

Efficiency in Resource Allocation

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ABSTRACT

The purpose of the present paper is to outline a health planning framework for the achievement of allocative efficiency by the comparison of programs across the entire health sector. Implementation of the framework could form the basis for improved resource allocation. In Part 1 there is a discussion of allocative efficiency; its importance, the theoretical requirements for its achievement, and identification of aspects of current health funding arrangements which inhibit the achievement of allocative efficiency. In Part 2, the health planning framework is outlined and its relationship to the prerequisites for allocative efficiency is explained. Implementation of the framework involves several key conceptual challenges, some approaches to these are discussed. Finally, current work on application of the framework to non-insulin dependent diabetes mellitus (NIDDM), in which issues to do with implementation will be explored, is introduced.

PART 1: ALLOCATIVE EFFICIENCY

1 The Importance of Allocative Efficiency

1.1 Introduction to the Role of Economics

The discipline of economics is concerned with the maximisation of community well-being in the face of unlimited wants and limited resources. The primary focus of economics is the allocation of resources to enhance community well-being. Achieving an optimal allocation of resources, the allocation that maximises well-being, requires attention to the three fundamental economic questions vis:

- i) what to produce: known as 'Allocative Efficiency' and concerned with the optimal mix of goods and services;
- ii) how to produce: known as 'Technical (or production) Efficiency' and concerned with the least cost combination of resource inputs for the production of nominated goods or services; and
- iii) to whom should goods and services be distributed; the question of social justice or equity.

The focus of this paper is the health service mix. There is a broader allocative efficiency question which concerns the allocation of resources between health and other sectors of the economy. It may be that the optimal allocation of resources across the economy will require spending more (or less) on health services than presently occurs. That question is not the subject of this paper.

Within the health sector resource use must be technically and allocatively efficient and reflect social justice objectives or else, by definition, it will be possible to obtain greater social benefits - either better health or some other benefit - with exactly the same resource use. Governments have a legitimate concern with these matters and legitimate grounds for interventionist policies to address the sources of inefficiency.

From a policy perspective, the achievement of allocative efficiency in the health sector requires answers to the questions:

- i) which health interventions make relatively greater contribution to well-being per dollar, constituting preferred programs; and
- ii) what policy instruments are available to effect a transfer of resources to preferred programs, at the expense of less cost-effective programs.

This paper is concerned with the first of these two questions.

1.2 Is the Health Service Mix Optimal ?

There is ample evidence that the current delivery of health care in Australia is not least cost, does not incorporate the optimal mix of health interventions nor does it ensure equitable access.¹⁻⁵ For the health service mix to approximate optimum, without input from a suitable health planning framework, a number of conditions would need to be met including: (i) opportunity for unimpeded transfer of resources between health services offered by different agencies and through alternative funding sources; (ii) a tradition and expertise in economic evaluation of health services; (iii) payments for services on the basis of health outcomes or value, not the cost of service provision. None of these conditions are met by the Australian health delivery system. Even if they were, issues of access to health services, and global budget would need to be separately addressed. Specific aspects of the health funding and delivery arrangements that discourage the efficient allocation of resources, especially in relation to the health service mix are described later.

A dominant focus of current health policy, is technical efficiency (minimising unit costs of production). This is being addressed through a mix of policies including the global budget and service payment based on throughput. The latter is typified by case-mix funding of acute hospital care (based on DRGs) and its counterpart in the nursing home sector (CAM SAM) and the setting of recommended fees for medical services. Imposition of budget limits has also been used successfully in Australia and overseas, to restrain health system expenditures and to create an incentive for rationalisation of resource use.⁶

Policies directed at technical efficiency will not necessarily achieve the optimal allocation of resources and may even exacerbate distortions. Throughput is generally a poor proxy for health outcomes; and restriction of application to a single health delivery setting (eg inpatient care, nursing home care) generates distortions. Explicit consideration of the impact on the health service mix and achievement of allocative efficiency is necessary but is not part of the current approaches to technical efficiency.

1.3 Sources of Distortion in Health Service Mix

Typically health funding arrangements and the institutional setting for health service delivery, inhibit the movement of resources from less efficient to more efficient health programs, as exemplified by the following arrangements.

i) Discrimination in the funding of health professionals

'Medicare' reimburses the health services of medical practitioners (to the schedule fee) but does not cover the services of allied health professionals (excepting optometry and limited dental). At the margin this discourages use of allied health services.

ii) Fee-for-service funding arrangements

Commonwealth funded Medicare meets the cost of health services delivered on a fee-for-service

basis by medical practitioners, supporting one-to-one service provision to the patient. The only limit on the supply of medical practitioner services is medical manpower. Medicare services are funded in response to any level of demand (including supplier induced demand). Multi-disciplinary teams, group sessions and support services to family members may be funded by state governments, but with supply strictly restricted by global or program budgets, often leaving substantial unmet demand. The differential funding arrangements jeopardises rational choice between models of care.

iii) Incentives for Cost Shifting

The split in funding and responsibility for health care between the Federal and state governments, has encouraged agencies to engage in cost shifting. The 'privatisation' of some outpatient clinics, previously funded by state governments, through direct billing of Medicare for medical services, is an example of cost shifting from the state to the Commonwealth Government. This has had the effect of medicalising these out-patient services, potentially offering less appropriate care, at higher cost to the community, but at lower cost to state governments.

iv) Split in health service provision

Health service providers are responsible for their own services, with accountability for general health status of patients unclear. Agencies acting in isolation cannot always ensure the optimal mix of services to patients. This is especially so where clients (and/or family members) need to access 'outside' services, which may or may not be available within the service delivery system or to that client group. In addition financial incentives can inhibit referrals. This poses a particular problem for the treatment of chronic diseases which often require on-going management utilising the services of a number of agencies/service providers.

Partly because of such distortions, the health service mix is suboptimal. This means there is potential to improve health outcomes without expanding health service budgets, by shifting resources away from programs where marginal cost-effectiveness is poor to those that yield better health gain per unit of cost.

The possibility that health outcomes can be enhanced by shifting resources between broad program areas and between health interventions is particularly pertinent at a time of restricted health budgets and increasing health service demands associated with advances in medical technology and an ageing population. The challenge is to enhance health outcomes without using extra resources, or in the face of resource reduction. The appropriate level of total expenditure on health services is a separate issue which ideally would be reviewed simultaneously or subsequently.

Unless a health funding and delivery system can be devised that can replicate the signals of an efficient market, allocative efficiency can only be addressed through a suitable health planning framework.

2 APPROACHES TO HEALTH SERVICES PLANNING

A number of approaches to health services planning, currently used in Australia and elsewhere, which in part at least, address the health service mix are introduced below. Serious methodological

shortcomings occur with all these approaches.

2.1 Needs assessments

Needs assessments are of two broad types;

i) *Cost of illness studies:*

Cost of illness or disease costing studies highlight the 'importance' of a particular disease to the community, by estimating the impact of the disease on mortality, morbidity and the economy.⁷⁻¹¹ They generate an assessment of the total burden on the community of the nominated disease, based on broad health service data and known epidemiology. This by itself, is of no assistance in choices between competing health interventions. Unless cost of illness studies also consider in a rigorous way, opportunities for changing the burden of illness, through specific interventions, they cannot contribute to identification of the optimal health service mix.

ii) *Community based surveys of health care priorities:*

Service providers may seek to establish, through survey techniques the health care priorities of the communities they serve. Such studies focus on perceptions of the public and often highlight issues of access. They invariably identify an extremely broad range of concerns.¹² The application of a rigorous approach to prioritisation of concerns or ranking of possible intervention options tend to be rare.

