

**Disease Based Allocative Efficiency
Framework: Implementation**

Volume I: Summary

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The Allocative Efficiency Research Program

In response to concerns about inefficiencies that can be caused by a distorted health service mix, the Health Economics Unit has a major research stream on allocative efficiency. This paper reports on that research, with a brief description of the Framework for priority setting and its application to diabetes. The Framework has been developed based on economic principles which require that all options be treated equivalently, whether they be for primary prevention, management or end stage care. The Framework ensures the consideration of options outside narrowly defined areas of program responsibility of a single agency. The structure developed is that of a disease based model, which provides a mechanism within which to establish resource priorities to minimise disease burden. In application of the model to diabetes, the overwhelming conclusion is that too few resources are allocated to primary and secondary prevention and health promotional approaches to management, with a consequent higher complication rate than could otherwise be achieved. This is consistent with the distortions expected from a medically focused funding system.

We found the broad structure of the Framework to be workable, and the priority setting task tractable with a modest resource commitment (of perhaps 3 to 6 equivalent full time research staff at senior and junior research fellow level, per disease). Suggested modifications to the Framework largely reflect the extreme paucity of cost-effectiveness and health outcome data. The role of this type of research in contributing to research agendas and priorities for clinical and health services research is perhaps one of the more important conclusions.

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EXECUTIVE SUMMARY

The Allocative Efficiency Research Program

There is ample evidence that the allocation of resources across the health sector is inefficient and, at present, there is no satisfactory policy framework for the achievement of allocative efficiency. In response to this a research program was commenced late in 1993 at the Health Economics Unit, Centre for Health Program Evaluation (Monash University) to address this issue. The objective was to develop a comprehensive framework for priority setting based on economic principles, and then to implement the Framework to determine its practicality. The purpose of this paper is to report on Phase II of the research program, the lessons gained from application of the Framework to the selected case study, non-insulin dependent diabetes mellitus (NIDDM).

Alternative approaches to prioritisation have been proposed such as 'goals and targets'. To the extent that their methods deviate from the optimal economic prescription it follows, as a matter of logic, that they will result in allocative inefficiency: there will be less health outcome from given resources. The fundamental economic principle for achieving allocative efficiency is that the ratio of marginal benefit to marginal cost should be equalised across all possible interventions. The practical application of this principle is daunting with the number of possible interventions and thus potential comparisons across the entire health sector immense. A Framework has been developed in which potential interventions are grouped in such a way as to permit their staged comparison. All health interventions, actual and potential, are grouped by: (i) disease category (subcategory); and (ii) stage in the disease process. The Framework proposes an initial focus, for a selected disease, on possible interventions at a single disease stage, followed by comparisons between stages within the disease class.

The analysis within each disease category requires that each of the possible interventions at a disease stage is identified and ranked using cost effectiveness analysis to identify the most and least cost effective options at each stage. Full cost benefit or cost utility analyses would only be

used to compare these marginal options and to determine which was the highest priority for increased or decreased funding. In principle, this process could achieve budget neutrality as increased funding for cost effective options could be offset against decreased funding for the least cost effective options: iteratively, the next most marginal options at each disease stage would be compared and result in recommendations with respect to funding. Finally the analysis would be directed across disease classes (and subclasses) at a single disease stage and ultimately across the entire health sector.

The framework being based on economic principles has elements in common with Program Budgeting with marginal analysts (PBMA) and League Tables (Mason et al 1993). It is in the method of implementation, the process for making an immense task tractable, that the main source of differences between the approaches can be observed.

The central features of the Framework are:

- a method for applying the correct economic principles to resource allocation across the entire health sector;
- a method for staging the analysis of all health sector programs which is logistically feasible;
- the opportunity to apply the relatively efficient (with respect to research effort) technique of cost-effectiveness analyses for ranking within stage options;
- a method which achieves economies of research effort by analysing options within a single disease category, which therefore require the same evidence with respect to disease incidence, characteristics and aetiology, and an opportunity to bring together the range of evidence relating to a particular disease;
- a method for obtaining staged policy recommendations regarding the most cost effective options for increasing or decreasing funding to particular program areas; that is, policy recommendations that are incremental and do not require immediate and major redesign of the provision of health services.

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.

Conclusions about the practicality of the Framework, implementation issues and capacity to contribute to resource allocation decisions are reported below. These have been derived primarily from the application of the framework to NIDDM. More recent work in applying the Framework to colorectal cancer and hypertension has also been used.

