Use of programme budgeting and marginal analysis to set priorities for local NHS dental services: Learning from the north east of England

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ABSTRACT

Background: Priority setting is necessary where competing demands exceed the finite resources available. The aim of the study was to develop and test a prioritisation framework based upon programme budgeting and marginal analysis (PBMA) as a tool to assist National Health Service (NHS) commissioners in their management of resources for local NHS dental services.

Methods: Twenty-seven stakeholders (5 dentists, 8 commissioners and 14 patients) participated in a case-study based in a former NHS commissioning organisation in the north of England. Stakeholders modified local decision-making criteria and applied them to a number of different scenarios.

Results: The majority of financial resources for NHS dental services in the commissioning organisation studied were allocated to primary care dental practitioners' contracts in perpetuity, potentially constraining commissioners' abilities to shift resources. Compiling the programme budget was successful, but organisational flux and difficulties engaging local NHS commissioners significantly impacted upon the marginal analysis phase.

Conclusions: NHS dental practitioners' contracts resemble budget-silos which do not facilitate local resource reallocation. 'Context-specific' factors significantly challenged the successful implementation and impact of PBMA. A local PBMA champion embedded within commissioning organisations should be considered. Participants found visual depiction of the cost-value ratio helpful during their initial priority setting deliberations.

Background

Managing scarcity and assessing the merits of competing priorities are key responsibilities for health care decision-makers.[1] It has been reported that health care decision-makers may not be well-equipped to make explicit decisions, instead relying upon existing historical or political funding processes.[2] Ad-hoc priority setting approaches may however, lead to the sub-optimal use of scarce resources[3,4] and research has suggested that decision-makers within health care organisations may require assistance with priority setting.[5] A potential tool to assist decision-makers may be to use an explicit economics-based priority setting framework to guide the process.

However, whilst economics-based approaches have been proposed, they may not always acknowledge important local contextual factors nor the varying levels of understanding by decision-makers about health economics.[6,7] Contextual factors specific to health care organisations (including difficulties moving resources between budgets within the same organisation) have been reported as reasons for the apparent restricted application of economics-based approaches.[8,9] Others have reported that priority setting approaches are perhaps viewed as a 'bolt-on' to health care commissioning which 'tinker around the edges' of investment decisions rather than being used as mainstream tools to guide commissioners.[10] A potential solution to overcome this challenge would be to make economics an integral component of clinicians' and managers' management processes.[11]

One pragmatic approach that considers multiple sources of evidence and the complexities associated with 'real world' decision-making is Programme Budgeting and Marginal Analysis (PBMA). PBMA adopts an inclusive approach to the priority setting process and it has been used as a framework to guide decision-making in many contexts globally.[12-17] PBMA considers the incremental costs and incremental benefits of different options on an informed and rational basis.[18] In economic terms, PBMA attempts to maximise the benefits from health services with specific reference to opportunity cost and resource shifts 'at the margin'.[19] With the rise in global austerity in recent years, there is also arguably a role for the use of PBMA in organisations wishing to make rational disinvestment decisions.[20,21] An overview of

the individual stages involved in operationalising PBMA are listed in Table 1. Further detail about each step can be found elsewhere.[11,22]

The paper presents a case-study of a dental priority setting exercise within a real-life NHS context. The benefits of using case-study exemplars have been highlighted in the literature as revealing lessons that are not part of established theoretical accounts.[23] Furthermore, the case-study method permits the observation of 'social processes'[23] (decision-makers using PBMA in a day-to-day management context) rather than the focus being upon undertaking an economic evaluation from beginning to end. Our research question was: 'How can health economics improve the commissioning of NHS dental services for the benefit of patients and local populations?'.

Methods

An overview of our approach and research methods are outlined in our published study protocol.[24] The study received a favourable ethical opinion from County Durham and Tees Valley 2 Research Ethics committee [Ref: 10/H0908/9].

Setting

The study setting was a former large NHS commissioning organisation in the north of England, which at the time, served a population of over 0.5 million people. Almost 100 dental practices held NHS contracts with the commissioning organisation.

Design

A case-study approach was adopted in order to involve local stakeholders; describe new knowledge; and to potentially improve the priority setting process for local NHS primary care dental services.[12,14,15] The research was designed to follow the stages inherent to traditional PBMA exercises (Table 1). The PBMA research meetings with participants and the methods involved are detailed in our study protocol[24] and Table 2 in this paper.

Participants

RH invited all NHS commissioners (those with responsibility for managing local NHS dental services) in the chosen organisation and selected local NHS dentists identified by the commissioning organisation's 'dental practice advisor' to participate. NHS patient representatives were sought from two sources: the commissioning organisation's local patient involvement group and a regional research and engagement panel.