Neither approach includes any explicit method for the identification and analysis of health programs which may reduce the burden of disease or address the health issues of concern to the community. Without this, such studies can make little contribution to prioritisation of interventions to modify the health service mix.

2.2 Statements of goals and targets

The development of goals and targets is a health planning approach particularly common in the field of health promotion.¹²⁻¹⁵ Typically targets are specified for incidence and prevalence of modifiable risk factors and/or for the incidence of disease and nominated complications. Statements of goals and targets will represent little more than 'wish lists', unless there is specific consideration of the capacity of interventions to achieve nominated goals within available budgets. Even where epidemiology is used to establish the theoretical preventability of a condition, without information on health interventions their cost and capacity to achieve change, they offer no basis for allocating resources between health programs. In the development of goals and targets, research teams in recognition of these issues, often try to incorporate consideration of 'achieveability' and cost but inevitably in an adhoc fashion.

2.3 Best practice documents/guidelines for practitioners

Best practice guidelines are usually prepared by clinical groups/health service providers, often through a 'Consensus Conference'.¹⁶⁻¹⁹ While guidelines are most valuable to practitioners, they are not a substitute for health services planning. They cannot be expected to achieve or even promote allocative efficiency. They rarely include explicit or adequate consideration of the costs of patient management options. It is perhaps contradictory, to expect a document to serve both as a guide for clinicians, who commonly perceive their role as that of advocate for their patient to obtain the best care regardless of cost, and also to be a planning document which describes optimal patient management from the viewpoint of the whole community. On occasions this latter task may involve withholding or limiting provision of effective but cost-ineffective services.

2.4 Historic based decision rules

Historic based decision rules have been the standard approach to health services planning. Funding is based, broadly on previous years allocation to program areas, plus or minus some percentage, with the adjustment usually reflecting changes in health service costs, the population base, gross domestic product, or a politically determined budget. Adjustments tend to be relatively uniform, with all program areas treated alike regardless of whether they are more or less cost-effective. Where differential adjustment does occur, this is typically in response to pressure group input or partial reviews of segments of the health sector. This approach is effective in capping total health spending, but has no mechanism for maximising health outcomes within a predetermined budget by reallocating resources from less to more cost-effective programs.

2.5 The Quasi-Market Approach

Case-mix funding(within global budget constraints) and fee-for-service reimbursement for medical services, represent quasi-market approaches to health services planning, with services funded on the basis of average cost of production. By rewarding low cost at the expense of high cost producers, at its best, they promote technical efficiency and the movement of resources to the more technically efficient production units. While technical efficiency is desirable, it is only one of the three prerequisites for optimal resource allocation(as listed in section 1.1). It's achievement does not guarantee allocative efficiency or the achievement of social justice objectives. If cost-based funding formula are limited to only one part of the health delivery system and in isolation of other measures to address the health service mix and access to health services, they may well worsen overall health outcomes for the community. The Quasi-market approach would, at the same time, achieve allocative efficiency only if the cost of service delivery were a good approximation for marginal value, in terms of contribution to health outcomes and if the same cost/value based reimbursement applied across all health services. Clearly, these conditions do not apply.

All of these common approaches to health services planning give scant recognition to resource scarcity and the need to make choices between competing demands. This violates the most fundamental economic principle, that the benefits of activities should be compared with the benefits foregone by diverting resources to the next best alternative activity, ie the opportunity cost. Analysis needs to be at the margin, addressed at opportunities for change. Most importantly none of the

approaches give sufficient attention to outcome measurement.

2.6 Economic Evaluation

The literature contains few reported economic evaluation studies in which resource allocation has been analysed across the entire health sector or even within a broad disease grouping.²⁰⁻²² Most economic evaluation of health programs is restricted to the review of a small number of interventions targeted at a narrowly defined and often intermediate health objective, such as alternative models for breast cancer screening, normalisation of blood pressure or screening for diabetic retinopathy.²³⁻²⁵ While some attempts at an economic framework for adjusting the health service mix have been reported, such as 'program budgeting'(which is only proposed as a partial model) and the more rigorous development of league tables.^{26,27} These are largely discussed at a conceptual level .

The most famous of the studies to date broadly based on an economic framework, 'the Oregon experiment'²⁸ was compromised by methodological as well as implementation flaws. Some perverse results have been reported.²⁹⁻³¹ Implementation of the Oregon model has been compromised by gross simplifications in the costing of health interventions, the limited scope of services covered by the model, the use of a simplified and locally calibrated version of Kaplan's 'Quality of Well-being' (QWB) instrument for the measurement of QALYs. Even the original version of this instrument incorporates some highly perverse values. The requirement for marginal as distinct from average analysis was ignored in the experiment.

An Australian example of the systematic use of economic analysis to inform resource allocation decisions, is provided by the health planning framework adopted in 1993 by the Commonwealth Government, for the listing of drugs on the Pharmaceutical Benefits Schedule(PBS). Pharmaceutical companies are now required by the Commonwealth to submit economic analyses (cost-effectiveness or cost-utility analysis), according to published Guidelines³² in support of the listing of new drugs on the PBS. The Guidelines provide a valuable input to health services planning. This is despite a number of practical problems, and the attitude of the regulatory authority to evidence (on efficacy and health service costs other than pharmaceuticals) which effectively protects drugs already on the schedule and the limitation on choice of comparator. A subset of health interventions is now subject to rigorous economic analyses, potentially influencing resource allocation. Unfortunately, because this does not constitute a health sector wide planning framework, there is no certainty that any resulting changes to resource allocation will be in the direction of a global (health sector-wide) optimum.

Recent developments in the theory of health delivery systems might suggest that the entire issue of a health planning model could be avoided. The 'Purchaser-Provider' and the 'Managed Competition' models of health service delivery represent models of health care funding and delivery designed to promote both allocative and technical efficiency. In these models there is a separation of the purchasers and the providers of health care, with the former responsible for the **total** health care of a community or constituency, and receiving commensurate funds for the purchase of services on behalf of their community. A small number of countries have moved towards such a health funding/health delivery system (including Britain and New Zealand). The possible relevance to Australia is a matter of current debate.³² Importantly, any 'purchaser-provider' system or system of 'managed

competition' requires advice on how to select between competing health interventions. In other words, these models of health service funding and delivery are complementary to, and not competitive with, a health planning model for allocative efficiency, and have an incentive to use information provided by research into the health service mix.

A key challenge for health economists and health planners at this time is thus to develop and operationalise a health planning framework for the achievement of allocative efficiency.

3. ACHIEVING ALLOCATIVE EFFICIENCY

3.1 Specification of conditions for allocative efficiency

Economic theory provides the conceptual framework for the prioritisation of health services to maximise health outcomes given limited resources. An important prerequisite for maximisation is that **at the margin** health outcome per unit cost must be equal for all interventions. This necessary condition for allocative efficiency is usually expressed by the equation :

$$MBa/MCa = MBb/MCb = MBc/MCc = \dots MBi/MCi \dots = \dots$$

(where MBi & MCi refer to the marginal benefit & marginal cost of project i).

