

Economic evaluation and health care decision-making¹

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Abstract

The current role of economic appraisal in health policy and medical practice is outlined, emphasizing the pharmaceutical sector where developments are most marked. General health policy in the Netherlands and pharmaceutical policy in Australia are presented as examples of how economic appraisal may diffuse further as a decision-support tool for health authorities. This can be promoted by studying how policy-makers interpret and use results of economic evaluation studies and how the international transferability of information on the cost-effectiveness profiles of health technologies can be enhanced. To be relevant for health policy, results from economic appraisal studies must be valid and reliable, relevant to the policy context and communicated to the proper decision-makers. A number of recommendations are provided for economic appraisals to meet such requirements.

Keywords: Economic evaluation; Health care decision making; Policy impact

1. Introduction

The objective of this paper is to describe the current role of economic appraisal in health policy and medical practice. The various ways to control the diffusion of medical technologies are considered, as well as the reliance on economic appraisal in these options for regulatory control. General health policy in the Netherlands and pharmaceutical policy in Australia are presented as examples where economic appraisal has diffused further as a decision supporting tool. Economic evaluation or

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economic appraisal is understood here as all scientific studies aimed at describing or predicting the differential costs and benefits of two or more alternative interventions, which are open to a policy maker. Specific problems with the use of cost-effectiveness information in health policy are discussed, such as the use of cost-effectiveness profiles based on prospective clinical trials and the need to extrapolate from such information. Finally, some tentative observations will be made on the future development of economic appraisal as a tool for health policy.

2. Economic appraisal in support of various policy instruments

When considering the options for controlling the diffusion of health care technologies, one may usefully distinguish between regulation by directive and regulation by incentive [1]. The former can be seen as a direct way of interfering with resource allocation, while the latter concerns policies influencing the diffusion of technologies and treatments in an indirect way. Table 1 provides an overview of possible regulatory mechanisms, some of which may be supported by economic appraisal. The type of health care system, government dominated or more liberal, determines the relevant mix of policy instruments. Below we will consider a number of these control mechanisms and assess the role of economic appraisal in the use of such instrument.

2.1. Excluding technologies from public reimbursement

Economic appraisal is beginning to play a role in deciding on the exclusion or inclusion of medical technologies from public reimbursement. One of the first well-known approaches in the U.S. was the so-called 'Oregon-plan' to ration the health insurance package of the state Oregon on the basis of global information on costs and benefits of various facilities. This information, based on consensus procedures and the opinion of population-panels and experts, supported the exclusion of some benefits from the package as from early 1994 onwards. An

Table 1
Options for control of the diffusion of health care technologies

Regulation by directive	Regulation by incentive (central/regional government)
Pre-market controls for drugs and devices	Reforming payment schemes for health care institutions (e.g. hospitals)
(Conditional) exclusion from public reimbursement	Budgetary reform within institutions
Planning of specialist facilities or specific technologies	Changing payment systems for health care providers
	Cost-sharing arrangements
	Encouraging competition in the health care system

Source: adapted from Rutten and Haan [1].

evaluation study of the Oregon approach is in progress. Also with regard to the Medicare package, early studies on the most cost-effective strategy to treat end-stage-renal disease and the role of EPO (erythropoietin) in the support of dialysis patients have been influential in policy decisions [2].

A systematic approach can be found in the Netherlands, where the Health Insurance Executive Board consistently uses economic appraisal to support decisions on the health insurance package. In 1986 this Board decided to adopt a three-step procedure for deciding on major additions to the health insurance benefit package: diffusion of the new technology should be limited and controlled, a medical technology assessment should be carried out simultaneously, and finally, a decision should be made on the basis of such study. A number of large medical technology assessments (MTAs) have been carried out under this program, notably all new transplant studies such as heart, liver and lung transplantation. The results have been quite influential in deciding on inclusion in the benefit package [3].

In 1988, the so-called Investigative Medicine Fund was initiated, which is now the main source of finance for health care technology assessment in the Netherlands, and potentially well placed to assure policy relevance and ultimate impact on practice. This Fund exists of 36 million guilders a year, and is intended to support projects to evaluate new or established medical technologies, looking prospectively at cost-effectiveness and sometimes also social, ethical and legal implications in view of the policy decisions to be taken. Proposals are submitted by university hospitals and approved on by a special committee on the Investigative Medicine Fund at the Health Insurance Executive Board. Since 1988, 80 projects have been funded and 15 projects are finished and have submitted final reports. Most of the finished studies produced recommendations for clinical protocols, a number led to a conclusion regarding the composition of the benefit package and one was related to a licensing procedure for a specialist facility. Critical remarks on this program relate to the fact that, although the bottom-up procedure taps the creativity and interest of the medical scientific community, many of the projects could not be considered high priority in terms of solving the problems faced in health policy. Therefore, plans have been made to combine the top-down and bottom-up approach in the Investigative Medicine Fund and to initiate an exercise to set priorities for MTA-research. One of the consequences of the program has been that medical technology assessment as an interdisciplinary effort develops well in the Netherlands and meets increasing interest from clinicians and policy-makers.