Application to NIDDM

Non-insulin dependent diabetes mellitus (NIDDM) or adult onset or type 2 diabetes) is a major cause of illness and loss in quality of life. It is estimated to impose a 100% excess annual mortality rate on the 200-250,000 diagnosed diabetics and 80-200,000 undiagnosed cases. It is an important risk factor for stroke and coronary heart disease, vision impairment, kidney failure, lower limb amputation. Ongoing management of NIDDM and its complications imposes attributable costs of \$1,800+ per diabetic per year. There are a wide range of options for reducing the burden of NIDDM. These span all disease stages from primary prevention, to screening for early diagnosis, to on-going management and end stage care. Programs are (or can be) offered through different health delivery settings, and with alternative models of care and mix of health professionals.

The task of identifying desirable resource shifts for the prevention and management of NIDDM was approached, as indicated by the Framework, through a separate research program at each major disease stage: (i) primary prevention; (ii) screening/early diagnosis; (iii) on-going disease management; (iv) prevention of specific complications; and (v) management of end stage care. With the research resources available for the project, it was only possible to conduct satisfactory analyses of the first three components. The results of this analysis are summarised here, including broader conclusions concerning the value of the Framework and implementation issues.

Conclusions: The Disease Based Model for Allocative Efficiency

Our analysis of programs for the prevention and management of NIDDM confirms the expectation that the resource allocation is highly inefficient, that marginal cost-effectiveness ratios of programs differ markedly and that there is substantial opportunity to enhance health gain, within current budgets through appropriate resource shifts.

Strengths of the Framework

- ***Size of research task.***

An important conclusion from this research, is that the framework is tractable: the magnitude of the research is not prohibitively large. The (incomplete) application of the Framework to NIDDM was achieved by a small research team of 0.5 EFT senior research fellow plus 0.6 EFT research fellow/research assistant, over 3 years. This research effort and associated budget is modest and indicates that implementation of the Framework could be replicated for other disease categories with comparatively small research budgets.

- ***Capacity to draw robust policy conclusions.***

With some qualifications, the disease based Framework has provided a satisfactory structure within which to generate conclusions with respect to both resource and research priorities. This is primarily because of the economic perspective that it adopts and its focus upon outcomes in relation to cost. This conclusion holds despite serious data limitations and the incomplete analysis of end stage options. The capacity to draw conclusions about resource priorities is greatest where:

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- (i) *Outcomes can be expressed in terms of ultimate health objectives*, specifically life years gained or quality adjusted life years.
 - (ii) *Options are highly cost effective*. This is the case where health gains are obtained whilst simultaneously there is a reduction in health service costs (due to a projected savings in the downstream costs of management). With this outcome the desirability of program expansion is unequivocal.

Similarly, the cost/life year gained is very low (say less than \$5,000), clear conclusions can be drawn. Even without a precise figure for the value that the community places upon life, it is likely to be greater than this figure.

- (iii) *Options are highly cost ineffective*. Where the cost/life year gained is extremely high (say greater than \$150,000), or where the evidence indicates health outcomes are invariably negative, clear conclusions can be drawn about the desirability of contracting such programs.

Our research suggests that these situations may not be rare.

■ ***v Information requirements and prioritisation of research effort.***

The Framework ensures a focus on the questions that are important for priority setting. It can provide clear guidance for the research agendas of clinical and scientific communities, highlighting the type of information needed for policy purposes. Despite the enormous and ever increasing health and medical literature, surprisingly little is of use for priority setting. It is astonishing that so much health related research could be conducted world wide and yet so little be related to the issue of achieving the greatest health gain. This is a clear reflection of the way in which medical research agendas have been set and their disregard of the importance of resource constraints in achieving population health. With a 'bottom up' approach to medical research - that is, research that seeks to increase understanding of the biomedical model of the human being or the proximate impact of a particular program - there is no recognition of the true opportunity cost of the implied policy options. This requires a research agenda that is 'top down' in its orientation; that is, a set of research priorities that is based upon the information requirements for maximising population health from given resources. The framework here highlighted the need for such complementary research and in particular the need for information with respect to:

- (i) ***epidemiology:*** normal disease progression, incidence and prevalence of disease and disease specific morbidity and mortality (total and by population subgroups);
- (ii) ***intervention options:*** documentation of the full range of possibilities (covering prevention and management) for minimising morbidity and mortality, including evidence of costs (resource use) and effectiveness (impact on disease prevalence and incidence, ultimate health outcomes and downstream use of health services). This requires a broader clinical trial research program, but also greater access to meaningful data from clinical practice.