If this equation is not satisfied then, as a matter of logic, it is possible to increase social benefits. Supposing that $MBa/MCa > MBb/MCb$: the transfer of \$1.00 away from project B would lower benefits by $MBb/MCb \times \$1.00$; its transfer to project A would increase benefits by $MBa/MCa \times \$1.00$ and, as this is the greater amount, overall benefits would increase. The equation highlights several important issues as explained below.

3.2 Centrality of marginal analysis

The condition for allocative efficiency requires a focus on marginal benefits and marginal costs, which reflect options for change. The possibilities for enhancing health status through shifting resources between health programs cannot be established from information about total costs of a disease or even total or average costs of an intervention. Average costs will invariably differ from marginal costs as effectiveness tends to vary with the patient/community group to which a program is directed (and other program attributes).

The health planning framework must focus on marginal program elements. This requires that for each health intervention, the specific attributes that would maximise benefits from an additional unit of expenditure be identified and also the program attributes for which a reduction in expenditure will result in minimum loss in health status, be identified. For example, a screening program for type 2 diabetes, directed at those at high risk (eg older obese individuals with a family history of diabetes, or members of ethnic groups known to exhibit high prevalence rates) is likely to be more cost-effective than a screening program directed at the general community. Programs with different attributes need to be analysed as separate sub-programs.

The concept of marginal also relates to the most marginal health program area. The aim is, to identify

that intervention with the greatest health gain per unit cost, and at the other extreme the intervention for which the loss in health benefit per unit cost reduction is least. Well-being would be enhanced by shifting resources from the least cost-effective to the most cost-effective intervention. Continual iterations at the margin, following recommended resource shifts, would move the health service mix towards optimal and reduce differences between MB/MC ratios of programs and sub-programs.

3.3 Measurement of benefits

The equation also highlights the importance of measuring benefits. Common approaches to health services planning often do not measure benefits at all, or else inappropriately. This may be a response to the difficulty in deriving valid benefit measures. While this may be the reason for the neglect, allocative efficiency cannot be achieved without consideration of benefits. An approach to the valid assessment of benefits cannot be avoided if the health service mix is to be adjusted so as to enhance community well-being.

Benefits may be taken as equal to the health effects of an intervention times the value of these effects to the individual, where health effects may incorporate physical, emotional, psychological or social dimensions. Or it may be more useful to think of the health effect and the value to the individual as inseparable. The latter is effectively the approach of revealed preference techniques, which rely on market prices or contingent valuation analysis to measure directly the value of the benefit. While attempts to translate health benefits into dollars are contentious³⁴ a role for contingent valuation analysis in health service evaluation should not be dismissed.^{35,36}

Either way, measurement of the benefits of health interventions is fraught at a conceptual and practically level. Epidemiological and health service data on the impact of interventions are incomplete and often inconclusive. The economic techniques for valuation of health effects or for the direct valuation of interventions are still in the development phase.

Cost-effectiveness analysis addresses the problem of health outcome measurement by expressing benefits in a common health unit; either a final health outcome such as 'life year gained' or an intermediate measure such as 'normalisation of blood pressure'. While simplifying the analysis, some 'health outcome' measures are insensitive to changes in quality of life and represent poor proxies for change in health status. These problems have led to the development of cost-utility analysis, in which health outcomes are expressed in terms of 'quality of life' relative to 'full health'. When multiplied by time in health state this translates into the quality adjusted life year (QALY).^{37,38} While arguably the best method to date for the inclusion of quality of life in economic analysis, the design of a suitable measurement tool and its application remains controversial.³⁹

But, the valuation of benefits cannot be avoided if the objective is allocative efficiency. Further, choices implicit in the current health service mix embody assumptions about the value of health programs. It is preferable that the valuation of health benefits be made explicit and based on cost-utility analysis, where this represents the best method available.

3.4 Costs

The condition for allocative efficiency also indicates the importance of measuring costs. Economic

or resource costs are defined as the real resources of land labour, capital and consumables allocated to the activity in question. A point emphasised in every introductory text book on economics is that resource costs may differ from dollar expenditures or charges, as a result of taxes, direct or cross-subsidies, transfer payments, excess (monopoly) profits or the exclusion of certain costs from the market (such as patient or spouse time, loss of household/work-force production by patients or carers). Transfers may represent `costs' to a subgroup of the community (eg the state government) but if balanced by receipts to another subgroup do not impinge on total resource use and do not constitute economic costs.

A less well documented point is that from the perspective of an institution with a limited budget (for example a health department) the condition for allocative efficiency needs to be modified to reflect the limited flexibility for redirecting resources.^{40,41} The more compartmentalised is the health funding and delivery system, the more relevant will be the budget constraint. However, as it is desirable to develop the health planning framework from the view point of the whole community, without regard to current health funding arrangements, the original specification of the conditions for allocative efficiency is valid. Furthermore, to include the effect of the budget constraint of a particular institution still requires an understanding of societal costs and benefits of health programs.

While the theoretical prerequisites for allocative efficiency are clear and logically compelling, their implementation is problematical. The measurement of marginal costs and benefits is difficult and the magnitude of the research task for health sector wide allocative efficiency is daunting. The challenge is to develop a theoretically sound framework that is broad based - which encompasses all pertinent interventions, but is tractable in terms of research effort required and the possibility for a staged analysis.

PART 2 : A HEALTH PLANNING MODEL FOR ALLOCATIVE EFFICIENCY

4. THE HEALTH PLANNING MODEL FOR ALLOCATIVE EFFICIENCY

4.1 Overview

In principle, the achievement of optimal resource allocation in the health sector, requires the evaluation and comparison of every possible health intervention. The framework described here provides a method for containing the scope of interventions that need to be subject to full economic analysis, recognising the reality of a constrained evaluation budget. It also incorporates a staging of the evaluation tasks for achieving allocative efficiency. The framework meets the theoretical requirements for allocative efficiency discussed in Part 1.

The health planning framework provides an approach to the practical use of economic analysis to guide decision making about desirable resource shifts. It is focused on changes at the margin; to identify where additional dollars should be spent to achieve greatest contribution to health outcomes for a unit increase in expenditure and where dollars can be saved with least impact on health outcomes.

The proposed framework is described with reference to Figures 1 and 2. Figure 1 represents resource allocation across the **entire** health sector. All health interventions, actual and potential are grouped into the cells in Figure 1 by a two way classification:

- i) disease category, (and subcategory) along the horizontal axis, and
- ii) stage in the disease process, from primary prevention through to end state care/palliative care; vertical axis.

The objective is to compare all possible health interventions, grouping interventions in such a way as to expedite the evaluation task. The framework proposes an initial focus on within cell comparisons, that is at a single disease stage for a nominated disease subclass. This is followed by comparisons between stages within a disease (that is down a column in Figure 1). Finally analysis is directed across disease classes(and subclasses) at a single disease stage.

The initial focus on a single disease class(or subclass) is for a number of reasons:

- i) All health interventions are then options for the management of the nominated disease, so substantial commonality in the intermediate health outcomes can be expected. This will facilitate the use of cost-effectiveness analysis, a relatively straightforward economic evaluation technique, suggesting economies with respect to research effort.

- ii) Interventions targeted at early disease stages, (such as primary prevention), can potentially be translated into outcomes pertinent to later disease stages, using knowledge about normal disease progression and aetiological fractions pertaining to modifiable risk factors.
- iii) Health interventions targeted at a disease class (subclass) will be potentially complementary or direct substitutes. The approach can draw on research into desirable approaches to patient management within a disease group.
- iv) An explicit objective of the framework is to focus attention upon allocative efficiency **between stages** in relation to the management of a particular disease, recognising the comparative neglect of this issue to date. The approach will enable conclusions to be drawn concerning the desirability of directing resources between programs offered at different stages of disease.

