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# STAR – People-Powered Prioritisation: A 21<sup>st</sup>-Century Solution to Allocation Headaches

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## **Abstract**

*The aim of cost effectiveness analysis (CEA) is to inform the allocation of scarce resources. CEA is routinely used in assessing the cost-effectiveness of specific health technologies by agencies such as the National Institute for Health and Clinical Excellence (NICE) in England and Wales. But there is extensive evidence that, because of barriers of accessibility and acceptability, CEA has not been used by local health planners in their annual task of allocating fixed budgets to a wide range of types of health care. This paper argues that these planners can use Socio Technical Allocation of Resources (STAR) for that task. STAR builds on the principles of CEA and practice of Programme Budgeting and Marginal Analysis (PBMA). STAR uses requisite models to assess the cost-effectiveness of all interventions considered for resource reallocation by explicitly applying the theory of health economics to evidence of scale, costs and benefits; with deliberation facilitated through an interactive social process of engaging key stakeholders. In that social process the stakeholders generate missing estimates of scale, costs and benefits of the interventions, develop visual models of their relative cost-effectiveness and interpret the results. We demonstrate the feasibility of STAR by showing how it was used by a local health planning agency of the English NHS, the Isle of Wight Primary Care Trust, to allocate a fixed budget in 2008 and 2009.*

## **1. Introduction**

A central problem of healthcare systems funded through taxation or social insurance is to decide what services to offer, given a limited budget. Health economists have developed the tool of

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cost-effectiveness analysis (CEA) to tackle this problem <sup>1,2</sup>. Its key idea is that decisions over which services ought to be funded should be made on the basis of, or at least meaningfully informed by, a comparative analysis of the costs of those programs, and the health benefits that those services deliver, and to whom. Within the mainstream of health economics, health benefits are generally measured in Quality Adjusted Life Years (QALYs), <sup>3</sup> which can be interpreted as the quantum of health or as the utility generated by this quantum <sup>4</sup>.

Conducting CEA, as laid out theoretically, is demanding. It requires systematic literature reviews of randomized controlled trials and significant technical expertise, as demonstrated by the work of the National Institute for Health and Clinical Excellence (NICE) in the making of recommendations on funding new drugs<sup>5</sup>. The analysis underpinning NICE's recommendations are difficult to understand for people who are not health economists <sup>6</sup>. For institutions such as NICE, this lack of transparency is less important than being able to demonstrate that their judgments are based on rigorous analysis with the objective that they are able to withstand appeals and legal challenges by manufacturers and organisations representing patients' groups or professionals <sup>7</sup>. To achieve this rigor, NICE depends on about two thousand external experts <sup>8</sup> and spends on average £150,000 for conducting CEA on each new drug <sup>9</sup>.

The practice of NICE is close to a canonical form of CEA and appropriate for one-off adopt-reject decisions over a single intervention or procedure. CEA is not, however, appropriate for local decisions on resource allocation over the mix of services that ought to be provided, <sup>10</sup> which entail making trade-offs to allocate a fixed budget every year within national policies.

We adopt the characterization by Bryan and colleagues <sup>6,11</sup> who identified two types of barriers in applying CEA: 'accessibility' and 'acceptability'. These barriers concern the ability to understand the details, and accept the assumptions, of the analyses. Accessibility is compromised because of the need for specialist health economics skills to interpret the results of CEA and lack of access to data used in the analysis. The acceptability of CEA is limited because of ethical reasons, in particular the use of QALYs<sup>6,12</sup> which do not currently reflect relevant aspects of health such as the irreversibility of a disease or the burden on carers; the focus on efficiency rather than equity or the minimization of catastrophic risk<sup>10,13</sup>; and concerns over the choice of the threshold cost-effectiveness value, over which interventions are deemed cost-ineffective and should not be funded. Evidence from the UK suggests that the range of threshold values used by the NICE may

be too high and that potentially highly cost-effective interventions for which no CEA is available may be displaced in order to fund others of lower but documented cost-effectiveness<sup>14,15</sup>.