Results

In total, 27 participants were recruited to the study. Participants comprised: 5 NHS commissioners, 8 local NHS dentists (with 4 to 29 years of clinical experience) and 14 patients/service-users (11 women; 3 men aged 20-80 years).

The results below are ordered by traditional PBMA stage (Table 1). Each section represents what actually occurred as the PBMA process evolved.

1. **Determine the aim and scope of the exercise**

Participating commissioners and dentists were invited to a presentation at the local NHS headquarters to outline the principles of PBMA, how it could be operationalised and how this may assist commissioners with local priority setting and resource allocation. NHS participants decided themselves that the aims of the exercise should be to provide greater clarity about how the locally-held budget for NHS dental services was currently being spent and to inform the development of a new internal dental commissioning policy. Commissioners and dentists unanimously agreed that the scope of the PBMA exercise should consider all NHS dental services (primary care, community and hospital dental services) commissioned by the organisation.

A small PBMA oversight group was established to oversee the process. This group comprised two senior dental commissioners, a finance representative and the lead author.

2. **Compile a programme budget**

NHS participants agreed to base deliberations on local financial data and dentists' activity (treatment) data provided by the NHS Business Services Authority for the financial year preceding the study.

The total spend on all NHS dental services by the commissioning organisation was just over £27 million in the financial year of interest. Approximately £25.4 million was spent on delivering primary (high street) dental care services alone. The amount of NHS dental activity commissioned was just under 1.05 million UDAs (Units of Dental Activity). UDAs may be viewed as a form of 'contract currency' used in England to measure NHS dental practices' activity against their contractual obligations.

A revealing finding from the programme budget phase was that over 94% of the organisation's total budget for dentistry was essentially 'locked' into primary dental care practitioners' contracts as a consequence of the introduction of the 2006 General Dental Services (nGDS) contract. The nGDS contracts are not time-limited. They are held in perpetuity by dentists subject to adherence to certain rules and them achieving the number of UDAs specified within their contracts on an annual basis.

3. Form marginal analysis advisory panel

Each of the three stakeholder groups were invited to nominate three individuals to be part of the advisory panel. The panel would consider the criteria for appraising different interventions and then vote on the perceived benefit of cases put before them taking into account the evidence provided. The group ultimately consisted of nine individuals: three NHS patients, two dentists and four commissioners. The panel was chaired by RH.

4. Determine locally relevant decision-making criteria

The commissioning organisation had recently developed a decision-making tool for commissioners incorporating a number of prioritisation criteria against which to judge new business proposals. The criteria had not yet been used for funding decisions relating to local dental services. The panel unanimously decided to use these criteria for consistency (Supplementary information, file 1).

The advisory panel were asked to weight the headline and sub-criteria for specific use against new business proposals for local dental services. The budget-pie method was used to do this which involves each participant allocating points or tokens from a fixed budget in any way they choose from the options available.[25] For NHS commissioners and dentists this process was undertaken by questionnaire individually and anonymously (Supplementary information, file 2). For the patient and service-user group, the process used the same questionnaire, but it was facilitated by the Chair at a face-to-face meeting with responses recorded anonymously. The mean scores for the headline prioritisation criteria (broken down by participant group) can be found in the Supplementary information, (File 3).

5. Advisory panel to identify options

A customised postal questionnaire was sent to every member of the advisory panel by the Chair and participants were asked to initially identify three areas for potential dental service investment with the proviso that each investment be supported with one disinvestment within the dental service portfolio. Eight questionnaires were returned (n=4 dentists, n=4 commissioners and none from NHS patients). However, before a meeting could be held to discuss the potential investment and disinvestment options, two commissioners participating in the study were redeployed within the organisation and a further two were made redundant. This profoundly affected the momentum of the study. To resolve the situation, the advisory panel elected to modify the PBMA exercise. Outside of the PBMA process, the Chair (RH) devised four hypothetical dental business proposals which focused upon four options for investment from the business cases already received. The intention of the exercise from this point onwards, was to raise participants' awareness of inclusive priority setting as a way of incorporating costs and potential benefits and to determine the value of a method for presenting the relative merits of competing proposals.

The business proposals were independently verified for their estimated costs and reported benefits by a consultant in dental public health. The Chair prepared the paperwork for the proposals including summaries of the evidence supporting each option for the advisory panel. The four hypothetical proposals related to expanding

an oral health promotion programme (W), piloting targeted oral cancer screening in primary dental care (X), developing a sedation service for children (Y) and modernising an out-of-hours dental emergency service (Z).