The framework proposes that for each disease group (sub-group) health interventions at a single disease stage (ie within a cell) would be ranked in terms of indicative cost-effectiveness, using best available data on costs and effectiveness. The best and poorest health interventions at each disease stage would then be subject to a full cost-effectiveness or cost-utility analysis. This would enable identification of the most marginal programs for management of the disease (best and worst) regardless of stage of care. The analysis would be repeated to identify progressively the next most marginal interventions, both at each disease stage and then across all interventions.

Subsequently the process could be carried out for another disease category and subclass. Eventually cost-utility comparisons could be made between programs targeted at different disease categories, initially at a single disease stage. The procedure will, in effect result over time in the construction of a 'league table' for interventions, initially within a disease grouping, and then across disease groupings, incorporating the most marginal (best and worst) programs (and the most marginal specifications of these programs), and successively the next best and next worst programs. The league table would be based on the correct economic principles, especially with respect to scope of interventions and focus on the margin.⁴²

Figure 1: Health Planning Approach to Allocative Efficiency

DISEASE CLASS AND SUB CLASS

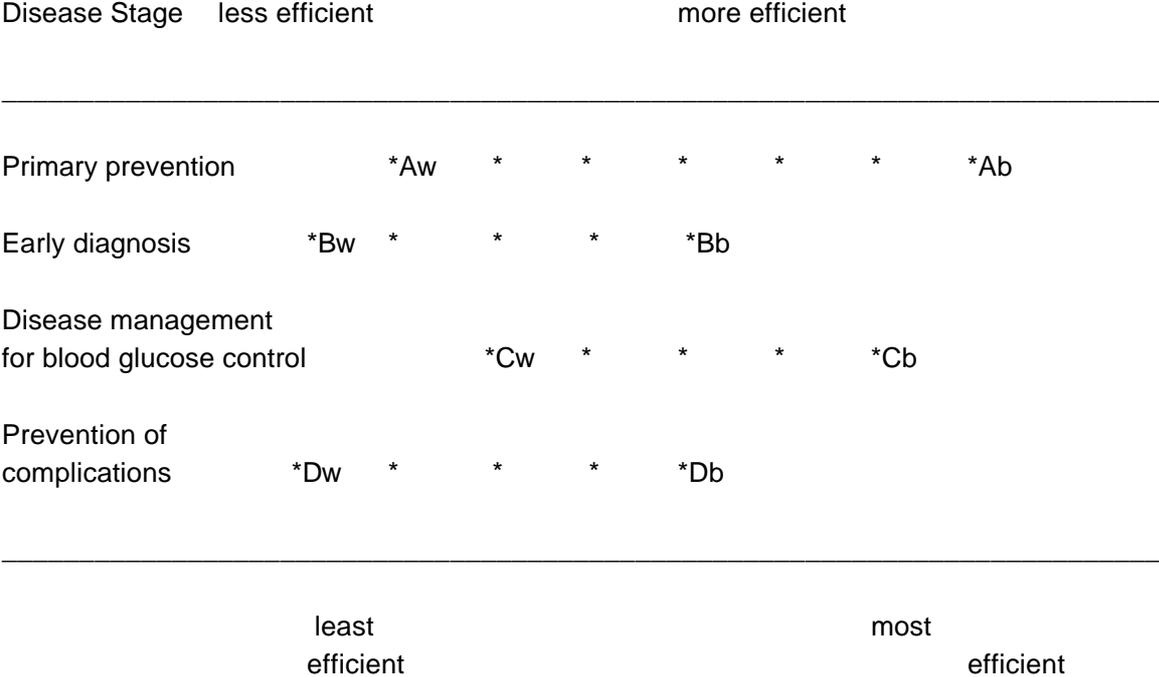
DISEASE STAGE	Endocrine Disorders		Cancers	Neuro-logical	Cardio-vascular	Other	Total Resource Use
	type 2 diabetes	type 1 diabetes					
Primary prevention							
Early identification							
Disease management Prevention of complications							
Treatment of end stage conditions/ Palliative care							
Total resource utilisation							

4.2 Model description - Stage 1: Disease Management Review

The first broad study activity (tasks i) to iii) below), involves the ranking of all interventions at a single disease stage and (single health outcome) in order to identify the most marginal programs, best and worst at each disease stage. The second broad study activity(tasks iv) and v) below) involves the full economic analysis of **all** of the most marginal programs(best and worst) at each disease stage using epidemiological relationships to translate outcomes into the same health unit wherever possible, or cost-utility analysis otherwise. This analysis will enable confirmation of differential cost-effectiveness of marginal programs at a single disease stage and also identification of the best and worst programs addressed to the disease, regardless of the stage of care.

Recommendations could then be developed concerning desirable resource shifts from the worst to the best intervention from any program area, or where budgets are linked to a disease stage, within a disease stage. While the approach draws heavily on the available economic and epidemiological literature and current work of clinicians for the generation of intervention options and the initial ranking, more detailed analysis which may involve primary data collection, is undertaken in relation to the most marginal interventions.

Figure 2 Ranking of interventions



The research activities required to implement the health planning framework are:

Task i) Select a disease grouping (or sub-grouping) for review.

The first study task is to select a disease grouping or suitable subgroup for study (eg cancer might be the disease grouping, the subgroup would be a particular type of cancer-such as breast cancer or related cancers). The selection could reflect stated government priorities, perception of level of community concern, provisional evidence that current health service mix departs substantially from optimum, or expected access to relevant data. As the model proposes that, progressively, all areas of the health system would be reviewed, the choice of where to start is less important than the commencement of a staged program that will over time cover the whole health sector.

By using the term `disease grouping', this is not to restrict the scope to medical conditions. The intention is to cover any cause of ill health or reduction in health related quality of life. The framework should be equally applicable to injury caused by accidents or conditions that may have a dominant psychological or emotional aspect (such as with sleep disturbance) as more narrow definitions of disease.

Task ii) Analyse sets of interventions addressed at a single stage in the disease, represented by a single cell in Figure 1.

Identify and document all major types of programs addressed to the particular stage of the selected disease. This requires a good knowledge of the pertinent literature and extensive contact with

clinicians and other service providers. This task involves the identification and grouping of interventions directed at identical intermediate health parameters. A distinction is made between existing health programs (including definite proposals), which could be terminated or scaled down and potential health programs, new programs which could be introduced or existing programs which could be expanded.

Sufficient analysis of all identified programs is conducted to develop a preliminary ranking of programs directed at a stage of the disease (within a cell) in terms of cost-effectiveness. This ranking would be based on the published and unpublished literature, discussions with health service providers concerning the resource use (cost) and health outcomes (effectiveness) of interventions, scenario development reflecting best available data combined with professional judgement. In addition collaboration with clinicians and other health service providers in the collection and collation of costing and outcome data would be pursued to fill outstanding data gaps. In defining intervention options the requirement of marginal analysis means that one program area will often need to be redefined as several program options to reflect differing service attributes.

Task iii) Undertake indicative cost-effectiveness analyses for all interventions addressed to the same health outcome.