The development of Programme Budgeting and Marginal Analysis (PBMA)<sup>16-19</sup> is a constructive response to the need for a different approach from CEA for making decisions on the allocation of resources at the local level. PBMA is a pragmatic approach to engage local managers and healthcare professionals in understanding where resources are currently spent and in assessing the benefits of shifting resources from a list of interventions that currently deliver low benefits to a list of new, more beneficial interventions within the same budget. Benefits are defined by locally agreed, multiple criteria, and, in principle these are aggregated in a benefit score using Multi-Criteria Decision Analysis (MCDA). The problem in practice, however, is that there is no clear conceptual framework specified for the application of the theory of MCDA<sup>20</sup>. A review of PBMA in practice for setting priorities for healthcare has identified a lack of rigor in the application of MCDA,<sup>21,22</sup> which has been recognized as a problem by leading practitioners of PBMA.<sup>18</sup>

In this paper, we build on the strengths of CEA and PBMA to develop STAR (Socio Technical Allocation of Resources) which is designed to be used locally. STAR is a socio-technical process. The social process entails engaging local key stakeholders (including patients, clinicians and managers) in building a model of the problem at hand with the help of a facilitator and visual models. The technical process is the use of visual models based on the principles of CEA to specify how MCDA ought to be applied.

We present a case study to demonstrate the application of STAR locally. This research and development was conducted in collaboration with the Isle of Wight Primary Care Trust (PCT) of the English NHS on how best to spend £1m of growth money in 2008. At that time PCTs were responsible for designing contracts with providers defining the type and volume of activity they expect to purchase to meet the health needs of the local population (on average about 330,000 people). As the local planning and purchasing agency of the NHS, PCTs were funded through general taxation distributed by a capitation formula<sup>23</sup>. Following the major healthcare reform announced in 2010, the Isle of Wight Clinical Commissioning group formally took on these responsibilities from April 2013.

Section two describes the research methods. Section three presents the case study in terms of context, terms of reference, the deliberative approach (formal analysis, communication procedure and interactive elicitation methods) and results. Section four discusses the strengths and limitation of the approach on overcoming barriers to the use of CEA; section five provides concluding remarks.

## **2. Methods**

The approach was organised around evaluation workshops with stakeholders in the form of ‘decision conferences’. Decision conferencing (DC), like PBMA, is a deliberative process. An impartial facilitator works iteratively with key stakeholders to generate a formal, ‘requisite’ model to assess options on multiple objectives using Multi Criteria Decision Analysis (MCDA) and generate a summary benefit score<sup>24</sup>. A model is ‘requisite’ when it is sufficient to represent the mental models, beliefs about uncertainty and preferences of the participants and additional model refinements do not generate new insights in the problem<sup>25</sup>.

The analysis is based on extensive field notes, which include: the chronological development of the stakeholder engagement process and of the prioritisation technique, comments and reflections on these developments of the Strategic Planning group, semi-structured and unstructured interviews with clinical staff and PCT managers, email correspondence with PCT staff, direct observation of workshops, flipcharts produced by workshop participants, clarification questions and comments received on the report summarizing the results of the analysis.

## **3. Case study**

### ***Organisational context and term of reference***

In 2008 the Isle of Wight NHS PCT was responsible for healthcare for an Island off the South-East coast of England with a population of about 140,000. The PCT was comparatively small and, in contrast to elsewhere in England, it was organised as an integrated healthcare system with both purchasing and provision responsibilities, but with governance arrangements to ensure separation of responsibilities. The analysis of local mortality and disease morbidity conducted by the

director of Public Health (JS)<sup>26</sup> highlighted five key priority areas to focus on to reduce mortality and improve quality of life: cardiovascular disease, cancer, respiratory conditions, mental health and children's health. The financial accounts highlighted a surplus of about £1m that the PCT could allocate on a recurrent basis from 2008<sup>27</sup>. The PCT, which had a duty to engage local stakeholders, used decision conferencing to involve stakeholders in the five identified priority areas to generate a robust plan for allocating the additional £1m. The PCT Board recommended looking at costs and using three criteria to identify value: to increase health, to reduce health inequalities, and to be operationally and politically feasible.

## ***STAR***

The case study ran from April to November 2008 and consisted of:

- i. a schedule of meetings (two initial meetings in the spring and then fortnightly from June);
- ii. the design, in collaboration with the PCT, of a social process to engage key stakeholders (including managers, clinicians, patients and public representatives) and of a technical process to assess the relative cost-effectiveness of all interventions considered for funding;
- iii. guidance on extracting information from available demographic and epidemiological data to support the evaluation of different interventions;
- iv. facilitation of meetings with stakeholders;
- v. analysis of results;
- vi. the production of a report to document the process and to identify recommendations from the analysis; and
- vii. follow-up assistance in performing supplementary analyses.

