

# Programme budgeting and marginal analysis: a case study of maternity services

Julie Ratcliffe, Cam Donaldson and Susan Macphée

## Abstract

**Background** This paper reports on a study which applied the framework of programme budgeting and marginal analysis (PBMA) to assist in developing a strategy for purchasing maternity services within the Grampian region of Scotland.

**Methods** PBMA as a process involves assessing how health care resources are currently distributed within services or programmes and making recommendations, in a resource neutral environment, about possible future changes. Data on activity and the extent of service provision within maternity care were used alongside information from national policy documents to decide on the main proposals for change in service delivery. Candidates for more resources were compared with each other and with candidates for service reduction to determine whether and what changes should go ahead. This involved 'marginal analysis' of the costs and benefits of the proposed changes.

**Results** The results demonstrate that modest changes in maternity services in line with government policy are achievable. Estimates of the cost of larger changes in line with policy appear to be feasible 'on paper'. However, it may not be possible to achieve the resource shifts required.

**Conclusions** This paper introduces the theoretical concept of PBMA and, in describing the study of maternity services, illustrates not only its usefulness but also practical problems in its implementation.

**Keywords:** economics, programme budgeting, marginal analysis, maternity services

## Introduction

Purchasing is a natural focus for collaborative work between economists and public health practitioners. A framework within, and around, which these skills can be pooled is known as programme budgeting and marginal analysis ('PBMA'). Of course, 'PB' and 'MA' are in fact two separate, but related, activities. The basic premise of PB is that it is important to know how resources are currently used before thinking about ways of changing this pattern. The basic premise underlying MA is that to have more of some services it is necessary to take resources from others. If this

latter premise were not accepted, there would be no need to set priorities and we could purchase or provide as much of any type of health care as was wanted or needed.

PBMA is not new to the public sector in general nor to health care specifically. In the United Kingdom, the technique was advocated as being of use in health care priority setting in the 1970s.<sup>1–3</sup> Since then, however, common use of PBMA in health care priority setting has failed to materialize. Only recently have examples of its use in health care purchasing come to light.<sup>4,5</sup>

The first aim of this paper, therefore, is to address the question 'why now for PBMA?' given its somewhat chequered history. Second, the paper then goes on to outline in more detail what PBMA is before describing a case study of its use in planning maternity care provision. One reason for choosing this case study is that maternity care is the area of health care for which there is probably the most comprehensive collection of evidence on outcomes from randomized trials in the form of the (updated) database on Effective Care in Pregnancy and Childbirth (ECPC).<sup>6</sup> Thus, the relevance of such an 'evidence base' to local priority setting issues could be examined.

## Why should the health service be more receptive to PBMA?

It could be argued that PBMA was not commonly used in the past (a) because of problems with information technology and (b) because the information produced

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Health Economics Research Unit, University of Aberdeen, University Medical Buildings, Foresterhill, Aberdeen AB9 2ZD.

JULIE RATCLIFFE, Research Fellow

CAM DONALDSON, Deputy Director

Grampian Health Board, Summerfield House, 2 Eday Road, Aberdeen AB9 1RD.

SUSAN MACPHEE, Consultant in Public Health Medicine

Address correspondence to Cam Donaldson.

in previous exercises tended not to be generated by those who would be using it. Therefore, the relevance of the information was somewhat diminished.

More importantly, however, the culture in the NHS is changing, largely as a result of two factors:

(1) The purchaser–provider split has clarified the role of each agency and explicitly made it the objective of the purchaser to address the health care needs of the local population within a fixed budget. If it is accepted that ‘need’ can be redefined as ‘ability to benefit’, then maximizing ‘met need’ produces an objective comparable to economic efficiency (i.e. maximizing benefits from a given budget). The situation is not this straightforward, as we will see below, but produces an environment that is potentially receptive to economics.

(2) There has been a growing acceptance among all types of NHS staff that resource scarcity is not the product of a particular government or dogma but a fundamental factor that will have to be addressed in all future decisions. This is not to say, ‘We are all economists now’, merely that the potential relevance of means of assisting with difficult decisions is more widely recognized.