The Framework clearly identifies the clinical, epidemiological and economics data needed for evidence based decision making. It enables major information gaps to be identified and provides a basis for a research agenda to fill these gaps. (We note the lack of evidence about the effectiveness, is not only a problem for health economists but for clinicians seeking to practice evidenced based medicine.)

Revisions to the Framework

Qualifications to the Framework arise principally because of the paucity of published data with respect to interventions, their costs and effectiveness and a recognition of the complementarity of health interventions. The theoretical model was constructed on the assumption that a relatively large number of interventions would be identified in the literature with adequate information about costs and effectiveness. It was also assumed that a good understanding of the disease processes could be obtained.

■ ***The two stage process.***

Under these circumstances a staged process was envisaged in which, firstly, alternative interventions at each stage would be ranked according to their cost-effectiveness and, secondly, the best/worst options identified at each stage would be compared using either cost benefit or cost-effectiveness analysis. This process did not occur as envisaged for two reasons. First, and most importantly, in the case of diabetes there were not sufficient options identified in the literature to require Stage 1 ranking. Indeed, in some cases no interventions had been evaluated. With such limited information preliminary cost-effectiveness analyses must be undertaken, and incorporate assumed values informed by the evidence that is available. Where no programs exist, indicative analyses must be undertaken, based on hypothetical programs. The resulting recommendations are then likely to be for pilot interventions to obtain more substantive data on program costs and outcomes.

Secondly, and as noted above, in cases where good information did exist it was often possible to draw robust conclusions without the need for a two stage analysis. This was a reflection of the self evident benefit (lack of benefit) of some of the identified options. Stage 2 analysis would become more important when such self evident options had been fully implemented and priorities were less obvious.

■ ***Interdependence of program options.***

The Framework envisaged the development of a hierarchy of health interventions. This was to apply, at each disease stage, across disease stages, and across the health sector, with interventions ranked from most to least cost-effective. While differential cost-effectiveness estimates can be calculated, it is now clear that these cannot be used to develop a simple hierarchy in interventions. This reflects two important observations: firstly, interventions directed at the same health objective are not always perfect substitutes for each other and may even be complementary. Secondly, marginal cost-effectiveness ratios can be expected to vary with service level, service

attributes and target populations. As a consequence it is not always possible to make the simple recommendation that a service should or should not be funded. Rather, there are occasions when a service could be justified but only when an alternative has been tried and failed; and many occasions when a service could be contracted or expanded but not unconditionally (dis)endorsed. A simple recommendation is only appropriate in circumstances of absolute dominance over a near perfect substitute (ie cases of higher cost/poorer outcome; equal cost/poorer outcome; or higher cost/equal outcome). In these cases or where outcomes are invariably deleterious, a conclusion to withdraw funding entirely from such services is appropriate.

- ***Subgroup analysis.***

Health service options need to be defined in the context of patient or population subgroups reflecting equity and access as well as efficiency considerations. Equity in health cannot be achieved by income transfers through the social security system, but must be built into service provision. Furthermore equity and access is a fundamental objective of the health sector. Evidence of differential program effectiveness with different population subgroups also supports the place of subgroup analysis.

Other Lessons

- ***Selection of health outcome.***

The unit of health outcome chosen as the primary measure of effectiveness determines the capacity to draw conclusions about priorities beyond the disease stage. The definition of effectiveness in terms of ultimate (final) health outcome and specifically life years or quality adjusted life years gained, has proved to be most powerful as it allows comparisons across a diverse range of programs, across disease stages and across diseases. Intermediate outcome measures allow only limited comparison, and with relatively little effort, intermediate health outcomes may be translated into final health outcome measures through modelling.

- ***Definition of program options.***

A central task of the Framework was the specification of the full list of options and the selection of a subset for analysis proved to be more complex than expected. The potential number of interventions is extremely large, while paradoxically, the interventions which have been documented or for which there is any evidence on costs or outcomes is extremely small.

In selecting a manageable set for review, the approach adopted was to select programs which would provide a reasonable coverage of the potential program attributes and to identify key dimensions around which there is current debate. Even where the number of broad program types is not excessive, there may be innumerable variations in program characteristics, that may have an important influence on cost and effectiveness. Selection of the particular version of each program type for review should ideally be guided by a preliminary prefeasibility assessment to identify the attributes likely to constitute the marginal programs (most and least cost-effective).