Executive level leadership was provided through a Strategic Planning Group (SPG), which consisted of all eight executive directors of the PCT (including JS) and the facilitator of the decision conferences (MA). Its remit was to design an engagement process, choose a prioritisation technique and put forward recommendations to invest available, additional resources. Commissioning managers were involved in the detailed planning of the events. A commissioning manager is responsible for the implementation of the PCT strategy, for instance by designing and monitoring contracts with providers in a particular disease area.

The agreed engagement process consisted of two types of events. The first type was a two-hour meeting for each of the five priority areas to identify key issues in the provision of healthcare and to put forward a list of initiatives to improve quality of life and reduce health inequalities. A mix of stakeholders was invited, chosen by the commissioning managers to represent the diverse perspectives that they wished to consider in allocating resources and included: acute and community care clinicians, council representatives, voluntary sector representatives, nurses, public and patients' representatives, managers of the hospital and the ambulance service. The number of participants varied between 10 and 30 (a total of about 100 people were involved in total). The second type of event was a one-day decision conference to prioritise the proposed initiatives and to put forward recommendations to allocate resources across different priority areas. Twenty-five stakeholders attended the event: the eight executive directors of the PCT, nine commissioning managers, three patients and public representatives, four clinical experts and one representative of social services.

The area specific workshops identified twenty-one initiatives to be prioritised. Their total cost was over £5m. The proposed initiatives were described on a standard template reporting available information on: the expected costs, the estimated number of people who would benefit, a description of the 'average' beneficiary (in terms of demographics, severity of the condition, socio-economic background) and a quantitative or qualitative description of the health benefits to patients, their families and caregivers.

In the decision conference, participants built a formal model of the costs and value of all twenty-one strategic interventions (indexed by  $j$ ) interactively, in terms of:

- *costs* ( $c_j$ ): the additional annual funding required in 2009 and 2010 to set-up and to run the intervention, compared to current care. Set-up costs included training and equipment, and the running costs included staffing;
- *population health benefit* ( $N_j*B_j$ ): the product of the number ( $N_j$ ) of patients who benefit from the intervention and the potential benefit ( $B_j$ ) in quality (and length) of life, assuming successful implementation, to the 'typical' beneficiary (e.g. QALY gains), compared to current care;
- *health inequalities* ( $I_j$ ): the extent to which the intervention has the potential for reducing both differences in access and differences in health outcomes (across geographical areas, between men and women, of special groups);

- *feasibility ( $p_j$ )*: Probability of success (from 0% to 100%) of achieving the assessed benefits, assuming funding is granted and taking into account: ease of implementation; availability of workforce; acceptability to stakeholders (e.g. willingness to make this change happen); process complexity (e.g. number of steps required). This criterion captures the concept of ‘operationally and politically feasible’ that the Board included in the SPG’s terms of reference.

The formal model underpinning the evaluation is to Max  $\sum_j E(v_j) * x_j$ , where

$E()$  indicates an expected value calculation,

$v_j$  is the benefit from intervention  $j$  (details of its calculation will be provided later), and

$x_j$  is an index variable with value 1 in case intervention  $j$  is funded, and value 0 in case it is not.

In the model used during the workshop, we made a simplifying assumption about the expected value calculation ( $E()$ ): that if the intervention  $j$  were successful (with probability  $p_j$ ); then it would have delivered its benefits in full, and if it were unsuccessful (with probability  $1-p_j$ ), then it would have delivered no benefit. This assumption was subjected to sensitivity analysis after the stakeholder event through a parameter  $k \in [0,1]$ , which represented the proportion of benefits that would have been achieved in case of unsuccessful interventions. The workshop participants were presented with accessible visual aids for each step of the process, which will be described below (and not the formal model and its notation). The budget constraint was not modeled explicitly because the PCT had some flexibility on allocating resources in the current and the subsequent year. The aim of the technical model was hence to generate a priority list of the 21 interventions in terms of their cost-effectiveness and to agree on the budget to spend that year.