Repeat the analysis outlined in step ii) for all cells, to cover progressively all stages of the disease and the full range of interventions for disease management using cost-effectiveness as the analytical model. Depth of analysis will be sacrificed to achieve breadth of scope and resulting rankings will be indicative.

Task iv) At each disease stage select the most marginal interventions; that is the best (actual or possible) and worst actual(or planned) intervention and conduct detailed economic analyses.

Select the most marginal interventions on the basis of tasks ii) and iii). Translate health outcomes achieved through early interventions into outcomes achieved at later stages in the disease using known epidemiology and conduct cost-effectiveness analyses. Cost-utility analysis would be used to compare interventions with disparate health outcomes that cannot be equated using epidemiological relationships.

As illustrated in Figure 2, full economic analyses would be undertaken for projects Ab, Bb etc (best possible) and projects Aw, Bw etc (worst existing or planned). This would allow comparison between interventions directed at different disease stages, and identification of the most marginal projects for disease management, best and worst, regardless of point of intervention. It would also provide some feedback on the preliminary rankings (tasks ii) & iii).

Theory would dictate the analysis proceed in an iterative fashion, with the most marginal projects considered first then, after allowing for recommended resource shifts, from worst to best project, the evaluation would be repeated to identify the next most marginal projects, and so on. (In practice information gained in the first round analysis may provide sufficient insights into the magnitude of costs and benefits of some intra-marginal projects to permit additional recommendations of desirable resource shifts).

Task v) Develop conclusions.

Based on tasks i) to iv) a provisional ranking of interventions for management of the nominated disease would be developed, firstly in relation to interventions directed to a single health objective and secondly between disease stages and different health objectives. The ranking would have a high level of confidence in respect of the most marginal programs. Specific recommendations would be made concerning types of interventions that warrant resource expansion and interventions which should be subject to resource cuts or not introduced.

Where conclusions reflect hypotheses about likely distortions, derived from known anomalies in current funding arrangements, some generalisations may be postulated.

It is recognised that issues of access and health inequalities need to be simultaneously addressed. It simply is not possible to redistribute health status amongst members of the community once allocative efficiency is achieved. Health status is an independent contributor to well-being. One possibility is that as part of task iv) the *likely* implication for equity be incorporated into the analysis. Where no conflict is expected to arise between equity and allocative efficiency, recommended resource shifts would be unequivocal, where they do arise, some consideration of the acceptability of a trade-off between equity and allocative efficiency would need to be made.

4.3 Health Sector wide analysis

Progressive Disease Management Reviews

Repeat tasks i) through v) above until all disease categories have been covered.

Health Sector Wide Review

The final phase of the analysis is to draw conclusions about desirable resource shifts between disease categories, initially at a single point in the disease process.

Taking each stage in the disease process in turn, compare the most marginal interventions directed to the disease stage, comparing across different disease categories. The procedure would be similar to that outlined in task iv), using cost-effectiveness analysis where health outcomes could be expressed in the same units, or otherwise cost-utility analysis. The analysis would proceed in an iterative fashion, firstly comparing the most cost-effective and least cost-effective programs and then proceeding to the next most marginal programs.

4.4 Central features of the health planning framework

The central features of the health planning framework are i) its breadth of scope, ii) the method for staging the analysis and iii) the extensive opportunity to apply relatively straightforward cost-effectiveness analysis at an indicative level with a more limited requirement for comprehensive economic analysis.

Most importantly the framework is consistent with the theoretical requirements for allocative efficiency. It recognises that all health interventions are competing for the same limited resources, that prioritisation is inevitable and will occur either implicitly or explicitly. The framework is based on the premise that all possible interventions should be judged by consistent criteria. The evaluation of interventions at only one stage of a disease, or delivered through one agency, or component of the health delivery system, or provided through a single funding source, results in the endorsement of strategies that are 'locally' effective but potentially less cost-effective than alternatives. The inevitable consequence of this is poorer health outcomes for the community from the resources allocated to the health sector.

The framework does not assume a medical model of illness or health care, but rather provides the opportunity to broaden the scope of health evaluation and definition of health outcomes to incorporate the diversity of programs which may enhance health outcomes and well-being.

Over time and assuming appropriate resources can be allocated to the research task, the framework provides for the economic analysis of all types of health interventions (either at an indicative level or in depth) using a consistent approach. It can provide an important input to the agenda of health researchers, health service providers and health economists. The ultimate objective would be to facilitate the redistribution of resources across the health delivery system, between stages of care and disease categories, in such a way that the marginal cost-effectiveness ratio is broadly equivalent for all health interventions.

The analysis would need to be continually updated to reflect new information, ideally obtained from an on-going data collection program into health interventions, but also to reflect changes in the cost and effectiveness of interventions associated with changes in resource shifts, health technology, disease patterns and population attributes.

The framework does not explicitly address the question of how to achieve the desired re-allocation of health resources. Policy instruments and funding arrangements to facilitate desirable resource shifts need to be explored as a complementary research program.

5. CONCEPTUAL AND METHODOLOGICAL ISSUES

5.1 Description of health outcomes

A central methodological issue in health economic evaluation is the definition and measurement of health outcomes. The task is to select outcome measures which can be generated, are meaningful and provide a suitable basis for comparison between interventions.

The disease management model facilitates measurement of health outcomes in several respects: first, by grouping interventions directed to a single stage of the disease process and within that by health objective, the use of relatively simple health outcomes in a cost-effectiveness analysis is facilitated; and second, it allows the transformation of health outcome measures, through known epidemiological relationships, to allow comparison across disease stages. This minimises the need for cost-utility analysis, while still allowing for comparison between interventions directed to reduction in disease

incidence, in incidence and severity of complications, and/or the amelioration of quality of life impacts of disease.

i) Cost-Effectiveness Analysis

Simple health outcome indicators are likely to have greater validity in comparing programs within a single disease stage and more specifically where interventions are directed to the same health objective. Using appropriate health outcome indicators, comparisons will be possible between different interventions targeted at the same health outcome, provided cost and effectiveness data can be obtained. For instance, with primary prevention programs health outcomes will be in the form of a reduction in disease incidence. Where interventions are directed at changing certain risk factors (such as obesity), population attributable fractions (based on relative risks and prevalence), will be used to translate an expected impact on obesity to a reduction in incidence of the disease. Alternative interventions directed at primary prevention could then be compared in terms of cost per case avoided or deferred.

Comparison between health services directed to different stages of disease, should, where possible, proceed using knowledge of relationships between different outcome measures, such as between incidence of diabetes and known complications.

ii) Cost-Utility Analysis

For those interventions directed to quite different health objectives and which cannot be reduced to a single health outcome through a known (or assumed) epidemiological relationship, it will be necessary to gain an understanding of these disease states and their impact on quality of life. A measure that encapsulates quality of life as well as impact on survival, is needed as the common unit of outcome, such as the QALY (based on a multi-attribute utility scale). The multi-attribute utility scale is developed from a generic instrument incorporating general attributes of health related well-being, such as level of distress and capacity to fulfil normal role function, rather than narrowly defined disease or disability specific definitions. Such instruments have potentially very wide applicability. There are a number of generic instruments which have been developed to measure quality of life.⁴²⁻⁴⁷ These have all been subject to criticism⁴⁸ and currently their use must be considered more contentious than the simpler health outcome measures discussed above in the context of cost-effectiveness analysis.