This ‘favourable climate’ is to be welcomed. One problem with this is the difficulty purchasers have in using research evidence, particularly on health outcomes. Data on such outcomes are often not available or, if they are, are difficult to apply locally. However, this should not prevent more explicit considerations of resource availability, how such resources are used and how this can be changed for the better, especially as such decisions are taken anyway. It should be remembered that although ‘programme budgeting and marginal analysis (PBMA) has received a new lease of life as a result of the introduction of the purchaser–provider split in the United Kingdom, . . . it does not require such a split to exist before the ideas and techniques used can have value. . . . All that is required for the PBMA approach to be relevant is that there are concerns about how best to decide priorities in health care.’<sup>7</sup>

## What is PBMA?

The PBMA approach is very simple in theory. The basic premise of programme budgeting is that it is important to assess how resources are currently used before thinking of ways of changing this pattern. With marginal analysis, the premise is that to have more of some services, it is necessary to have less of others, and so the costs and benefits of proposed expansions in care must be weighed against costs saved and consequent ‘disbenefits’ from reducing the amounts of resources devoted to other areas of care.

TABLE 1 Five stages of PBMA

Stage 1	Identify your programme
Stage 2	Statement of expenditure and activity by sub-programmes (i.e. the ‘programme budget’)
Stage 3	Decide on services which are candidates for expansion or introduction and services which are candidates for reduction
Stage 4	Measure costs and benefits of proposed changes (i.e. ‘marginal analysis’)
Stage 5	Make recommendations

The implementation of such principles is not so straightforward. The five basic stages of PBMA are outlined in Table 1. In Stage 1, it is important to think about ‘what constitutes a programme?’. The main source of debate around this issue is whether programmes should be disease-specific or client- or service-specific. The driving force will be the classification which best suits the purchaser. In the exercise reported in this paper we have chosen a service-specific classification in considering the provision of maternity services throughout the Grampian region. This is because the reason for establishing a group to examine maternity services was a result of recent national policy documents on the provision of such services.<sup>8</sup>

Stage 2 involves compiling a statement of the activity and expenditure incurred in each part of the programme, i.e. the ‘programme budget’. This process helps to define a programme and its component parts (or sub-programmes) and allows for an assessment of the current situation. It also facilitates consideration of where possible future changes in relation to the use of resources within sub-programmes can be made. Whether this stage of analysis is in fact necessary is a controversial issue. After all, the important stage is the marginal analysis (i.e. analysis of costs and benefits of proposed changes). However, it may be the case that a group is reluctant to suggest candidates for more and less resources without knowledge of how resources are currently being used. Furthermore, if the group has little knowledge of the service in advance, it is even more important to have the information provided by a programme budget. The very process of compiling such information can also be useful in identifying potential areas for change. Nevertheless, it remains the case that, if the group is already aware of what the important issues are, it may be a better use of time to proceed straight to marginal analysis.

One thing is certain: if an attempt is made to compile a programme budget, there will always be some costs which cannot be exactly allocated to different parts of the programme concerned. It is important to

remember, however, that a programme budget is simply an attempt to provide a 'rough and ready' picture of how resources are currently spent. It could also be argued that the fact that programme budgeting exposes such deficiencies in data is to its credit rather than being a weakness of the technique.

Stage 3 of the process involves the compilation of a list of candidates for service expansion or introduction, and candidates for service reduction. There are several ways of identifying these candidates. These have been listed in a recent publication by the Scottish Needs Assessment Programme (SNAP) of the Scottish Forum for Public Health Medicine.<sup>9</sup> Relatively structured approaches can be taken, such as examining whether there appear to be objectives without adequate spending allocated to them or, indeed, whether there appears to be spending with no apparent objective. One other method, recently employed in stimulating thought about possible expansions and reductions in services in maternal and child health services<sup>4</sup> and in dementia services for elderly people,<sup>10</sup> is to ask groups of purchasers, providers or consumers questions along the following lines: 'If spending on your programme were to be increased by £200 000 per annum, what would you spend it on and what would the effect be – if possible, in terms of both services and health, but, failing the latter, then in any terms in which an estimate can be made?' and: 'If spending were to be reduced by £200 000 per annum, what would go, and what would the effect be in terms of services and health?'