In conclusion, there is some evidence that economic appraisal supports decisions on inclusion or exclusion of general medical technologies from the benefit package. Dutch experience has learned that for such information to be useful in policy-making, a continuous dialogue between policy-makers and researchers is required, especially in the design phase. Furthermore, the identification of medical technologies to be submitted to an MTA is considered difficult but necessary to increase the impact of economic appraisal on policy-making.

2.2. Pricing and reimbursement of medicines

The role of economic appraisal is more prominent in policies on pharmaceuticals, especially in those regarding reimbursement. In many countries, especially the U.S. and some European countries, the increase in expenditure on pharmaceutical care has been significantly larger than the increase in total health care expenditure for a number of years now. Different policies to contain the costs of pharmaceutical care reflect the degree of government control on the sector and suggest little consensus among policy-makers on how to tackle this problem. In a number of countries like Belgium, Switzerland, France and Italy, the prices of medicines are set by the government, but only in the latter two cases is there some consideration of prices relative to therapeutic value, and in France a favourable cost-effectiveness profile may help the industry to negotiate a good price for a product.

How economic appraisal may support direct price regulation is not an easy question. There are obviously at least two issues: that of a just price in terms of a fair award to the (risk bearing) industry and that of an acceptable price in terms of a reasonable cost-effectiveness level relative to the competitive drug as seen from a societal perspective. Economic appraisal has no contribution to assessing the fairness of a price. And only if an implicit or explicit cut-off point for cost-effectiveness is chosen [4], does it provide something to hold on to for determining an acceptable price. Sometimes this distinction between equity- and efficiency-considerations is blurred and economic appraisal is misused to defend or justify a price.

Reimbursement of pharmaceuticals on the basis of some social security arrangement (from insurance premiums to taxes) may be restricted in many different ways and economic studies may be useful in all these cases. There may be positive or negative lists of pharmaceuticals eligible for reimbursement, there may be restrictions on reimbursement (e.g. specific indication groups, a priori approval by controlling physicians), or one may require mandatory returns on products reimbursed by the social security system (e.g. Belgium). Regarding reimbursement of pharmaceuticals there are two interesting new developments: the establishment of a formal role for economic analysis in decision-making in Australia and Canada and the introduction of reference price systems in Germany, the Netherlands, Denmark, Sweden and Norway. The first development is illustrated with the example of Australia, where since January 1993 economic appraisal is legally required for the pharmaceutical industry in Australia when submitting their products for listing on the Pharmaceutical Benefits Scheme. Only if a drug is listed on this scheme, will its use be subsidized by the Commonwealth Government. By the end of 1994, 133 submissions for listing were filed, nearly half of which could be characterized as cost-effectiveness analyses, the other two quarters being either cost-minimization analyses or incomplete, qualitative analyses. Mitchell [5] from the Pharmaceutical Evaluation Section of the Commonwealth Department stresses the pivotal place of the measurement of clinical performance and reports very few cases where an economic difference could be substantiated without being able to demonstrate a clinical difference. Furthermore, he emphasises a hierarchy for preferred primary evidence for economic evaluation, defined as:

1. randomised head to head trials;
2. transitive analysis of randomised head to head trials;
3. observational studies;
4. expert opinion.

Finally, he thinks it is necessary to define more explicitly the role of modelling. Further clarification of all these points is sought in the draft guidelines 1995.

Under reference pricing no prior judgement is made about which drugs will be reimbursed. In this system a price is set at which a given category or class of drugs will be reimbursed. A patient buying a particular drug is reimbursed up to the reimbursement limit, determined for the associated cluster. If the drug is priced above this reimbursement limit, the patient pays the difference out of pocket. Such a system may be appealing to policy-makers, who see a way to encourage price competition by industry, but the reported effects to date have been small [6]. In the Netherlands, for instance, where there has been a price reference system since July 1991, the government does not seem to be satisfied by its accomplishments as it is now considering direct price regulation as an additional cost-containment measure.