6. Advisory panel to make recommendations

The full PBMA advisory panel met at a city centre hotel one week after receiving the dental business proposals and evidence summaries by post. The aim of the meeting was to consider and deliberate the four proposals in turn, and then for each panel member to independently score the proposals against the headline prioritisation criteria (the perceived benefits) that had been previously weighted. Consideration of each business proposal took approximately 30-35 minutes. Based on the weighted benefit score (WBS) alone (with no detailed cost data factored in at this point), a provisional ranking was obtained for the four options (Table 3).

An indication of costs had been provided to participants prior to the panel meeting, but it was after this meeting that the Chair added in the detailed costs per proposal which were calculated as the net financial impact per patient using the formula (present value of costs – present value of savings) / number of patients affected by the proposal. Costs were calculated over a 3-year time frame unless the intervention was a shorter pilot. The cost-value ratio (CVR) was then calculated by dividing the net financial impact per patients by the WBS. Table 4 lists this detail and it shows how the priority rank was altered from the provisional rank shown in Table 3.

To assist the panel and particularly the patient representatives, the CVR was also graphically illustrated (Fig. 1) and distributed to the group via email for evaluation. There was almost unanimous agreement from panel members that the final priority ranking seemed appropriate based upon the evidence considered. However, one participant on the panel (a patient) expressed disappointment regarding Proposal ‘X’ falling into fourth place:

> “I know it’s hard to prioritise these services but I would have preferred more emphasis on the oral cancer screening service [Proposal X].” (P25, patient)

Independently, the most senior NHS commissioner on the panel countered the above view:

> "Proposal 'X' benefitted from the use of 'cancer' in its title rather than any rational argument." (P6, commissioner)

Despite the commissioner agreeing that the evidence did not support proposal 'X', they described that they would still fund the proposal because of the high levels of non-recurrent resource available within the organisation - potentially undermining the ethos of the priority setting process:

> "Investment decisions can be recurrent or non-recurrent and the phasing of the latter is particularly important…Project X [oral cancer screening] is particularly attractive as it's a 4 month pilot only, so I can use non-recurrent funds. So, despite its low score I'd go for it if I had a cash surplus mid to end year". (P6, commissioner)

The CVR chart was reportedly helpful to all of the patient representatives on the panel. One participant commented about the way in which the priorities had been presented:

> "Your table [Table 4] is just as informative as the graph [Figure 1], but of course it may be perceived as 'instructing' with the listing of priority rankings 1, 2, 3 and 4 rather than simply informing". (P24, patient)

Additional qualitative evidence is contained within the lead author's doctoral thesis available online.[26]

Discussion

Main findings of this study

Almost 94% of the devolved financial resources for local NHS dental services in the commissioning organisation studied, were allocated to dental practitioners' contracts in perpetuity due to NHS dental regulations. This meant that most of the financial

resource for local NHS dental services could not easily be reallocated within dentistry on a large scale. Whilst the programme budget phase of the study was successful, the marginal analysis phase faced significant challenges. Engagement with local dental commissioners was severely constrained as a result of organisational restructuring and redeployment. In light of these barriers, the traditional PBMA approach had to be modified. Despite these issues, the priority setting exercise was well-received - particularly by patient representatives. The graphical representation of the cost-value ratio was perceived as a helpful starting point for deliberations involving priority setting.

What is already known on this topic?

Much research has been published on PBMA and its application in health care settings internationally,[15] but there is little evidence or learning linked to its use within dental services.[27] The evidence reports that PBMA is not always successfully implemented but this depends upon how 'success' is actually defined.[14] Although PBMA has been used in health care for around three decades, it is not always easy to implement.[28] Cornelissen et al. highlight the need for adaptability and 'functionally independent stages' within the PBMA process in order to maximise the value of each step for the organisations involved.[28]

Elsewhere in dental research, cost-effectiveness and return on investment data exist for selected oral health initiatives[29] together with evidence-based disease prevention guidance for dental practitioners.[30]

What this study adds

We are not aware of published research using PBMA as a framework focused solely upon dental services in England. Our research provides evidence of challenges to the successful implementation of PBMA relating partially to the way in which NHS dental services are funded, as well as local barriers including organisational flux and the availability of commissioners to support the process. The study serves to highlight the real impact of 'context-specific' factors on local priority setting.[31] Our study found that priority setting frameworks such as PBMA must be adaptable to local factors or they face implementation failure.