Another structured method is to examine the literature for areas of potential expansion and of doubt about 'value for money'. This literature may include local or national policy documents (often produced by expert groups). Equally important, but less structured, is to establish bodies, such as an advisory group of local providers, to aid purchasers in this process. This local knowledge can be very important. There is no ideal way of doing this, but, in general, the candidates for service expansion should be those activities which have the greatest capacity to benefit from increased expenditure. The candidates for service reduction should be those activities which provide the least (or even no) benefit given the resources spent. The best candidates for expansion and reduction may not always be identified. The relevant question, however, is whether such proposed changes have the potential to improve the outcome of service delivery relative to the status quo. None the less, this stage, if anything, displays the distinguishing feature of using an economics-based approach in purchasing: the explicit recognition that sacrifices have to be made to achieve improvements elsewhere.

Stage 4 involves comparison of the candidates

through marginal analysis, i.e. by comparing them in terms of costs and benefits. There is nothing new in this. It involves the use of conventional economics techniques.<sup>11</sup> It is important to recognize, of course, the difficulties of obtaining accurate (or indeed any) estimates of the benefits gained by expansions in some services and the benefits lost by reducing others. Quite simply, this has to be done in the best terms possible. If outcome data are not available, it may be possible to define certain benefit criteria against which options are to be judged, to weigh each criterion and then to score each option using the weights. This is similar to the framework used for benefits assessment in option appraisal of capital developments. Some groups may feel more comfortable with simple 'descriptions' of benefits of options without resorting to scoring mechanisms. It is important at this stage to emphasize that (a) assessing benefits is a problem of purchasing in general and not just of economics, and (b) it may still be possible to make progress by the use of an economics framework to organize whatever information is available. This framework can still be used as a basis for judgement that certain costs are worth incurring or should be cut back rather than providing decision rules about which services to expand and which to reduce. On the basis of such judgements, Stage 5 is reached and recommendations can be made.

This discussion of the practicalities of implementing PBMA has, so far, not addressed the problems of estimating costs. Problems here are in assessing the magnitude of any proposed reductions in activity and in estimating costs savings from such reduced activity. Scales of change are important here. For example, a small reduction in activity may hardly affect staff costs, whereas a much larger reduction in activity may mean that staff costs can be reduced (or at least staff can be redeployed to more beneficial activities). Therefore, it is important to work through proposed changes with provider managers to establish reasonable estimates of staff required to facilitate expansions and savings in staff costs from proposed reductions. For example, in the study of maternity services outlined below, all of the proposed changes were worked through with a midwife-manager to assess the impact on staff costs. Assumptions can also be made about impacts on other costs, such as 'hotel cost' savings arising from reduced lengths of stay.

## **PBMA in maternity services**

### **Background**

The exercise in Grampian lasted from April 1994 to January 1995. Two groups of individuals were formed.

The first group was the main driving force in the exercise and the second group acted as an advisory body. The first group comprised three members of Grampian Health Board (including a public health physician, a contracts and planning manager and a member of the finance department) and two health economists. The second group was made up of providers of maternity services including obstetricians, midwives, general practitioners and a member of the local consumer health council. In consultation, the groups decided that the best approach would be to split services into three components of care (antenatal, intrapartum and postnatal) and look at each separately. Initially, it was decided to concentrate on intrapartum care, as this forms the heart or core of maternity services. However, it turned out that, in looking at intrapartum care in detail, suggestions for changes in antenatal and postnatal care were made (see below).

### Programme budget

The programme budget used in the PBMA of maternity services in Grampian is displayed in Fig. 1. The maternity services programme has been split into a number of sub-programmes according to two main criteria – the planned location of delivery and the eventual type of delivery. The programme budget contains information relating to activity and estimated annual expenditure for that activity. The shaded areas represent cells which simply do not make sense. For example, no-one booked for obstetrician care would be expected to deliver in the location 'Aberdeen Maternity Hospital Midwives Unit'. Therefore, there is no expenditure figure in this cell (i.e. B4).

A list of points to bear in mind when constructing a programme budget is provided in the SNAP publication referred to above.<sup>9</sup> In this case, records of activity within each of the cells of the programme budget were made available by service providers on the advisory group. Costs for the 1993–1994 financial year were also obtained from providers. For members of staff involved in providing other services or in providing intrapartum care in more than one location, estimates of staff time attributable to intrapartum care in each cell were obtained from finance, medical and midwife staff in the relevant units. Consumable and equipment costs were directly attributable to each cell, but capital and overhead costs had to be apportioned in similar ways to staff costs.

Despite its 'rough and ready' nature, this stage of the work helped the groups in defining the maternity services programme and its component parts (or sub-programmes). The process of its construction also resulted in suggestions for changes in uses of resources.