Participants revised the information provided in standard templates. These templates listed each initiative eligible for funding in a specific commissioning group or priority area ( $g$ , which corresponded to the priority area specific stakeholders’ workshops). The templates also evaluated each initiative, one criterion at a time, one commissioning group at a time through scoring. Table 1 reports the assessment for the three proposed interventions by the commissioning lead for cancer services, who also commissioned all palliative care. This required, for each intervention:

- Validating the number  $N$  of people who would benefit (using demographic and epidemiological statistics, data on hospital admissions and expert judgment).



- Providing a description of the typical patient and agreeing on a qualitative description of the expected benefit (derived from clinical evidence of effectiveness and expert judgments).
- Quantifying the expected benefit  $B$  for that typical patient attributable to action within the budget period (benefits that might extend over the patient's lifetime, assuming successful implementation and compliance). This assessment was informed by evidence (e.g. of QALY gains) whenever available. Due to time constraints and the exploratory nature of this approach, we used direct rating with a Visual Analogue Scale (VAS) technique<sup>28,29</sup> on the basis of the evidence brought to bear by clinical experts attending the meeting as follows: participants identified the option providing the greatest individual health benefit which was assigned a score of 100; they then scored the remaining interventions relative to this benchmark score of 100 and a fixed benchmark of 0 corresponding to 'no additional health benefits compared to current care'. A rectangle summarized the population health impact  $N*B$  visually (Figure 1), with the numbers who benefit on the horizontal axis and the average benefit per person on the vertical axis. The area of the rectangle is the expected overall benefit of the intervention in the population.
- Assessing the impact on reducing health inequalities  $I$  on a VAS. Interventions that had no impact on health inequalities were given a score of zero. Participants identified the option with the greatest potential to reduce health inequalities (assuming successful implementation and compliance); this was assigned a score of 100 and the remaining options scored relative to this benchmark.
- Assessing the operational and political feasibility of the option by asking participants their degree of belief that it would deliver the stated benefits in probabilistic terms  $p$  (with 100% representing absolute confidence).

In case of disagreement, participants explored the reasons and sought a consensus view, which was usually reached. If a consensus view could not be arrived at, the range of proposed values was recorded for sensitivity analysis purposes and the majority's view at the end of the discussion used for the base model.

Table 1

Initiative [j]	No. who benefit per year [N <sub>j</sub> ]	'Average' beneficiary	Description of individual benefit compared to current care	Health benefit per person score [B <sub>j</sub> ]	Health inequality reduction score [I <sub>j</sub> ]	Feasibility (Probability of success) [p <sub>j</sub> ]
<b>Early detection &amp; diagnosis in cancer</b>	200	Person in her/his mid-60s, more likely to be female and from "hard to reach" groups in society	Earlier diagnosis is associated with better prognosis (we assume no benefit for people screened and with negative results)	100	100	95%
<b>Palliative &amp; End of Life care (all diseases)</b>	1,500	Person in her/his late 70s, with life limiting long term health condition, equally likely to be from any socio-economic groups	Benefits to carers/family/friends. Benefits to patient: no change in life expectancy but a better quality of life in its last months	75	50	70%
<b>Relocation of active treatment in cancer</b>	300	Person in her mid-60s, more likely to be female; extremely severe illness	Patients are already receiving this treatment off the island, but there are psychological benefits of providing the service locally	25	0	10%

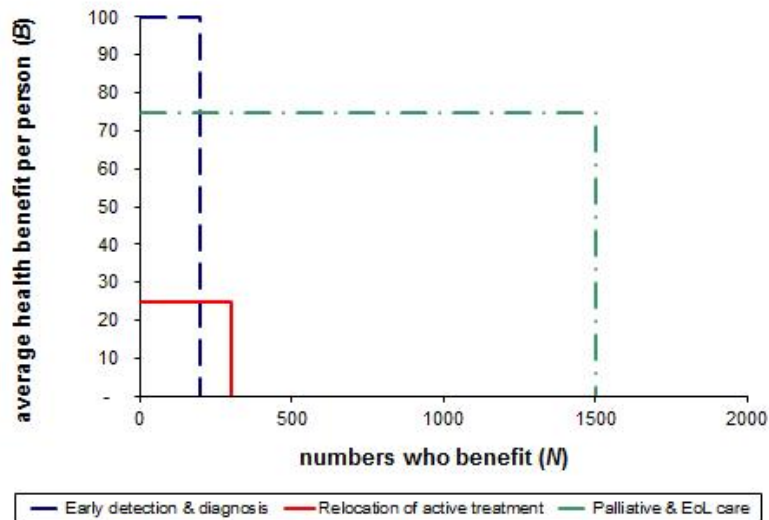


Figure 1 The rectangles of health benefit to the population for the three proposed initiatives in Cancer. Similar rectangles were drawn for each of the five areas and their interventions