Conclusions: Resource Allocation for NIDDM

Based on our research program we conclude that the current health service mix for the prevention/management of NIDDM is suboptimal. This means that health outcomes can be enhanced, in a budget neutral setting, through a redistribution of resources. The types of resource shifts suggested are as follows:

Primary Prevention

■ ***Preventability of NIDDM.***

Based on disease aetiology and documented intervention programs it is established that NIDDM is often preventable. For diet/behavioural change programs, reduction in rates of incidence of NIDDM of 50% is documented, while for surgical intervention, reduction of 90% in the incidence of NIDDM is reported.

■ ***Selection of Program Options.***

Six program types were selected for review:

- intensive diet and behavioural for seriously obese,
- intensive diet/behavioural for women with previous gestational diabetes,
- general practitioner based life style program,
- group behaviour for overweight men,
- surgery (stomach stapling, stomach banding etc) for seriously obese,
- media life style campaign with community based support.

■ ***Cost-effectiveness.***

A model was developed to establish program effectiveness which incorporated values for projected diabetic state and annual mortality in a hypothetical intervention and control cohort. The difference between the number of survivors in the intervention and control cohorts provided the estimate of life years gained through the intervention. Model values were based on the literature, discussions with service providers and judgment of the study team.

■ ***Results - Cost/Life Year Gained.***

Net cost/life year saved of \$2,600 or less was estimated for all the behavioural programs. Three programs were identified as **cost saving** (discounted savings in down stream health care costs greater than the cost of delivering the program) - the media program, workplace group program for overweight men and intensive diet/behavioural program for seriously obese persons with IGT. We conclude that the prevention of NIDDM, potentially represents a most cost-effective use of the communities health resources.

■ ***Policy Implications.***

Efficiency in resource allocation as well as principles of equity and access would support greater public sector resourcing of services for the prevention of NIDDM. Pilot programs are recommended from which to gain further evidence of costs and effectiveness, a response to the limitations in published data. The highest priority for further research should be i) intensive multi-disciplinary behavioural program for women who have had gestational diabetes and for seriously obese persons possibly targeted at those with IGT, ii) support to existing community/work place based obesity control/life style modification programs to engage in follow-up and formal evaluation, iii) funding of a media campaign.

Role for Screening

Screening to achieve earlier diagnosis and more timely management has been proposed in recognition of the documented delay between disease onset and diagnosis in NIDDM. An analysis of screening options to develop an estimate of screening cost per new case identified has been undertaken. Access to suitable data has been a problem, with important information gaps on the accuracy of screening tests for diabetes, prevalence of NIDDM (known and undiagnosed) and IGT amongst the whole population and subgroups, and the possible effect on disease progression of early case finding. These information gaps seriously undermine attempts to assess the cost-effectiveness of screening.

Cost per new case of NIDDM (and IGT) identified were estimated using a spread sheet model to combine cost of screening test (reflecting recommended screening protocols), with assumed prevalence rates for undiagnosed NIDDM (and IGT) in population subgroups. Unit test costs were based on the Medicare Benefits Schedule. The results are summarised in table 4.4 and show costs per new case of NIDDM diagnosed of between \$1,200 and \$3,250 on a full costing base, or between \$80 and \$170 on a marginal cost basis. If identification of IGT is also an objective of screening, in the context of a strategy for the prevention of NIDDM, then cost per case identified of NIDDM or IGT is lower.

In the absence of direct evidence of the benefits of screening from clinical trials what we can conclude at this stage is that:

- A comprehensive NIDDM screening program for adult Victorians 45 years and older, would cost an estimated \$3,252 per case found (full costing) and is most unlikely to be cost-effective and should not be encouraged;
- A screening test for NIDDM in high risk individuals (defined by age, overweight, ethnic group, family history) is likely to be cost-effective, especially if the test can be provided at partial or marginal cost, that is where individuals are already presenting to GP for some other reasons, and especially if a blood test is to be ordered for some other purpose;

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- In combination with a program for the prevention of NIDDM, screening of high risk groups to identify those with IGT for prevention, (and NIDDM for early management) is likely to be cost-effective and should be encouraged.

Management of Diabetes and Complications

Specification of intervention options for diabetes management proved complex. The management of NIDDM is individualised, with each patient accessing a particular mix of health services and providers. A decision was made to focus on two distinct philosophies of care; i) the medical model of patient care provided through GP and physician visit, and ii) the patient empowerment model, where medical care represents part of a multi-disciplinary approach, and where a major focus of management is the achievement of effective patient self care. Research proceeded through a literature review plus collaborative research with health service providers.

