables budget. In reality, governments will need to account for administrative costs of training, hiring and procurement, and the appropriate geographic placement of additional health workers (World Health Organization (WHO), 2010) among other considerations. A further limitation is that our analysis only considers the public health sector whereas people may also be able to access care in the private sector. Finally, while we were able to apply the approach to a relatively data constrained setting, it is important to point out the data intensive nature of this constrained optimization methodology. The consideration of any health system resource requires information on the specific resource demands of each intervention to be evaluated in the framework. For this reason, we were able to consider only 125 interventions in our analysis, potentially excluding some efficient interventions on which evidence is limited. In the absence of adequate evidence, the inclusion of other interventions should be based on expert opinion and deliberation, followed by "squeezing out" interventions from the theoretical optimal HBP to account for resources committed to these additional interventions.

Even for the 125 interventions considered, we had to rely upon numerous sources to obtain the required data and the quality of our results depends on the quality of the data used. We believe that we have used the best estimates available, but we wish to emphasise that the goal of our paper is not to provide results based on incontestable data. Rather, the main objective is to illustrate a systematic method for designing a health benefits package (HBP) in a resource-constrained setting, and demonstrate ways in which the framework can be used to answer questions other than the composition of an HBP, such as comparing the marginal value of investing in various health system constraints.

Despite the limitations listed above, we believe that our analysis serves as a useful base for the Government of Uganda to not only design their new HBP but also for other policy decisions such as health systems investments, geographic resource allocation (McGuire et al., 2020), workforce training and deployment, and funding negotiations with partners. Our analysis has also demonstrated the dynamic nature of HBPs, which should change with changes in the capacity of a health system in addition to changes in epidemiology and medical technology, as well as the availability of new and better evidence, in order to allow the best use of evolving resource capabilities. In the future, we plan to apply a similar approach to assess the impact of task shifting certain primary healthcare responsibilities to relatively less trained, but more accessible community health workers.

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CONFLICT OF INTEREST STATEMENT

All authors certify that they have NO affiliations with or involvement with any third party with financial interest in the preparation of this work. This work was supported through the same institution which pays the authors' salaries. Freddie Sengooba, Elizabeth Ekirapa Kiracho, and Chrispus Mayora were hired by the Ministry of Health, Uganda as independent consultants to support dialogues and consultations to arrive at the final health benefits package for Uganda. However, the work undertaken for this manuscript was undertaken prior to and independent of this consultancy. Candia Tom Aliti serves as the Commissioner Health Services (Health Sector Partners and Multi-Sectoral Coordination) in the Health Governance and Standards Directorate, Ministry of Health, Uganda, which is the body responsible for taking the final policy decision on Uganda's Health Benefits Package.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

ETHICS STATEMENT

The study relies upon secondary data, consisting exclusively of national level aggregate figures and does not use any personally identifiable information. No primary data collection was undertaken and secondary data were accessed and used with MOH consent.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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