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Balancing Equity and Efficiency in Health Priorities in Ghana: The Use of Multicriteria Decision Analysis

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ABSTRACT

Objectives: To guide the Ministry of Health in Ghana in the priority setting of interventions by quantifying the trade-off between equity, efficiency, and other societal concerns in health.

Methods: The study applied a multicriteria decision analytical framework. A focus group of seven policymakers identified the relevant criteria for priority setting and 63 policymakers participated in a discrete choice experiment to weigh their relative importance. Regression analysis was used to rank order a set of health interventions on the basis of these criteria and associated weights.

Results: Policymakers in Ghana consider targeting of vulnerable populations and cost-effectiveness as the most important criteria for priority setting of interventions, followed by severity of disease, number of beneficiaries, and diseases of the poor. This translates into a general preference for interventions in child health, reproductive health, and communicable diseases.

Conclusion: Study results correspond with the overall vision of the Ministry of Health in Ghana, and are instrumental in the assessment of present and future investments in health. Multicriteria decision analysis contributes to transparency and accountability in policymaking.

Keywords: efficiency, equity, priority setting, resource allocation.

Introduction

Health systems around the world address two broad objectives in health, i.e., efficiency and equity [1], and its policymakers share the common concern on how to find the right balance between these objectives [2,3]. Efficiency aims to maximize population health given a certain budget, whereas equity, or fairness, aims to minimize differences in health among population groups, with special reference to the severely ill, disadvantaged or vulnerable populations [4]. The trade-off a country makes between the efficiency and equity objectives can have important implications, e.g., adopting severity of disease rather than cost-effectiveness as a guiding principle in the selection of HIV/AIDS interventions—and thus choosing treatment rather than prevention-centered strategies—would lead to an extra 25 million infections over the next decennia in Sub-Saharan Africa [3,5].

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The Ministry of Health (MOH) in Ghana also recognizes the need to consider both efficiency and equity objectives in health. This vision is expressed in the second Five Year Programme of Work (POW 2001–2006) which is "to improve the health status and reduce the inequalities in health outcomes of all people living in Ghana" [6]. The POW spells out the vision, priorities, strategies, targets, resource envelope, and resource allocation criteria for the sector and is a result of nationwide consultations with stakeholders. In addition, the POW is influenced by the Ghana Poverty Reduction Strategy, and key international development targets such as the Millennium Development Goals [6]. As such, the POW aims to serve different efficiency and equity objectives in relation to health.

The MOH now seeks to further refine this vision in preparation of its third Five Year POW (2007–2011) by quantifying the trade-off between efficiency and equity concerns. More specifically, it seeks ways to identify the groups in society that should be given priority in health, and to determine the relative importance of these groups to guide budget allocation decisions. Furthermore, it aims to identify other criteria in health that may affect the choice of interventions,

such as size of target population [7]. The resulting information can be used to develop policies to, for example, target subsidies for certain services or population groups.

This article responds to this, and employs multi-criteria decision analysis (MCDA) to guide priority setting in the public health sector in Ghana. MCDA is a conceptual framework that aids people in making complex decisions, and has evolved as a response to the observed inability of people to effectively analyze multiple streams of dissimilar information. Generally speaking, MCDA establishes preferences between options by reference to an explicit set of objectives, and for which it has established measurable criteria to assess the extent to which the objectives have been achieved. In this article, MCDA is used to aid policymakers in prioritization of interventions in health by identifying the rational criteria for priority setting and weighing their relative importance, and by rank ordering the health interventions accordingly [7]. The relative weights of the criteria are based on preferences from Ghanaian policymakers, and as such bring local values and judgments into the priority setting process, which has otherwise been criticized for being donor-driven [8]. Moreover, MCDA contributes to transparency and accountability in this process, which is often regarded as being ad hoc and irrational [7]. To our knowledge, Ghana is the first country to adopt MCDA to support priority setting in health.

In the process, the MOH recognizes that not all relevant criteria for priority setting are amenable to quantification, and a deliberative process is required to assess ethical and social acceptability concerns and reach consensus (when possible) by different stakeholders on the prioritization (and implementation) of interventions [9]. MCDA is considered a first step in the broader priority setting process.

This article follows up on earlier experimental research in the same country [10], but is now strongly embedded in the organizational context of the MOH. This implies a more careful identification of priority setting criteria, an assessment of the validity of the resulting ranking of a set of interventions, and the use of results by the MOH. Moreover, the present article applies a more appropriate econometric method (on the basis of marginal effects) to estimate the relative importance of the criteria and related attributes.