We concluded that, best practice management incorporating diabetes education and effective patient self care achieved through recommended protocols can reduce the rate of complications and appears to be highly cost-effective. Although this conclusion must be regarded as provisional as the data on which it is based is limited. The joint NSW Department of Health, Commonwealth Government, Diabetes Continuum of Care Study should provide important evidence of the impact of a comprehensive approach to care, on health outcomes and resource use (immediate and downstream), which should allow for more certainty on the most cost-effective approach to care.

We note also that current funding arrangements represent a major impediment to persons with diabetes accessing the optimal mix of services. Alternative funding and health service delivery arrangements, which will provide adequate access to allied health services and timely access to appropriate preventative services needs to be urgently investigated.

■ ***Prevention of Complications.***

The major complications of diabetes include: cardiovascular disease, neuropathy, eye damage, kidney failure, greater infection rate, and direct complications of hypo/hyperglycaemia.

There is strong evidence that complications can be reduced through appropriate on-going management of NIDDM; specifically good glycemic control and control of other risk factors/comorbidities such as smoking, hypertension, high cholesterol, obesity. There is also a range of strategies, specific to each class of complication, which can reduce the rate of disease progression and impact on morbidity and mortality. With the research resources available to the study, and the lack of pertinent published data, a full economic analysis of the options for preventing and managing complications has not yet been possible.

Based on a review of the literature covering the major areas of complication, some preliminary insights have been gained. There is good evidence that preventative care, of the type recommended in best practice guidelines, will improve health outcomes, while reducing a range of health care costs. The evidence for cost-effectiveness is most well established in relation to: i) screening and surgery for diabetic eye disease, ii) preventative foot care, through regular

complications screening, and regular use of podiatry services and specialised foot clinics for persons at high risk, and iii) use of ACE inhibitors in persons in renal failure. These approaches may even be cost saving, or otherwise involve very low net costs for the benefits achievable. Detailed research has not been completed to establish, within the broad management options the most cost-effective intervention strategies for particular population subgroups. To resolve these questions an on-going research agenda is required, ideally linked into more comprehensive data collection from normal clinical practice.

Research Agenda

The conclusions in relation to resource shifts are based on incomplete data and thus a major conclusion of the study is that there is a need to gather additional evidence. Specific research activities recommended for support include:

- (i) The establishment of pilot programs, with a commitment to evaluation, for interventions for the prevention and management of diabetes, but particular services for:
 - the prevention of NIDDM, targeted at persons with IGT, previous gestational diabetes and high risk ethnic groups;
 - screening for NIDDM and IGT, targeted at high risk groups;
 - protocol driven diabetes management supported by a network of ambulatory care centres (for instance as defined by the Commonwealth/NSW Diabetes Continuum of Care initiative).
 - non-inpatient management of high risk feet.
- (ii) collection of basic information on the incidence and prevalence of NIDDM, IGT and complications, including research to confirm the reliability (sensitivity and specificity of alternative screening tests and screening protocols).

General Policy Conclusions

Based on the research program for NIDDM, and early work in relation to cancer and heart disease, it is clear that it will be difficult to achieve the reallocation of resources that are desirable without substantial changes to health service delivery and funding mechanisms. Distortions in the health service mix are the logical consequence of the characteristics of Australia's funding and health service delivery arrangements. The optimal allocation of resources will often require the selection or staged use of interventions and not their indiscriminate use.

A complementary research program into health service delivery and funding arrangements that will encourage efficiency is required. There are a number of current initiatives of this nature, specifically, the Australia wide Commonwealth/State Coordinated Care Trials and the NSW/Commonwealth Diabetes Continuum of Care Trial.

We finally note that it will be difficult to shift resources into program areas with a high benefit-cost ratio without a short-term increase in total financing of health. This is particularly true where efficiency requires an increase in preventative programs at the expense of curative programs. Equity and short term efficiency considerations will make it difficult to deny critical care services to those who already have an advanced disease, even where cost-effectiveness is relatively poor (as with dialysis for end stage renal failure). Where resource shifts are recommended from programs funded through the CMBS (such as GP services or radiology or pathology), and increases recommendations for services funded on a program basis, such as for diabetes educators, the achievement of budget neutrality in the short run is problematical. The mechanism for achieving such resource shifts are only just now being trialed. Outside of a fundholder type arrangement, medical practitioners have the capacity to generate additional demand replacing any demand that may be lost through greater self care or a shift to allied health. These difficulties do not in any way detract from our conclusions but reflect the difficulty of their implementation.