Despite their imperfections, the QALYs produced by these instruments provide a workable approach to the measurement and comparison of dissimilar outcomes. None of the available quality of life instruments has gained the status of a 'Standard' and their relevance to Australia has not been established. A research program at the National Centre for Health Program Evaluation is aimed at developing a multi-attribute utility scale devised and calibrated for Australia. It is planned that this instrument will be used to generate the quality of life measures to include in the cost-utility analyses.

The proposed methodology, in effect means that the most marginal interventions will be expressed in terms of cost per QALY, either generated directly or through known epidemiological relationships.

5.2 Joint Outcomes

A second methodological challenge is posed by the existence of joint outcomes, a common feature of public sector programs. Within the health sector it is particularly relevant in primary prevention and specifically interventions aimed at lifestyle change. For instance, the important modifiable risk factors for NIDDM; obesity, exercise and nutrition, are also risk factors for many other diseases. Any primary prevention program which changes these attributes would effect incidence and severity of a range of diseases not just NIDDM.

There are several standard approaches to the handling of joint costs and benefits. One approach is to distribute costs according to a simplified allocation rule. One might apportion only part of the cost of a diabetes primary prevention program to diabetes, proportional to the relative incidence of major lifestyle diseases that could be influenced by the intervention program. This approach is not acceptable, as it does not establish that the program is cost-effective overall and that the value in other disease areas justifies the cost apportioned to them.

A second approach is to adopt the perspective of an authority with a designated disease focus (such as cancer or cardiovascular disease) and to ignore other benefits. From a societal perspective this approach is too narrow. However if an intervention is cost-effective from the point of view of a single authority, with additional benefits not included in the analysis, a firm conclusion about relative cost-effectiveness can be derived.

Thirdly, assessment of benefits is expanded to take account of the possible beneficial impact on other diseases/aspects of health status. This may require use of a health sector wide model. This is the correct approach to the achievement of allocative efficiency. The NCHPE in association with the Australian Institute of Health and Welfare is developing a health planning model which can be used to indicate the impact of primary prevention programs across major disease classes.⁴⁹ Through the use of aetiological fractions, the impact of primary prevention programs on utilisation of health services and morbidity and mortality for each disease group can be calculated, given information on the impact of the primary prevention program on known risk factors.

5.3 Data

The data needs of the economic framework for allocative efficiency are substantial and include knowledge about:

- (i) *disease process*: an understanding of the disease process under review, including epidemiological data on the incidence of the disease, common complications, morbidity and mortality rates at various stages;
- (ii) *list of interventions*: a comprehensive, but manageable list of types of interventions for disease management, classified by stage of disease, reflecting current practice and 'state of the art' (whether currently provided or not). The list needs to separately document important differential attributes of each type of program where these are likely to differentially affect marginal benefits and costs (for instance a breast cancer screening program targeted at over 40's with annual mammography is different to a program targeted

at over 50's with biannual mammography).

(iii) *information on specific interventions covering:*

- description of intervention, including statement of health objective;
- cost of delivery (resource use);
- expected efficacy or effectiveness.

Sources of information are known to be inadequate relative to data needs. Even simple descriptions of interventions, their costs and effectiveness are inadequate. This of course represents a problem not just for health planners, but for health service providers who often treat patients on the basis of little more than expert opinion. A program to enhance data collection practices would ideally proceed simultaneously with the implementation of the present framework. Recent quality assurance requirements for the medical profession are likely to enhance the availability of health outcome data within a few years.

Despite this shortcoming, data of greater or lesser reliability can always be obtained. Lack of data is a common problem in policy work. Possible sources will include:

- the literature, especially published reports of interventions;
- primary data collections related to health interventions undertaken collaboratively with health service providers;
- collation of pertinent information from standard data files;
- views of senior clinicians, academics, researchers, support health professionals, (systematically obtained through discussion, workshops, or consensus groups facilitated through distribution of working papers);
- scenario development combined with sensitivity analysis to fill data gaps.

While some of these sources will generate imperfect data they may be the only sources available without an impossibly protracted and expensive research program. Analysis must be based on the best available information however imperfect. The imperfection of the data does not justify the use of a theoretically invalid approach to allocative efficiency. It does mean however that approaches for the explicit recognition of data gaps and the assessment and reporting of confidence in the data and the analysis need to be explored.

6. CASE STUDY APPLICATION - Non Insulin Dependent Diabetes Mellitus

6.1 Suitability of NIDDM as a Case Study

The framework for allocative efficiency and issues of implementation are being developed through the application to an important chronic disease in the Australian community, non-insulin dependent diabetes mellitus (NIDDM). The choice of NIDDM as the case study is not fundamental to the allocative efficiency research project. However it does provide an excellent disease class to test the economic planning framework. There are three broad reasons for this choice.

i) The range of intervention options.

The impact of NIDDM on the Australian community can be addressed through programs spanning the disease continuum and delivered and funded by all parts of the health system. Diabetes management can involve alternative models of care encompassing different groups of health professionals. The wide range of management options, health professionals and funding agencies involved in the management of NIDDM provides the opportunity to explore issues related to comparisons of cost and health outcomes across very different program types. Expert opinion suggests that NIDDM is potentially preventable, or that at the very least onset can be delayed.⁵⁰

ii) NIDDM is an important chronic condition in the Australian community.

Diabetes is ranked as the seventh most common cause of death in ABS Cause of Death statistics. In addition diabetes is an important risk factor for stroke and coronary heart disease with diabetics having two to four times elevated risk. It is thus an important contributor to deaths from cardiovascular disease, the major cause of death in Australia.

It is estimated that in Australia 2 to 3 percent of the total population (and 3 to 5% of adults) have diabetes, of which about 85 percent are NIDDM. There is an estimated 200,000 to 250,000 diagnosed diabetics plus 100,000-225,000 undiagnosed cases.⁵¹⁻⁵⁴ Prevalence in the elderly is far higher at an estimated 8-12 percent of the population over 65, with a further substantial group with impaired glucose tolerance.⁵⁵ With an ageing population the prevalence of NIDDM diabetes within the total community is expected to increase, the prevalence of diabetes in Australia having increased by at least 50 percent between 1966 and 1981.⁵⁶ The prevalence of NIDDM in some sub-communities is far higher, with estimates of prevalence within the adult aboriginal community of between 8 and 16 percent.⁵⁷

Diabetes is a major cause of morbidity and loss in quality of life. The extent of complications has not been established precisely but diabetes increases the risk of; lower limb amputations, retinopathy, kidney failure. Neuropathy or nerve damage is also common and has a wide range of impacts including, severe pain in the limbs, loss of muscle power, lack of bladder and bowel control and sexual impotence. Ongoing management of NIDDM and its complications poses a substantial burden on the patient and their family and the health delivery system.

iii) *Work of clinicians and other health service professionals in cost-effectiveness of interventions for diabetes management.*

There is a modest literature reporting evaluations of options for diabetes management; (for example diabetic retinopathy, patient management through diet and exercise, community-based education and control programs, specialised foot programs).⁵⁸⁻⁶⁰ Increasing numbers of health professionals in Australia are collecting data on the costs and efficacy of alternative interventions for diabetes management.