Methods

We employed discrete choice experiments (DCE) to determine the relative importance of criteria for priority setting. In a DCE, respondents choose their preferred intervention from sets of hypothetical interventions, each consisting of bundle of criteria that describe the intervention in question, with each criterion varying over a range of levels. Analysis of the interventions chosen by respondents in each set reveals the extent to which each criterion is important to the decision at hand [11].

Conducting a DCE involves a number of steps. First, a group discussion was organized with seven policymakers and people otherwise involved in regional health-care programs, to identify the relevant criteria and related levels to include in the DCE. Each group member initially developed a list of possible factors, and these were subsequently discussed in the group. A wide range of criteria were mentioned, and were categorized if they referred to similar concepts. The attributes "costs," "effects," and "cost-effectiveness" were all combined into a single attribute "cost-effectiveness." Some criteria put forward in these discussions were related to common aspects of all interventions, such as the need to improve access to health care. In as far these criteria related equally to all interventions, they were not retained in the subsequent research. The group discussion resulted in identification of five criteria with associated levels (Table 1). On the basis of four criteria measured at three levels, and one criterion at two levels, 162 unique scenarios can be defined for inclusion in a full factorial experimental design in DCE [12]. Nevertheless, to avoid information overload, using a fractional factorial design with a limited number of scenarios is often recommended [12]. Our fractional factorial design included a subset of 16 scenarios (representing an orthogonal array), to allow for estimation of all main effects [13]. Each of these 16 scenarios was paired to its mirror image to retrieve the maximum information from each choice. An example of a pair of scenarios is given in Table 2.

Second, the DCE survey was administered during a Ghana Health Service (GHS) senior management meeting in which a total of 56 regional and district directors of the GHS participated. Respondents were taken through the DCE concept and worked through several examples (with disease labels) before they embarked on the actual exercise (without disease labels). All respondents choose between 16 pairs of scenarios. Third, binary logistic regression models that condition on choice were used to analyze the response data, and regression coefficients, average marginal effects, and relative contributions were estimated. Regression coefficients indicate the sign of the effect of a variable on the probability of selection of an intervention. Average marginal effects reflect the change in probability of selection of an intervention after a change in a single variable (i.e., *level of a criterion*). The relative contributions indicate the contribution *of one criterion* to the share of variation in preferences explained by the model and thus describe the relative importance of the various criteria in the choice of interventions. This relative importance depends on the variation in the levels that are chosen for each of the attributes, i.e., greater variation results in greater

Table 1 Definition of criteria and levels in DCE

Attribute	Level	Definition	Comments
Number of potential beneficiaries	Few	Less than 100,000 (those who could potentially benefit from intervention)	Societies may favour interventions that target many people because these interventions may have a larger impact for society at large.
	Average	Between 100,000 and 1,000,000	
	Many	More than 1,000,000	
Severity of disease	Not severe	Remaining healthy life expectancy (HALE) more than 5 years in absence of intervention, when acquiring/having disease	Societies may want to give preference to severely ill patients on the basis of their greater need for health care, and the diminishing marginal utility of health: an improvement in health from a severe health condition is then valued more highly by individuals than the same size improvement in health for a less severe condition [5].
	Severe	As above, with HALE between 1 and 5 years	
	Very severe	As above, with HALE <1 year	
Cost-effectiveness	Not cost-effective	Cost per DALY >3× GDP/capita×	Societies may wish to prioritize on the basis of the cost-effectiveness criteria, as this would generate the largest health gains at population level for the available budget. Classification of cost-effectiveness results is according to WHO-CHOICE methodology [6].
	Cost-effective	Cost per DALY between 1 and 3× GDP/capita	
	Very cost-effective	Cost per DALY <1× GDP/capita	
Poverty reduction	Neutral	Disease is not more prevalent among poor	Societies may want to give preferential treatment to disadvantaged populations because they are in some moral sense more deserving of health resources than others [7]. In general, it is argued that the poor have a greater need for support than less poor sections of the community, due to their lower income and typically lower "stock" of health [8], and that investments in the health of the poor could lead to poverty reduction [9].
	Positive	Disease is more prevalent among poor	
Vulnerable population	No specific vulnerable population	General population except the categories mentioned below	Societies may have preferences to target vulnerable populations because of ethical or economic considerations.
	Children (<5 years)	<5 years	
	Women of reproductive age	Women of reproductive age	
	Old people (>65 years)	>65 years	

DCE, discrete choice experiments; DALY, disability adjusted life year; GDP, gross domestic product.

importance. Therefore, our levels are chosen such that they cover most of the relevant range. Variation explained by the model is based on Efron's R^2 [14]:

$$R^2_{Efron} = 1 - \frac{\sum_i (y_i - \hat{\pi}_i)^2}{\sum_i (y_i - \bar{y})^2} \quad (1)$$

where y_i indicates the observed choice and $\hat{\pi}_i$ indicates the predicted probability that choice equals 1. See Greene [15] for a discussion of Efron's R^2 measure.