The study demonstrates that stakeholder 'buy-in' is crucial. Where this buy-in is challenged by organisational flux, time constraints or the discontinuity of participants, the likelihood of successful PBMA implementation is much reduced. Published research has referred to the examples we have identified as '*Ex-Ante Barriers*'.[32] Reports of PBMA success elsewhere often involve leadership from health economists and PBMA 'champions' embedded within the organisations under study.[12,33] We would endorse this approach and we echo similar findings.[14,15]

The process ultimately developed into a multi-criteria prioritisation framework approach as reported by Wilson et al.[34-36] However, it is this much-needed adaptability that kept the process moving forward and the use of the cost-value ratio (CVR) was perceived by the majority of participants to have been helpful in their initial priority setting deliberations.

Although our study identified a number of challenges to the implementation of an explicit economics-based priority setting framework, our experience does not diminish the continued demand for tools to assist decision-makers. Indeed, this area of research is now being taken forward at a national level in England through the '*RAINDROP*' study (Resource Allocation in NHS Dentistry: Recognition of societal Preference).[37]

Limitations of this study

This was a small-scale study conducted in a former NHS commissioning organisation in the north of England. Consequently, our findings may not be generalisable to other NHS organisations. NHS dental services in England are now commissioned nationally, although practically this is delegated to 'locality office' teams in NHS England. Despite this organisational change, NHS commissioners arguably continue to face very similar priority setting and resource allocation challenges. Our engagement with commissioners was constrained at a crucial point, so our study focuses upon the process of attempting to apply a priority setting framework, rather than its ultimate impact upon local services.

There are recognised limitations with calculating and using 'cost-value' ratios.[36] However, all options for comparing costs and benefits are associated with

disadvantages and technical approaches to priority setting will only ever provide one input into any decision-making process. Our use of ‘cost-per-patient’ and WBS combine patient-level and system-level variables which, whilst not ideal, have been reported in research elsewhere.[36] We acknowledge that the business proposals may have received different scores if the panel had included specialists from within the discipline areas presented.

Authors’ contributions

RH led design of the study, applied for ethical review, recruited participants, chaired the oversight PBMA panels and led the data analysis. CD and CRV provided health economics expertise and data analysis. JGS contributed to the design of the study and data analysis. C.E. provided expert qualitative advice. RH prepared drafts of the paper to which all authors contributed and approved the content.

Supplementary data

Supplementary data are available at the *Journal of Public Health* online.

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Conflict of interest statement

None declared.

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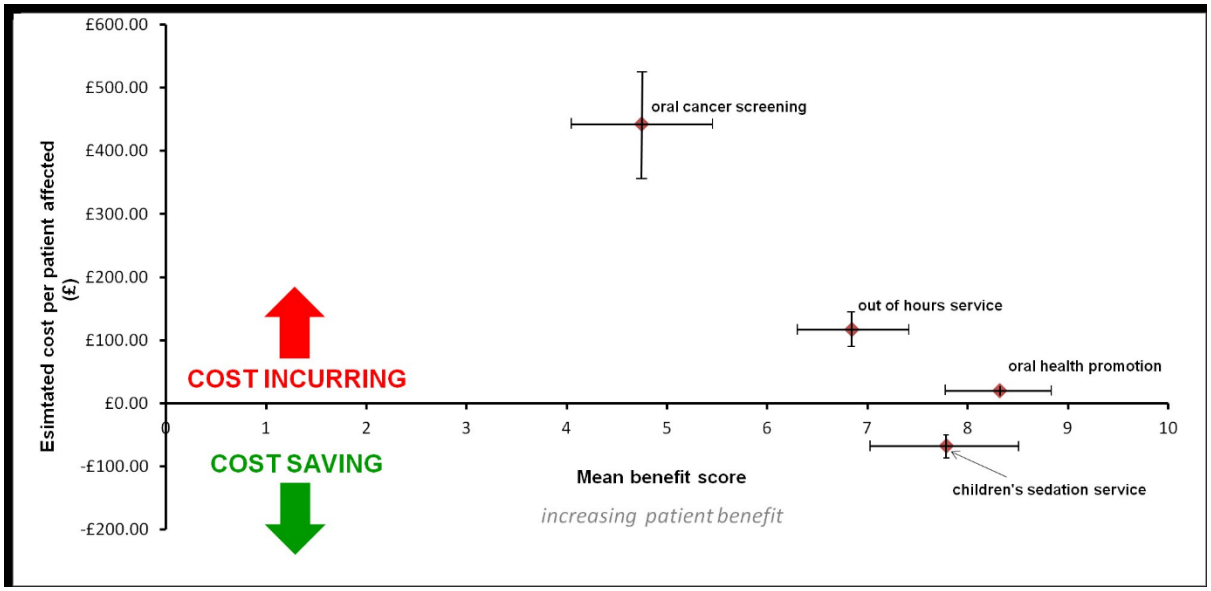

Fig. 1 Scatter plot of costs and benefits associated with four *hypothetical* dental business proposals for local NHS funding. ± 20% costs, ± 1 S.D. (standard deviation) mean benefit score.