The facilitator elicited three vectors of weights from participants in order to convert the scores on the two separate criteria of population health benefit ( $B$ ) and health inequality reduction ( $I$ ) to a common metric<sup>30</sup>. With the first two vectors of weights,  $w^B = (w_1^B, \dots, w_g^B, \dots, w_6^B)$  and  $w^I = (w_1^I, \dots, w_g^I, \dots, w_6^I)$ , participants considered one objective at a time and assessed the *relative contribution* to achieving the given objective by investing in a set of interventions in a disease group  $g$  (e.g. all proposed initiatives in the Cancer area) compared to another (e.g. all proposed initiatives in the Respiratory one). These weights are ‘within-criteria weights’, i.e. rescaling factors to convert scores for the same criterion in different disease areas on a common scale. Twelve within-criteria weights were elicited in total and a weight of 100 was assigned to the highest  $w_g^B$  and the highest  $w_g^I$ . Then participants considered health benefit and inequality reduction criteria and assessed their *relative contribution* to achieve the PCT’s objectives (an ‘across-criteria weight’), to convert scores on different criteria to a common value scale. To elicit this weight, participants considered the disease areas that received the highest within criteria weights of 100. A single rescaling factor  $W$  was sufficient to render scores on the health inequality criterion commensurable with scores on the health benefit criterion. The weighting judgments express critical value tradeoffs, and the facilitator encouraged participants to discuss these tradeoffs openly, noting uncertainty and disagreements to be explored by sensitivity analysis.

Defining  $g(j)$  as the commissioning group of intervention  $j$ , the expected value of each intervention was hence calculated as follows (assuming  $k=0$  during the decision conference and  $k \in [0,1]$  in sensitivity analysis after the event):

$$E(v_j) = p_j \cdot (w_{g(j)}^B \cdot N_j \cdot B_j + W \cdot w_{g(j)}^I \cdot I_j) + (1 - p_j) \cdot \left[ k \cdot (w_{g(j)}^B \cdot N_j \cdot B_j + W \cdot w_{g(j)}^I \cdot I_j) \right].$$

Thus, at the core of the analysis was a value model based on the expected value, with value computed as a weighted additive combination of health gain and inequality reduction. There is precedent for this model structure in the decision analysis literature: for example, Keeney and Winkler<sup>31</sup> also present an additive model with absolute and distributional components for evaluating risk reductions.

Participants were presented with a triangle that focused the discussion on the cost-effectiveness of each intervention (Figure 2):

- The horizontal side of the triangle represents the additional cost  $c_j$  associated with the intervention;
- The vertical side represents the additional expected benefit score  $E(v_j)$ ; and
- The slope of the hypotenuse of the triangle represents cost-effectiveness with the steeper the slope the greater the ratio of health benefits to costs.

Showing the triangles stimulated a discussion both for their comparative size and slope. In most cases participants recognized the comparison as a fair representation of their intuitive judgments, but they had now a language to entertain a more informed discussion. In few cases results were not intuitively clear and these were explored extensively by revising the assessments of costs and benefits that constituted the scale and slope of the triangle creating a better understanding of the appraised interventions. Whenever necessary, assessments were revised following this exploration.