Data Analysis

Dummy coding involves that a criterion with L qualitative levels is transformed into L-1 dummy variables in which each dummy is set equal to 1 when the qualitative level is present and set equal to 0 if it is not.

Table 2 Example of discrete choice experiment

Choice	A	B
Severity of disease	Severe	Not severe
Number of potential beneficiaries	Few	Many
Vulnerable populations	Children	Old
Poverty reduction	Neutral	Positive
Cost-effectiveness	Not cost-effective	Cost-effective
Which one would you choose? Please tick a box	□	□

We used binary logistic regression to analyze the response data in our main effect model using the following model specification:

$$\begin{aligned}\text{Logit}(P) = \ln(P/(1-P)) = {} & \beta_0 + \beta_1 \text{AveBen} + \\ & \beta_2 \text{ManBen} + \beta_3 \text{Sev} + \beta_4 \text{VerSev} + \\ & \beta_5 \text{CE} + \beta_6 \text{VerCE} + \beta_7 \text{Pov} + \\ & \beta_8 \text{VulChild} + \beta_9 \text{VulRepr} + \beta_{10} \text{VulOld} + \\ & \beta_{11} \text{Scen2} + (\ldots) + \beta_{25} \text{Scen16} + \varepsilon \end{aligned} \quad (2)$$

where P is the probability of an intervention being chosen by the respondents, β_0 the intercept term, β_i the parameters of the model, ε the error term that varies with both choice and respondent. All other variables are as defined in Table 1 (except for scenario variables for reasons of space). The variable coding is provided in Table 3. To control for differences in attractiveness of DCE scenarios, and thus its potential confounding impact on the measurement of the parameters, dummies were added for scenarios to equation (2). We allowed the error to be correlated between the choices of a respondent using a Huber-White-Sandwich estimator with respondents set as the primary sampling unit.

The average marginal effects are computed by taking the average difference in predicted probability of P holding the value of the dummy equal to one and

Table 3 Criteria, levels, and the estimated binary logistic model

Criteria	Levels of criteria	Level coding	Coefficient	*P* value	Marginal effect	Contribution R^2
Number of potential beneficiaries	Few	FewBen				
	Average	AveBen	0.394	0.018	0.121	0.029
	Many	ManBen	1.07	0.000	0.231	
Severity of disease	Not severe	NotSev				
	Severe	Sev	0.574	0.001	0.169	0.059
	Very severe	VerSev	1.135	0.000	0.301	
Cost-effectiveness	Not cost-effective	NoCE				
	Cost-effective	CE	0.649	0.000	0.200	0.092
	Very cost-effective	VerCE	1.41	0.000	0.366	
Poverty reduction	Poverty neutral	NoPov				0.028
	Poverty reduction	Pov	0.749	0.000	0.160	
Vulnerable population	No specific vulnerable population	NoVul				0.187
	Children (younger than 5 years)	VulChild	1.064	0.000	0.372	
	Women of reproductive age	VulRepr	0.998	0.000	0.393	
	Old people (65 years and older)	VulOld	0.290	0.275	0.056	
	Constant		−2.598	0.000		

Log-likelihood −1054.871; Efron's $R^2 = 0.225$; McFadden's $R^2 = 0.180$; percentage correctly classified 71.7%.

the predicted probability of *P* holding the value of the dummy equal to 0, while holding the distribution of the other variables at their sample value. The relative contributions are calculated by computing Efron's R^2 of the above model minus Efron's R^2 of the model where the criterion is held constant at its sample mean. This procedure allows us to evaluate the contribution of criteria irrespective of the number of levels they have.

Next, to illustrate the findings, we considered a selection of interventions related to childhood diseases, communicable diseases, noncommunicable diseases, reproductive health, and injuries. The interventions were selected to provide a broad picture of existing and possible interventions across disease areas, to draw out the kind of context in which MCDA is expected to guide decisions. The interventions were scored based on their performance on the levels of the respective criteria (scores are provided as supplementary material for this article at: http://www.ispor.org/publications/value/ViHsupplementary.asp). The cost-effectiveness of interventions was based on work by the WHO-CHOICE project [16]. Information on poverty reduction was retrieved from the World Health Report 2002 "Reducing risks, promoting healthy life" [17]. Information on severity of disease, the number of potential beneficiaries, and targeting of vulnerable groups was obtained from a range of sources and rated by the same group of policymakers as involved in the identification of DCE criteria as mentioned above. Subsequently, the "probability of selection" was estimated for each intervention using the regression model. Finally, all interventions were rank ordered on the basis of this "probability of selection," on the assumption that it relates in a positive way to the attractiveness of that intervention.