6.2 Research Program

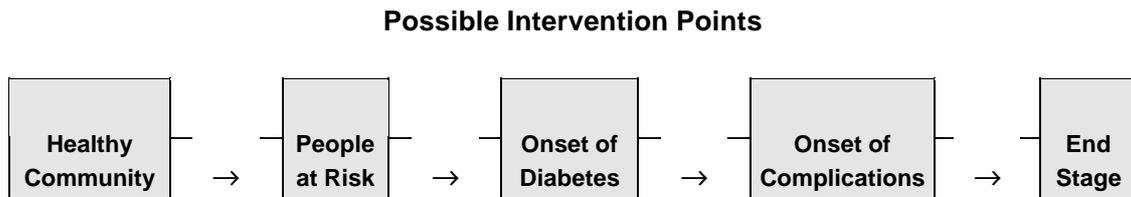
Consistent with the research approach outlined earlier, a six stage research program has commenced to implement the research framework for allocative efficiency in relation to NIDDM.

The broad research tasks are to:

- i) prepare a comprehensive list of types of interventions for management of NIDDM, classified by disease stage and types of health objective. The framework within which interventions will be listed is illustrated in Figure 3;
- ii) document typical interventions of each type, covering objective, resource use, throughput, outcomes, highlighting various service attributes and expected implication on resource use and outcomes;
- iii) develop a preliminary ranking of health interventions directed to each disease stage, and identifiable health objective; through simplified cost-effectiveness analyses, based on the literature, unpublished research data, collaboration with health service providers and scenario development;
- iv) select interventions for formal cost utility/cost effectiveness analysis to include the most cost-effective intervention (currently provided or planned) and the least cost-effective intervention now provided or under consideration at each disease stage, directed to a single health outcome;
- iv) undertake formal cost-utility analyses of selected interventions (approximately 12 evaluation studies), based on the literature, scenario development and collaborative studies with health service providers.
- v) review results of the research to develop conclusions about:
 - desirable resource shifts between interventions directed to each disease stage;
 - desirable resource shifts between interventions directed to different stages of the disease, that is between primary prevention, early diagnosis, standard patient management, prevention of specific complications, end stage care;

- possible generalisations to other disease categories, where conclusions are consistent with observed anomalies in health funding and delivery arrangements;
- vi) evaluate the success of the methodological framework for allocative efficiency, identifying the nature of unresolved conceptual or data problems. Report on approaches to various issues associated with implementation.

Figure 3 Structure for classification of interventions for the management of NIDDM



7. CONCLUSION

The primary purpose of any health program is to enhance health outcomes by improving quality of life, reducing morbidity and extending life expectancy. This is true whether the program is aimed at primary prevention, early diagnosis, standard disease management, management to prevent complications or end stage care. Health status is the unifying theme of health care programs, whether delivered through public health measures, primary care, hospital in-patient treatment or palliative care.

Much of the focus of health policy has been on technical efficiency: how to deliver nominated health services at least cost to the community? Initiatives to achieve technical efficiency, such as the introduction of (DRG based) case-mix funding, do not adequately address the question of what to produce. As improvements in technical efficiency are exhausted, and as health planners recognise the potential for health gains from adjusting the health service mix, greater attention to health planning models for allocative efficiency can be expected. Alternative health funding models that involve separation of function between purchaser and provider, and widening of the areas of responsibility of budget holders (the purchaser-provider debate) will provide greater opportunities to influence the health service mix.

The development of an economic framework for allocative efficiency is thus most timely and has the potential to make a substantial contribution to future resource allocation decisions for health services to the benefit of the community.

While the total research program is ambitious, it is grounded in sound theoretical principles. A staged research plan will yield useful intermediate outputs early in the research program, including the sequential development of management strategies for nominated diseases, incorporating desirable resource shifts between types of health interventions.

1. Macklin J, 1990 *Setting the Agenda for Change-National Health Strategy Background Paper No 1* AGPS Nov
2. Scotton RB & Owens HJ, 1990 *Case Payment in Australian Hospitals:Issues and Options*, Public Sector Management Institute, Monash University Aug
3. Harvey R,1991 *Making it Better-Strategies for improving the effectiveness and quality of Health services in Australia*, National Health Strategy Background Paper no 8 AGPS Oct
4. *Victoria's Health Reforms; The first Step Casemix Funding for Public Hospitals*, Dept Health and Community Services Victoria, March 1993
5. National Health Strategy,1992 *Enough to make you sick-How income & environment affect health*, Research Paper No 1 C'wealth Dept Human Services & Health, ACT
6. Abel-Smith B, 1992 'Cost Containment and New Priorities in the European community' The Millbank Memorial Fund Quarterly 70, 3, pp 393-416
7. Huse DM, Ostar G, Killen AR, Lacey MJ, Colditz GA; 1989, 'The economic costs of non-insulin-dependent diabetes mellitus', *JAMA*, Nov 17 vol. 262, no. 19, pp. 2708-2713.
8. Roesler J, Bishop D, Walseth J. 1991, 'Economic costs of Diabetes Mellitus -Minnesota 1988', *Morbidity Mortality Weekly Report*, vol 40, 14, pp. 229-231.
9. Colditz GA. 1992, 'Economic costs of obesity', *American Journal of Clinical Nutrition*', vol. 55, pp. 503s-507s.
10. Drummond MF. 1992, 'Cost of illness studies - a major headache', *Pharmacoeconomics*, vol. 2, no. 1 pp. 1-4.
11. Sheil A, Gerard K, Donaldson C. 1987, 'Cost of illness studies: An aid to decision making', *Health Policy*, vol. 8, pp. 317-323.
12. Summers M, 'Health and Community Consultations' 1992 *Health Issues* vol 31 June pp 25-27

13. The Australian Diabetes Society, 1993 *National Action Plan Diabetes to the Year 2000 and Beyond*, Diabetes Australia, Canberra, Australia.
14. Steering Committee on Future Health Scenarios. 1991 *Chronic Disease in the Year 2005, vol. 1, Scenarios on Diabetes Mellitus, 1990-2005*. Kluwer Academic Publishers, Netherlands.
15. Nutbeam D, Wise M, Bauman A, Harris E, Leeder S, *Goals and Targets for Australia's Health in the Year 2000 and Beyond* AGPS Canberra 1993
16. National Health and Medical Research Council, 1991 *Report of the Health Care Committee Expert Panel on Diabetes; Series on Diabetes; No 1. The role of ambulatory services in the management of diabetes*, AGPS, Canberra, Australia.
17. National Health and Medical Research Council, 1992 *Report of the Health Care Committee Expert Panel on Diabetes; Series on Diabetes; No 3 Diabetes in older people*. AGPS, Canberra, Australia.
18. Hypertension Guidelines Committee, 1991; *Hypertension Diagnosis, Treatment and Maintenance*. SA Faculty Royal Australian College of General Practitioners and SA Health Commission.
19. Consensus Panel, Chair Beilin L, 1992; 'The Management of Hyperlipidaemia: A Consensus Statement' *MJA* vol 156 Feb 3 Supplement p s1-s8
20. Hall JP, Heller RF, Dobson AJ, 1988, 'A cost-effectiveness analysis of alternative strategies for the prevention of heart disease', *M.J.A.* pp273-277.
21. Geelhoed, Harris A, Prince R, 1992 'Economic Evaluation of Strategies to reduce osteoporotic fractures in women: A markov chain modelling approach' *Economics and Health* pp282-286, Proceedings of the 14th Australian Conference of Health Economists, National Centre for Health Program Evaluation
22. Akehurst RL, 1991 'Purchasing the most cost-effective mix of health care: Modelling coronary artery disease', Presentation at the Developing Internal Market in Cardiology & Cardiac Surgery, Royal College of Physicians, London, December
23. Australian Health Ministers' Advisory Council Breast Cancer Screening Evaluation Committee, 1990, *Breast Cancer Screening in Australia Future Directions. Australian Institute of Health and Welfare: Prevention Program Evaluation Series No 1* AGPS Canberra Australia
24. Jackson R, Barham P, Bills J, Birch T, McLennan, MacMahon S, Maling T, 1993 'Management of raised blood pressure in New Zealand: A discussion document', *British Medical Journal* vol. 307, 10 July.
25. Sculpher MJ, Buxton MJ, Ferguson BA, Humphreys JE, Altman JFB, Spiegelhalter DJ et al;