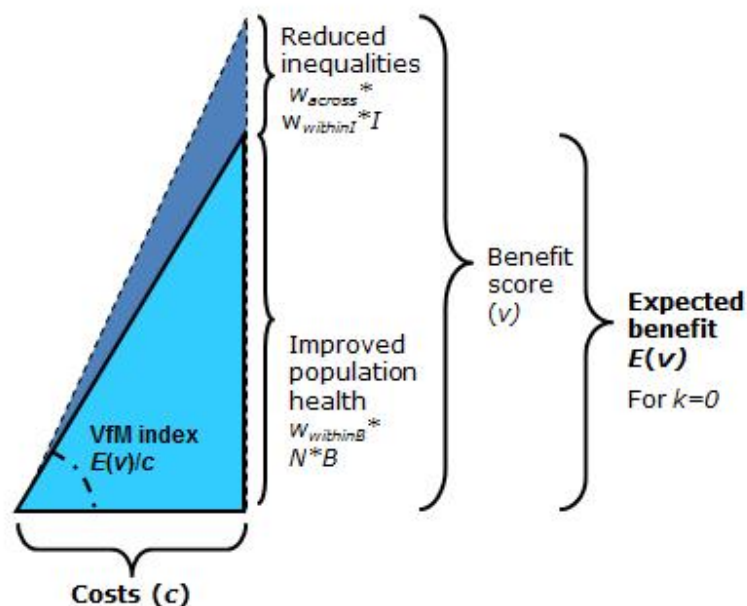


Figure 2 The structure of a value-for-money triangle

## Results

The triangles were used to generate a priority list in which interventions were ranked according to value-for-money (Table 2). This ranking is similar to a league table (but is of QALY/cost). Extensive sensitivity analysis was used to explore the uncertainties and disagreements among participants and the model proved robust, i.e. although the value-for-money score of some intervention changed, their relative ranking with respect to other interventions did not and participants could make clear recommendations to the Board. Figure 3 shows the same information in graphical form. The visual display generated important learning: for example, one intervention the evaluation of which had attracted considerable attention within the organisation was represented by a triangle which was not only shallow (and thus relatively cost-ineffective), but tiny, because it touched such a small number of people. Hence that intervention had negligible impact on population health perspective and costs.