As a validity check, the resulting rank ordering was compared to a simple rank ordering of 11 interventions as derived by a sample of 37 directors of those who participated in the DCE exercise.

Results

The results of the DCE are shown in Table 3. All coefficients were significant and their signs had the expected direction. The marginal effects show that, overall, interventions that target vulnerable populations, (very) severe diseases, many beneficiaries, diseases of the poor, and are (very) cost-effective have a higher probability of being selected than interventions without (one of) those characteristics. For example, interventions that target women of reproductive age have a 39% higher probability of being selected than interventions that target no specific vulnerable group, other things being equal. Also, interventions that are very cost-effective have a 36.6% higher probability of being selected than interventions that are not cost-effective.

The relative contributions show that targeting of vulnerable populations is the most important criterion, followed by cost-effectiveness, severity of disease, and number of potential beneficiaries. The least important criterion is targeting diseases of the poor. The model explained 23% of all observed variance in preference.

The intervention rank ordering shows that, overall, childhood interventions have the highest probability of selection, followed by most interventions targeting communicable diseases and two reproductive health interventions (supervised deliveries and emergency obstetric care) (Table 4). Interventions targeting noncommunicable preventive interventions and injuries are least attractive. These results showed a strong correlation with the simple rank ordering (Spearman rank order correlation: 0.79) (Table 5).

Table 4 Probabilities of inclusion for a selected set of interventions in Ghana

Interventions	Probability of inclusion (%)
Childhood interventions	
Childhood: improved complementary feeding	70
Childhood: Expanded Program on Immunization	93
Childhood: Integrated Management of Childhood Illnesses	93
Childhood: Accelerated Child Survival Development	90
Communicable disease interventions	
Malaria: insecticide-treated nets	70
Malaria: ACT plus AQ	90
Malaria: intermittent presumptive treatment of pregnant women	90
Malaria: chloroquine treatment	90
Tuberculosis: DOTS of smear-positive patients	72
Tuberculosis: treatment of multidrug resistant patients	38
HIV/AIDS: antiretroviral drugs	23
HIV/AIDS: voluntary counseling and testing	29
HIV/AIDS: prevention of mother to child transmission	56
Noncommunicable disease interventions	
Blood pressure: individual-based hypertension treatment and education	4
Tobacco: complete advertising ban	11
Tobacco: clean indoor air law enforcement	6
General: promotion of healthy lifestyles	31
Mental health: treatment of depression	14
Cancers: screening (e.g., for cervical cancer)	66
Diabetes: self-testing and regulation	21
Injury interventions	
Road traffic accidents: seatbelt legislation	29
Road traffic accidents: road side breath testing	21
Reproductive health interventions	
Reproductive health: adolescent interventions	65
Reproductive health: supervised deliveries	82
Reproductive health: emergency obstetric care	84
Reproductive health: antenatal and postnatal care	68

ACT, artesunate combination therapy; AQ, amodiaquine; DOTS, directly observed treatment, short-course.

Discussion

Policymakers in Ghana consider targeting of vulnerable populations—especially children and women of reproductive age—and cost-effectiveness as the two most important criteria for priority setting of interventions. This translates into a general preference for interventions in child health, reproductive health, and communicable diseases. Policymakers only attribute low importance to prioritization of interventions for diseases of the poor. This does not mean they do not wish to grant equal access to the poor and nonpoor (as is indeed one of the goals in the 2005 Annual POW [6], but rather that they do not want to give further preferences to the poor in the selection of interventions [18].

Table 5 Rank ordering of interventions in simple rank ordering and DCE exercise*

Interventions	Simple rank ordering	DCE
Childhood: Expanded Program on Immunization	1	1
Reproductive health: supervised deliveries	1	5
Childhood: Accelerated Child Survival Development	3	2
Reproductive health: antenatal and postnatal care	4	6
Malaria: intermittent presumptive treatment of pregnant women	4	2
General: promotion of healthy lifestyles	6	8
Reproductive health: adolescent interventions	6	7
Malaria: ACT plus AQ	8	2
Road traffic accidents: seatbelt legislation	8	9
Blood pressure: individual-based treatment and education	10	11
Tobacco: complete advertising ban	11	10

*Spearman rank order correlation: 0.79 ($P = 0.004$).
DCE, discrete choice experiments; ACT, artesunate combination therapy; AQ, amodiaquine.