- 1991 A Relative Cost-effectiveness Analysis of Different Methods of Screening for Diabetic Retinopathy. *Diabetic Med* 8 pp 644-650
26. Mason M, Drummond M, Torrance G, 1993 'Some Guidelines on the use of cost-effectiveness league tables' *BMJ* vol 306 12 Feb p 570-572.
 27. Mooney G 1984, 'Program budgeting: an aid to planning and priority setting in health care' *Effective Health Care* vol 2 no 2 p65-68.
 28. Eddy DM, 1991 'What's going on in Oregon?' *Journal of the American Medical Association*, vol 266.3 pp417-420.
 29. Street A & Richardson J, 1992; 'The Value of Health Care: What can we learn from Oregon?' *Australian Health Review* vol 15 no 2 pp 124-134
 30. Hall J & Haas M, 1993 'The rationing of health care: should Oregon be transported to Australia?' *Aust J Pub Health* vol 16 no 4 Dec pp435-440
 31. Nord E; 1993, 'Unjustified use of the quality of wellbeing scale in priority setting in Oregon', *Health Policy*, vol. 24, pp. 45-54.
 32. Commonwealth Department of Human services and Health;1992 *Guidelines for the Pharmaceutical Industry on Preparation of Submissions to the Pharmaceutical Benefits Advisory Committee* Aug, AGPS, Canberra, Australia.
 33. Scotton, RB. 1993; 'Restructuring the Financing of Health Care'; Paper prepared for the Office of the Economic Planning Advisory Council Seminar: Investing in Health Care - A challenge for the future, Oct 1993, Canberra, Australia.
 34. Burrows C & Brown K, 'Are any numbers better than no numbers? The sorry state of Willingness-to-pay and some major methodological shortcomings', *Australian Health Review* vol 15 no 2 1992 pp135-144
 35. Segal L, Helme RD, Gibson SJ,1993 'Economic Evaluation Pain Management Program for the Elderly', presentation, International Association for Pain Congress, Paris August 1993, and Conference Abstracts.
 36. Seller C, Stoll JR, Chavas J-P; 1985 'Validation of Empirical Measures of Welfare Change Comparison of Nonmarket Techniques', *Land Economics* vol 61 no 2 May 1985 pp157-175
 37. Richardson J & Cook J,1992; 'Cost Utility Analysis: New directions in setting health care priorities', *Australian Health Review* vol 15 no 2 1992 pp145-154
 38. Schwartz S, Richardson J, Glasiou P, 1993 'Quality-adjusted life years: origins, measurements, applications, objections' *Australian J of Public Health* vol 17 no 3 Sept pp 272-277

39. Brown K, Burrows C, 'How should we measure change in utility measures of health status - or should we?' *National Centre for Health Program Evaluation, Working Paper* no 26 1992
40. Richardson J, 1991, 'Economic Assessment of Health Care: Theory and Practice' *The Australian Economic Review*, Institute of Applied Economic and Social Research, 1st quarter, no93 p4-21
41. This is illustrated as follows; taking an assumed \$1.00 saving from project B if the \$1.00 saving was not, in fact, gained by the institution and was not available for spending on alternative project A institutions should replace economic cost in the equation with budgetary cost (Richardson 1991, Linnard 1993). This results in the revised equation below for achieving maximum benefits within the constraints of a fixed institutional budget: $(MB_a - MC_a) / MC_a^b = (MB_b - MC_b) / MC_a^b$ where MC^b is the marginal cost to an institutions budget.
42. Sintonen H & Pekurinen MA; 1993; 'A fifteen-dimensional measure of health-related quality of life (15D) and its applications' in *Quality of Life Assessment-Key Issues in the 1990s*, ed. SR Walker & RM Rosser, Kluwer Academic Publishers, Lancaster, United Kingdom.
43. Walker SR. & Rosser RM (ed), 1993, *Quality of Life Assessment-Key Issues in the 1990s*, Kluwer Academic Publishers, United Kingdom.
44. Nord E. 1992. 'An alternative to QALYs: The saved young life equivalent (SAVE)', *BMJ* Oct 10, vol 305 pp 875-877.
45. The EuroQol Group, 'EuroQol - a new facility for the measurement of health related quality of life', *Health Policy*, vol. 16, pp. 199-208.
46. Torrance, G.W. 1986, 'Measurement of health state utilities for economic appraisal', *Journal of Health Economics*, vol. 5, pp. 1-30.
47. Rosser, R. & Kind, P.A. 1978, 'A scale of valuations of states of illness: Is there a social consensus?', *International Journal of Epidemiology*, vol. 7, pp. 347-358.
48. Richardson J 1991 opcit
49. Carter, R. 'Economic approach to health promotion: A macroeconomic evaluation model to assist health policy', 1993; Economic Planning Advisory Council Seminar - Investing in Health Care - A challenging future, Canberra, Australia.
50. Zimmet, P.Z. 1988, 'Primary prevention of Diabetes Mellitus', *Diabetes Care*, vol. 11, no. 3, pp. 258-262.
51. Welborn T 1989 'An estimate of diabetes prevalence from a national population sample: a male excess'. *MJA* vol 150 pp78-81
52. Glatthaar C et al. 1985, 'Diabetes and impaired glucose tolerance: A prevalence estimate based on the Busselton 1981 survey', *MJA*, vol. 143, pp. 436-440,

53. National Heart Foundation *Risk Factor Prevalence Survey No 3 1989*, NHF & Australian Institute of Health and Welfare Canberra Aust. pub 1990
54. Diabetes Australia *Diabetes in Older People Report of the Health Care Committee Expert Panel on Diabetes 1992*, AGPS.
55. Welborn T., 1989 op cit
56. Guest CS, O'Dea K; 1992 `Diabetes in Aborigines and other Australian populations'. *Aust J Pub Health* vol 16 no 4 p340-349
57. Edmonds ME, Blundell MP, Morris ME, Thomas EM, Cotton LT, Watkins PJ; 1986 `Improved survival of the diabetic foot, the role of the specialised foot clinic'. *Quarterly J Med* 60 763-771
58. Gifford S, Zimmet P; 1986 `A community approach to diabetes education in Australia the region 8 diabetes education and control program'. *Diabetes Research and Clinical Practice*, 2 p105-112
59. de Weerd I, Visser AP, Kok GJ, de Weerd O, van der Veen EA; 1991 `Randomised Controlled Multicentre Evaluation of an Education Program for Insulin-treated Diabetic patients: Effects on Metabolic Control, Quality of Life, and Costs of Therapy'; *Diabetic Med* 8, p338-345
60. Kaplan RM, Atkins CJ, Wilson DK; 1988; `The cost-utility of diet and exercise interventions in non-insulin-dependent diabetes mellitus' *Health Promotion* vol 2,4