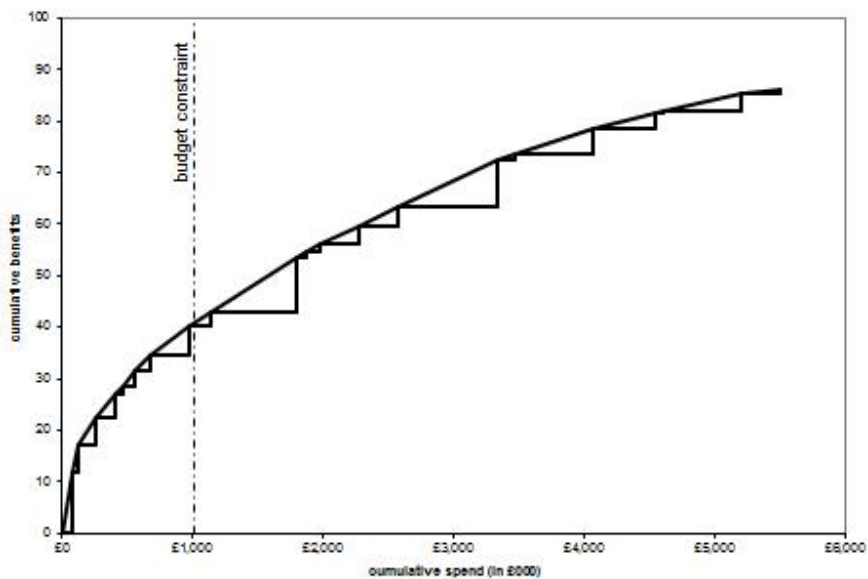


Figure 3 The efficient frontier of triangles ranked by value-for-money

Table 2

Commissioning area [g]	Intervention [j]	Additional cost in £k [c <sub>j</sub> ]	Additional benefit [E(v <sub>j</sub> )]	VfM ratio [E(v <sub>j</sub> )/c <sub>j</sub> ]*	Cumulative cost in £k <sup>A</sup>	Cumulative Benefit <sup>#</sup>
RESPIRATORY	pneumonia	£75	11.84	0.1579	£75	11.84
MENTAL HEALTH	Dementia services	£50	5.18	0.1036	£125	17.02
CVD	TIA & 2ndary prevention	£130	5.40	0.0415	£255	22.42
MENTAL HEALTH	Prison MH	£150	4.51	0.0301	£405	26.94
CHILDREN	Obesity training	£60	1.73	0.0289	£465	28.67
CHILDREN	Workforce development	£100	2.78	0.0278	£565	31.44
MENTAL HEALTH	Psych therapies	£120	3.05	0.0254	£685	34.49
CANCER	Early detection and diagnostics	£300	5.74	0.0191	£985	40.23
CHILDREN	CAMHS School	£160	2.76	0.0173	£1,145	42.99
CVD	Prevention	£650	10.48	0.0161	£1,795	53.48
CHILDREN	CAMHS 1:1	£80	1.26	0.0157	£1,875	54.73
CVD	Cardiac Rehab	£100	1.29	0.0129	£1,975	56.02
MENTAL HEALTH	Alcohol misuse svc	£300	3.77	0.0126	£2,275	59.78
MENTAL HEALTH	Social inclusion	£300	3.75	0.0125	£2,575	63.54
CANCER	Palliative & EOL	£760	9.05	0.0119	£3,335	72.59
CHILDREN	Obesity 1:1	£140	1.22	0.0087	£3,475	73.81
CHILDREN	Primary prevention	£600	4.61	0.0077	£4,075	78.42
CHILDREN	Access to dental	£480	3.24	0.0068	£4,555	81.66
CANCER	Relocating Active Treatment	£50	0.31	0.0062	£4,605	81.97
CVD	Stroke emergency	£600	3.37	0.0056	£5,205	85.34
CVD	CHD acute	£300	0.78	0.0026	£5,505	86.12

Three weeks after the decision conference, participants received a copy of the report for consultation. The report summarized the approach, documented each step of the process, and the results of the base models and of sensitivity analyses. The executive directors and commissioning leads discussed the results and proposed an investment plan based on the analysis to the IoW NHS Board for approval. The proposal followed the ranking of Table 2, with the exception of End of Life care, for which separate funding was sought in addition to the planned £1m.

The IoW NHS Board received the results of the analysis favorably and approved the proposed operational plan, including the provision of additional funds for End of Life care. The following year, 2009, the PCT hired a private consultancy firm of trained decision analysts able to replicate

the approach and participants from the previous year confirmed their willingness to engage in the workshops, which were extended to more people. Thus the approach we introduced was valued by the local organisation as a good way of continuing to make strategic decisions.

## **4. Discussion**

This section discusses how the use of requisite models and the engagement of stakeholders in a facilitated, deliberative process contributed to the systematic use of CEA principles. We frame this discussion in terms of the concepts of *accessibility* and *acceptability* as used in Bryan and colleagues<sup>6,11</sup>.

### ***Accessibility***

The visual aids proved essential to make the CEA framework accessible to non-health economists. The use of rectangles to visualise the population health gain helped clinicians and patients to share their knowledge and to articulate their opinions on the impact for the individual patient; and it enabled participants to discuss more clearly the details of the implementation, the number of beneficiaries and the associated costs, and to document the rationales of agreed funding recommendations. The visualisation of cost-effectiveness through triangles and their aggregation in an efficient frontier was particularly useful to communicate the principles of CEA as evidenced by comments from several participants (mostly managers and patients representatives), who felt they could fully appreciate the meaning of QALY/cost estimates for the first time.

The understanding of the evaluation framework was crucial both to incorporate available clinical and epidemiological evidence and to assess interventions for which evidence was missing or weak. This was particularly important for interventions in primary prevention, which were seen as critical locally, but for which hard evidence was not available. Our approach enabled participants to volunteer estimates, for these to be challenged by others, and their robustness to be tested by sensitivity analysis.

The decision conference showed problems in capturing impacts of interventions in reducing health inequalities. If these were measured in terms of the health gap between different groups in

the population, for instance in terms of quality-adjusted life expectancy at birth, one would expect that the greater the number of health-poor people affected, the greater the impact on health inequalities. Participants, however, did not consider the number of people affected by the intervention unless prompted by the facilitators and the rationales used to defend their health inequality score usually reflected their personal view of the extent of “health-poverty” of a typical beneficiary or his/her deservingness of better health. The development of a more intuitive and theory-based approach to modelling health inequality is the subject of further research <sup>32</sup>.