Table 1 Stages in a PBMA priority setting exercise. (Modified from Mitton and Donaldson, 2004).

Stage	Description
1	Determine the aim and scope of the priority setting exercise
2	Compile a program budget (a map of current budget and expenditure)
3	Form marginal analysis advisory panel (involve key stakeholders)
4	Determine locally relevant decision-making criteria (involve key stakeholders)
5	Advisory panel to identify options in terms of: a) areas for service growth b) areas for resource release through producing same level of output (outcomes) but with fewer resources c) areas for resource release through scaling back or stopping some services
6	Advisory panel to make recommendations in terms of: a) funding growth options with new resources b) decisions to move resources from 5b) to 5a) c) trade-off decisions to move resources from 5c) to 5a) if the relative value in 5c) is deemed greater than that in 5a)
7	Validity checks with additional stakeholders and final decisions to inform budget planning process.

PBMA Meeting	*Meeting content*	*Participants involved*	*Venue*	*Research Methods*
One	PBMA presentation, question and answer session, participant information sheets and consent forms	NHS commissioners (n=8)	NHS commissioning organisation headquarters	Researcher (RH) field notes
Two	Agreed aim and scope of local priority setting exercise, agreed permissions to access financial data for Programme Budget (PB)	NHS commissioners and local NHS dentists (n=5)	NHS commissioning organisation headquarters	Field notes, audio-recording, interrogation of local NHS dental financial budgets (quantitative data)
Three	Introductory meeting and presentation, question and answer session, participant information sheets and consent forms	Patients (n=14) recruited via NHS LINk and VOICE North	Neutral venue - local village hall	Researcher field notes
Four	Presentation of PB results to PBMA advisory panel representatives (n=9), Identified areas for potential investment and disinvestment in local NHS dentistry	NHS commissioners, patients and NHS dentists	NHS commissioning organisation headquarters	Researcher field notes, audio-recording
Five	Researcher-led Workshop: Weighting the organisation's prioritisation criteria. [NHS commissioners and dentists completed this exercise independently].	NHS patients	Neutral venue - conference centre	Researcher field notes, 'budget pie' method to weight criteria
Six	Final PBMA Advisory Panel Meeting considered four hypothetical dental business proposals, evidence considered for each proposal (sent out in advance of meeting) and private votes cast	NHS commissioners, patients and NHS dentists	Neutral venue - city centre hotel	Field notes, audio-recording, panel deliberation and independent voting.
[Evaluation and Reflection]	Views of PBMA advisory panel members sought re. engagement; methods; final ranking of business proposals; format of the data presented	NHS commissioners, patients and NHS dentists	N/A - via email (agreed by panel for logistical reasons)	Qualitative written responses collated and anonymised

Table 2. Sequence of PBMA meetings held with participants and the research methods used.

Table 3 Mean scores awarded by the advisory panel (pre-weighting), with the weighted benefit score (WBS) and the provisional ranking of business proposals prior to consideration of costs.

	Headline Criteria with mean scores					WBS	Provisional Ranking
	Quality	Access	Value for Money	National & Local Priorities	Partnership Working		
(Weights)	(0.3172)	(0.2311)	(0.2214)	(0.1313)	(0.0991)	(1)	
'W' Oral Health Promotion	8.8	7.7	8.8	8	7.9	8.26	1st
'X' Oral Cancer Screening	5.6	5	3.7	4.4	4.4	4.73	4th
'Y' Children's Sedation Service	8.9	7.3	8.1	7.7	5.1	7.77	2nd
'Z' Out of Hours service	7.3	6.4	7.1	6.9	5.7	6.80	3rd

Table 4 Estimated costs and the WBS to give the cost-value ratio (CVR) per proposal with the final priority rank to inform further deliberation. (Negative values = cost-saving).

Proposal	Net Cost impact per patient	WBS	Cost-Value Ratio	Priority Rank to inform further deliberation
'Y' Children's Sedation Service	-£67.02	7.77	-£8.63	1st
W' Oral Health Promotion	£19.89	8.26	£2.41	2nd
Z' Out of Hours service	£116.92	6.80	£17.19	3rd
'X' Oral Cancer Screening	£442.50	4.73	£93.55	4th