As well as the process of constructing the programme budget, candidates for reduction and expansion were identified largely on the basis of advice and expertise of the advisory group about the future development of maternity services in Grampian and recent policy documents from the Scottish Office which have made recommendations about the provision of maternity services.

### Marginal analysis: costs

The candidates for service expansion and reduction and their associated costs are listed in Table 2. The proposals for any future developments were complicated by the current redevelopment of services (including maternity) within Grampian resulting in the movement of some services for residents of the Moray area to the main hospital (Dr Gray's) in that area. Therefore, the scenarios for possible expansions listed in Table 2 are detailed separately for Moray and for the rest of Grampian residents.

The group debated various scenarios with regard to possible combinations of hospital, DOMINO ('*Domiciliary in out*') and home births. The initial scenarios considered, although useful for stimulating debate, were found to be cumbersome when trying to allocate costs. On re-examination of current activity data and predicted changes contained within the Scottish Office report, it was decided to assess the impact on costs and benefits of a small and large change from current activity in Moray and the rest of Grampian. It was also decided to include the home births in a total figure for home and DOMINO births, as the level of community and midwifery support for each of these would be similar. Also, it was felt that the number of home births would remain relatively small compared with the number of DOMINOs, particularly if DOMINO delivery became more freely available.

It is almost impossible to guess accurately what the future demand by women for hospital, midwife unit, DOMINO and home births will be. The purpose of these scenarios is to try to identify what might be reasonably realistic outer limits of expansion of DOMINOs and home births and to examine the resource implications of changes on such scales.

A number of possible reductions have been identified. The first suggested change is in the provision of antenatal care, i.e. moving towards a new primary care approach and reducing the number of visits made. The second is a reduction in the average length of postnatal stay by one day and the third is a reduction in activity at Aberdeen Maternity Hospital (AMH). The fourth is a reduction in activity outside Grampian for Grampian residents (e.g. at Raigmore Hospital in Inverness), as the proposed expansions would now

DELIVERY TOOK PLACE IN:	BOOKED FOR:			
	HOME	DOMINO	GP/MIDWIFE CARE (non-DOMINOs)	OBSTETRICIAN CARE
AMH SPECIALIST	A1 Transfers - 8  £6 584	A2 Transfers - 26  £21 398	A3 Transfers Turner - 11, Maryhill - 128, Peterhead - 56, Seafield - 29, Chalmers - 29, Torphins - 4, Leancoil - 19, Fraserburgh - 60, Jubilee - 12, Inch - 2.x £288 050	A4 Activity/Transfers - 4000  £3292 000
AMH MIDWIVES UNIT	B1	B2 Activity - 82  £47 756	B3 Activity - 1595  £825 244	B4
COMMUNITY HOSPITAL	C1	C2 P'Head F'Burgh Leancoil Buckie Banff  £2 000	C3 Activity Turner - 26, Maryhill - 234, Peterhead - 122, Seafield - 64, Chalmers - 78, Torphins - 45, Leancoil - 52, Fraserburgh - 151, Jubilee - 42, Inch - 6.  £349 300	C4
OUTSIDE GRAMPIAN	D1 Newcastles/Raigmore Hospital - 0	D2 Raigmore/Angus - 0	D3 Activity - 13  £17 142	D4 ECRs - 38 (including Ninewells - 10) Raigmore - 239  £452 150
HOME	E1 Activity Data - 28  £12 880	E2 Accidental - 3  £1 380	E3 Accidental Turner - 0, Maryhill - 4, Peterhead - 4, Seafield - 0, Chalmers - 0, Torphins - 1, Leancoil - 0, Fraserburgh - 0, Jubilee - 0, Inch - 0.  £4 140	E4 Accidental - 9  £4 140

FIGURE 1 Programme budget for intrapartum care. AMH, Aberdeen Maternity Hospital.