### *Acceptability*

The executive directors, with two different kinds of exceptions, accepted the application of deliberate CEA: the criteria selected, the way they were defined and used, and the method used to translate values into a priority order. One exception was that one member objected to the use of “an approach that aims at getting the greatest good for the greatest number”, and hence she rejected the utilitarian principle embedded in CEA in which ‘a QALY is a QALY is a QALY’. The core of her objection was a pragmatic one: she contended that it would have been difficult to defend hard choices based on the utilitarian principle in front of the public or the courts. The majority of the executive directors, however, thought that the technical analysis ought to aggregate health gains across people additively, and leave the assessments of the political feasibility of the recommended set of interventions to be funded to the social process. The second exception was that the executive directors judged the approach of valuing interventions in terms of QALY gains undervalued interventions for palliative and end of life care and that a different approach was required to value these interventions, which have the objective of enabling ‘a good death’. They were unable to articulate a general, acceptable definition of ‘good death’ as different patients and their families may have very different needs at this difficult time of their life, and ‘a good death’ may have more to do with allowing them time to understand these needs and respecting their wishes than with a specific healthcare intervention <sup>33</sup>. This is a general difficulty in aiming to use a common tool to assess curative and palliative interventions: for example, there is an unresolved debate about the appropriate cost-effectiveness threshold for end of life treatments, with some advocating a higher cost per QALY threshold <sup>34,35</sup>.

The assessment of preventative interventions and potentially life-saving interventions posed a similar challenge, with participants invoking the principle of the ‘rule of rescue’ to express their



difficulty in comparing the relative health benefits across these interventions. That principle recognizes the moral imperative to rescue identified people in immediate peril regardless of the costs. The executive directors decided to exclude ‘rule of rescue’ considerations in the formal analysis in order to be able to quantify and to face the hard trade-offs between investing in prevention compared to treatment. This is also the conclusion reached by NICE<sup>36</sup>. They recognized that the choice between prevention and potential cure is an intrinsically difficult value judgment, but also highlighted the value of visualising the opportunity cost of potentially life-saving interventions in terms of forgone benefits from preventative interventions to inform their decisions. Their difficulty is consistent with the current absence of any clear, agreed operationalization of the rule of rescue principles<sup>37</sup>. This analysis identified most preventative interventions as not being high value-for-money because they were usually also associated with a relatively low probability of success (which gave a low expected value of their benefits).

The opportunity cost of alternative budget allocations was modeled explicitly by using requisite cost-effectiveness models. Indeed the Board found the efficient frontier particularly insightful, because it enabled them to articulate a clear rationale for the proposed allocation based on the principles of opportunity cost.

## **5. Conclusions**

The paper presents a case study to illustrate, and to demonstrate the feasibility of, a deliberative approach to CEA. The proposed approach builds on the strengths of CEA and PBMA to develop STAR. It is not a substitute for CEA for the purpose of technology assessment at the national level. It does show, however, that health planners at the local or regional level could use the principles of CEA systematically, even though evidence on the effectiveness and cost-effectiveness of considered interventions is not routinely available, and could overcome the known barriers of CEA of accessibility and acceptability. The approach builds on, and contributes to, the PBMA literature by proposing and discussing critically a particular MCDA value function, which is in the spirit of that proposed by Peacock et al.<sup>18</sup>

The distinctive characteristics of the approach are the use of requisite detail to assess the cost-effectiveness of all interventions considered for funding, the use of visual aids to make CEA concepts accessible to non-health economists, and the engagement of key stakeholders in the

interactive development and interpretation of the models of cost-effectiveness and the underlying data. STAR requires a facilitator trained in health economics and MCDA. This is because the requisite models use health economic principles and concepts to combine evidence from public health, demographic surveys, health economic studies, RCTs, local administrative and accounting systems. The proposed visual aids enable those with no training in health economists to understand CEA principles and to contribute value judgments, and expert knowledge in interpreting available evidence. Stakeholders can also assess judgmentally the cost-effectiveness of interventions for which no published CEA is available. Although these estimates are necessarily approximate, they are better than the alternative, which is no information. Furthermore, these estimates represent explicitly the values and knowledge of those involved in the resource allocation process and help them to communicate and explain the rationale of their recommendations.

The success in facilitating clear, value-driven and evidence-based discussions are attributable to the intellectual robustness of the underpinning health economic theory, and indeed, where our methods lacked that underpinning, as in the modelling of inequality trading that off against health benefit, we were less successful in informing deliberative discussions. In areas where health economics theory has less purchase as a normative theory, in particular in the valuation of End of Life and palliative care, those responsible for making decisions used other criteria. This is as it should be for healthcare, where values are contested; the highest aspiration for analysis can only be to provide a basis for deliberative and informed moral choices.

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