These preferences are not surprising as Ghana is currently not on track to meet the Millennium Development Goals 4 (reduce child mortality) and 5 (improve maternal health) [19]. The results are also in line with the existing policies in Ghana, most notably the introduction of fee exemptions since the mid-1980s as a mechanism for ensuring access to the poor and other vulnerable groups. In here, provisions are made for exempting three categories of people on the grounds of economic status, age, and sex and include partial exemptions for a wide range of communicable diseases [6].

This article demonstrates the importance of simultaneously accounting for efficiency, equity, and other societal concerns in the prioritization of interventions. For example, whereas improved complementary feeding in childhood would be given low priority on the basis of cost-effectiveness alone, it would receive much higher priority when severity of disease, its number of potential beneficiaries, the vulnerability of children, and its potential for poverty reduction would be taken into account as well.

The DCE design combined relevant attributes "costs" and "effects" into a single attribute "cost-effectiveness." An alternative conceptual design would be to define the utility/attractiveness of an intervention on the basis of all criteria except "costs," and then link this estimate to costs, to measure the cost-utility of interventions. Nevertheless, because the criterion "cost-effectiveness" is of large importance in the choice of interventions in Ghana given the increasing resource constraints of the health sector, and is dominant in discussions on the choice of interventions [19], we decided to include it as a criterion on itself. Also, the DCE design includes attributes with a relative low number of levels, such as poverty reduction (two levels), or cost-effectiveness (three levels). It is not sure whether attributes with such low number of levels may fully capture respondents' preferences. Yet, adding more levels may make the discrete choices for respondents more complex, and may increase the pairs of scenarios required to obtain statistical significance, with the risk of informational overload of respondents [20].

This study elicits the health preferences of policymakers in Ghana who may be inclined to follow

national health policy. The study can hence be criticized that it is merely confirming current policy directions rather than providing new insights. Nevertheless, we consider the policymakers—regional and district directors—to represent political leadership in health and to be in a position to legitimately represent the preferences of the nation as a whole. Alternative approaches would be to elicit preferences from politicians, or from members of the general public: this, however, is a topic of much debate [21].

The priority setting process was strongly embedded in the organizational context of the MOH to secure its integration into the third Five Year POW (2007–2011) and hence its relevance and usefulness for policymaking. Study findings correspond with the overall vision of the MOH in Ghana and priority programs as documented in recent POW [6], but give further detail by being more specific on the criteria and their relative importance. The study provides policymakers an explicit structure to assess the extent to which current and future investments in (sets of) health interventions in Ghana serve the country's societal objectives in health. Policymakers in Ghana can score interventions under scrutiny based on their performance on the levels of the respective criteria, and consequently determine their overall attractiveness. Such an approach follows that of Table 4 of this article, in which a broad list of interventions is prioritized. Nevertheless, it is important to note that this list is only presented for illustrative purposes. We do not believe that policymakers should use such a formulaic approach to prioritize interventions.

Most important reason for this belief is that this study has only included a group of analytical criteria that are amenable to quantification, such as cost-effectiveness and severity of disease. Nevertheless, there is a second group of criteria that include nonquantitative concerns that must be addressed through a deliberative process to reach consensus (when possible) by different stakeholders [9]. These concerns may include not only assessments of ethical and social acceptability, but also more practical considerations like intervention complexity, and can be discussed by advisory panels. This requires a framework that combines quantitative and nonquantitative analytical criteria, and perhaps in a way that the quantitative criteria suggest a list of interventions that will subsequently be considered for final approval after sequential elaborations by different advisory panels.

Indeed, anecdotal evidence shows that policymakers have used the present study findings as part of the development process of the third Five Year POW. This involved a similar ranking of interventions as presented in Table 4. Other factors, such as ethical and budgetary concerns, were considered to determine health sector priorities for the next 5 years.

This study has applied MCDA in Ghana but the methodology is generalizable to other settings as well. Its application to, for example, another country would require the identification of priority setting criteria as relevant to that country, including the conduct of DCE, to arrive at a country-specific rank ordering of interventions.

We believe that the application of MCDA in the priority setting process of health interventions in Ghana is a step forward to transparency and accountability in policymaking.

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Supplementary material for this article at: http://www.ispor.org/publications/value/ViHsupplementary.asp

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