TABLE 2 Marginal costs of proposed expansions and reductions in maternity services

Proposed expansions	Cost
<i>Increased activity at Dr Gray's, Elgin</i>	
Total activity: 1000–1100 births p.a.	
Modest increase: 60 DOMINO or home births	£56 496
Substantial increase: 600 DOMINO or home births	£274 000
<i>Increased DOMINO or home deliveries in Aberdeen</i>	
Current activity: 1991 normal births p.a.	
Modest increase: 120 DOMINO or home births	To be absorbed
Substantial increase: 1200 DOMINO or home births	£116 000
<i>Increased DOMINO or home deliveries outside Aberdeen and Dr Gray's</i>	
Current activity: 1120 normal births p.a.	
Modest increase: 70 DOMINO or home births +500 others	£46 000
Substantial increase: 700 DOMINO or home births	£179 760
Proposed reductions	Cost savings
<i>Reduced antenatal visits</i>	
Average number of visits to be reduced from 13 to 7–8; estimate based on savings in staff costs from fewer clinics	£196 460
<i>Downsizing activity at AMH</i>	
(A) The above expansions could result in 960–1090 maternities being moved out of AMH	£160 000
(B) Postnatal length of stay to be reduced for normal births from 3.5 days to 2.5 days	
Cost reductions are assumed to be those of a small ward including overhead costs and reduced staff; this could be equivalent to making available 9 or 10 midwives (E grade) to work in the community	
<i>Downsizing activity at Raigmore</i>	
These are currently funded on a cost per case basis; funds will be released from obstetrics, the special care baby unit and out-patients as a result of change in the size of the contract, but it is unlikely that the full amount currently paid to Raigmore will be available	£241 860

make care of such people possible within Grampian (i.e. at Dr Gray's).

As well as providing an estimate of the cost implications of the proposed changes in Table 2, the assumptions underlying these initial cost estimates are outlined in the left-hand column of this table. Some of the proposed service reductions release only small amounts of cost savings. This is because such reductions in activity are not large enough to affect many cost items. It can be seen that the modest cost increases amount to £102 496 (i.e. £56 496 + £46 000) in total whereas the substantial increases result in total costs of £569 760 (i.e. £274 000 + £116 000 + £179 760). These increases are matched by cost reductions of £598 320. Overall, the expansions proposed could be financed out of the proposed reductions in services. This is, of course, based on the assumption that the savings estimated from such reductions would be realized. In this respect, it is important to stress that, particularly in the areas of reduced antenatal visits and downsizing at AMH, it is a question of releasing resources and not cash. Thus midwifery staff time can be released from

the hospital and taken up by more work in the community. Less confidence was placed in achieving savings from the closure of community units (at Turner, Maryhill, Seafeld and Leancoil in cell C3 of the programme budget), where, in practice, all savings identified to date have already been reallocated to the Dr Gray's Hospital development. The savings identified from less activity at Raigmore are more likely to be achieved. All of these costs are estimates and simply provide approximate figures which help to set the framework for more detailed discussions on the content of actual contracts. It does seem, however, that the modest expansions are achievable but that the more substantial ones are less clear cut.

One further thing to note is that most of the changes involve treating the same group of patients differently (e.g. a DOMINO instead of a more conventional delivery). No one group gains at the expense of another. The only possible exception to this is that there could be small reductions in benefit for some people at antenatal and postnatal stages, to allow (supposedly greater) gains to be had elsewhere. Indeed,

the following sub-section describes an assessment of whether any evidence existed on the possible health outcomes of such changes, and, if it did, then what such data implied in terms of whether or not proposed changes should proceed.

### **Marginal analysis: review of outcomes**

Outcome data were not available for most of the proposed changes. However, it was assumed that the expansion in services at Dr Gray's was preferred to having services available at Turner, Maryhill, Seafield and Leancoil; likewise with services at AMH and Raigmore which are proposed for reduction, with the activity being moved to Elgin (i.e. Dr Gray's). From the ECPC data set there is limited evidence available on each of the three other areas: DOMINOS, home births and postnatal stays.<sup>6</sup> There is no evidence on antenatal visits.

With regard to increased use of DOMINO deliveries and home births, there are no trials which have directly compared such deliveries with conventional delivery. However, there are indirect ways of establishing whether there is benefit here. The results of a randomized trial undertaken in the mid-1980s concluded that continuity of care is beneficial in terms of psychosocial outcomes such as feeling more in control during labour and feeling more prepared for child-care.<sup>12</sup> There were no differences in clinical outcomes between the two arms of the trial. It could be argued that such continuity is more likely to be associated with the model of care underlying DOMINOS and home births. Similar results have been reported for comparisons of midwife with medical shared care.<sup>13</sup>

Results from trials of early discharge are less clear cut. Yanover *et al.* reported on a study which randomized 88 patients to shorter hospital stay versus conventional care.<sup>14</sup> It was found that there were no significant differences or trends in numbers and types of morbidity during hospitalization or the six weeks postpartum period. The study concluded that early discharge with home care follow-up is safe, feasible and well accepted by patients. A much earlier study reported on 2257 patients, the majority of whom (1941) received early discharge and the remainder (316, acting as a control) received conventional care.<sup>15</sup> The results indicated that there was no statistically significant difference in the health or well-being of the mothers who were discharged from the hospital early as compared with the controls. However, it was found that the mothers who were discharged early were less satisfied with the hospital stay and with the general hospital care than those who stayed longer. In summary, the results show that early discharge is safe but is neither clearly beneficial nor wanted by the majority of women.

It is interesting to note that even with the facility of the largest collection of evidence from randomized trials for any area of health care (i.e. pregnancy and childbirth), much of the evidence is still not relevant to the kinds of choices faced in Grampian. Almost all of the changes proposed, although backed by policy documents, have to be based to a larger extent on judgement rather than evidence.

### **Lessons and future direction**

It seems that modest proposed expansions can be achieved at the cost of some service reductions based on reduced antenatal visits, shorter postnatal stays and downsizing of activity in several hospital locations. However, whether this is actually the case for more substantial expansions will require further discussion locally. From the limited evidence available, it would seem that the proposed changes would have little or no effect on health, and would result in a service which is more in line with women's preferences and local and national policies on maternity and childbirth services.

With regard to the use of PBMA, there were three main lessons. First, the process of constructing the programme budget was useful for generating debate about where possible changes in service delivery could be made. However, to make progress, it was not necessary to construct a programme budget for the whole of maternity services. In this case, a programme budget for intrapartum care only was used.

Second, we would never argue against having more evidence on patient outcomes. However, there are some local issues which are likely to arise in many purchasing organizations, particularly about the location of services, on which there is unlikely to be any evidence now or in the future. Despite this, it has been demonstrated in this study that progress can be made without a comprehensive set of such outcomes.

Finally, it is important to remember that although many savings are expressed in monetary terms, they represent resources which have a narrower range of alternative uses than a corresponding amount of cash savings. The advantage of thinking in terms of resources, however, is that resource savings are easier to 'get out of the system' than are cash savings. Therefore, stalemate is more likely to be avoided when seeking to implement change.

On this last point, it is important to be aware that what is contained in a report based on PBMA may not be what is finally included in a contract. PBMA is simply a tool for helping purchasers to establish their priorities, using a more systematic framework than in the past. Thus, it is simply a part of the purchaser's armoury when entering into negotiations with providers.

The result of such negotiations may not be as documented in the PBMA report.

## Conclusions

The use of PBMA helped in stimulating thought about possible future changes in the use of resources within the maternity services programme. It provided a useful background for judgement about possible service developments and possible service reductions which would have to take place to allow such developments. It is important to remember that the most important thing about the economics approach is the framework it provides; a framework for organizing information and a framework for thinking with regard to priority setting for purchasing. In many priority setting situations, the best one can hope for is simply a description of the possible outcomes of each option assessed. If such descriptions can be supplied, intangible costs and benefits can then be considered alongside those which are more readily measurable. The trade-offs between such benefits and costs will still be explicit.

Such exercises are not entirely problem free. The main constraints were getting a team together which could meet on a regular basis, going through the process of involving providers, and simply getting data out of the system. Information collection in the National Health Service is not geared up for PBMA exercises. Therefore, it is often difficult to disaggregate data to an appropriate level. However, it could be argued that the fact that PBMA exposes such deficiencies is important in itself.

Overall, the implementation of PBMA in maternity services has proved a beneficial exercise which has generated useful information to facilitate future purchasing decisions. It is hoped that relating the results and experiences of the use of PBMA in maternity services in Grampian gives encouragement to those who are struggling with trying to implement explicit and rational priority setting in the health care system. Locally relevant estimates of the costs and benefits of proposed service changes, though sometimes crude, are, ultimately, the outputs of PBMA.

## Acknowledgement

The Health Economics Research Unit is funded by the Chief Scientist Office of the Scottish Office Department

of Health (SODH). However, the views expressed in this paper are those of the authors, not SODH.

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Accepted on 5 December 1995