In principle, these price reference systems may be appealing to economists, who argue that costs and effects per drug within a cluster of drugs are equal, at least from the perspective of the third payer. This would be in line with a cost-effectiveness perspective, but the practice of these systems suggests otherwise. First, there are problems with the clustering of drugs on the basis of equal effectiveness, especially in case generic products and specialities are clustered together. Such a dispute has arisen in the Dutch case, where an original product (sumatriptan) and a generic product (ergotamine) were clustered together [7]. A further problem is that effectiveness, and indeed cost-effectiveness may differ with the indication. For example, HMG-CoA reductase inhibitors like pravastatin and simvastatin show different cost-effectiveness in preventing cardiovascular disease related to, for instance, initial cholesterol levels. Other problems occur when new indications for a particular product emerge, e.g. in the case of ACE-inhibitors, which are now also indicated for patients after acute myocardial infarction. In general, price reference systems do not take into account that cost-effectiveness is not a characteristic of a pharmaceutical product per se, but rather of the process of prescribing the drug to specific patients. Also on the cost side there may be different profiles for drugs within one cluster, despite the equal reimbursement costs to the third party payer. The latter does not take into account that medication may impact the duration of treatment differently, or that medication may have different effects on the overall use of health care resources. Furthermore, in all countries the determination of the level of the reimbursement limit is historically based. No evidence on the balance of societal costs versus benefits for a particular drug or group of drugs is being considered. The cost-effectiveness level which can be associated with each cluster of drugs, may also differ across the various clusters. A situation may occur where a cost-effective drug in one cluster may be reimbursed at a lower rate than a less cost-effective drug from another cluster. And finally, price referencing introduces cost sharing and may therefore have unfavourable equity implications. In particu-

lar, chronic patients, who take medication daily and who for some reason cannot switch to another medication, may experience significant increases in out of pocket payment. As economic evaluation is the only approach available to identify and compare the costs and consequences of health care interventions, we conclude that price reference systems are not an alternative to the use of economic appraisal in reimbursement decisions. The latter may be used as a complementary source of information, for instance to support the determination of reimbursement limits, both within clusters and across clusters.

In summary, with respect to pricing and reimbursement of medicines, we observe a growing role of economic appraisal in these decisions. Efforts are made to define even more clearly what information is needed for policy decisions and this may help to increase the quality and consequent impact of future economic studies. Reference pricing is clearly not an alternative to the use of economic appraisal, but may benefit from using cost-effectiveness information to support the determination of reimbursement limits.

2.3. Planning of specialist facilities or specific technologies

A second mechanism to control the diffusion of medical technologies is the planning of specialist facilities or specific technologies. Public health authorities may want to regulate such diffusion, because certain facilities may show 'economies of scale' or should only be provided under strict conditions regarding quality of care or otherwise. There is surprisingly little work to support such decision-making, although some countries exercise a sort of licensing procedure for advanced medical facilities. For instance, the Netherlands has a licensing option for particular specialist facilities in the context of article 18 of the Hospital Facilities Act. Although a budget has even been made available for research to support decision-making under this regimen, no work can be reported yet. Recently, the Health Care Financing Administration in the U.S. has initiated a study on economies of scale in open-heart surgery and in the UK, the heart transplant study performed during in mid-80s also considered the economic effects of further diffusion across more than the two units performing transplants at that time [8].

As a conclusion, we observe that there is a wide, almost unexplored, field open for economic research to support the planning of specialist facilities.

2.4. Regulation by incentive

Regulation by incentive requires that appropriate incentive structures are in place for the key actors in the health care system. Such incentives should stimulate them to act efficiently from a societal perspective. This means that reimbursement schemes, cost-sharing arrangements, etc., should encourage such behaviour and be devised in line with information on the relative cost-effectiveness of alternative treatment strategies. In other words, the reimbursement rates in a DRG-type payment system should reflect the costs of applying the most efficient treatment alternative. If the relative rates do not reflect most efficient solutions, hospital managers cannot be expected to behave efficiently.

There are a number of impediments for efficient behaviour of managers and professionals within the hospital, and the use of cost-effectiveness information in particular. One is the compartmentalization of specific budgets. Most health care institution managers face tight budgets and will be mostly interested in cost consequences, and only in direct costs rather than indirect costs, and only in so far as resources saved can be quickly utilized or costed in another area. So in practice the selected course of action will often differ from what is efficient from a societal viewpoint. Decision-makers at decentralized levels often complain about this lack of stimuli towards efficiency and may lose their interest in economic appraisal studies.

Another hurdle is the fact that sometimes budgets are not really closed and that there are options to shift costs to other budgets, which precludes a full trade-off between costs and benefits. This is for instance the case in the UK and the Netherlands, where hospitals sometimes have the opportunity to offload some of their prescribing costs on the primary care sector. Furthermore, pharmaceutical companies often heavily discount their medicines to hospitals to make them attractive to formulary committees in the hope that their use is also extended to primary care settings. From these examples it is evident, that a broad view, passing the borders of institutions and health care sectors, is required. Compartmentalization of budgets within institutions should be minimized and shifting resources across departmental budgets on the basis of cost-effectiveness claims should be made possible.

In the U.S., managed care organizations, which are well placed to initiate and use economic appraisals, have not yet established a good track record of activities in this field [9]. Their dominant perspective appears to be cost-containment rather than efficiency. Also the way in which one attempts to increase the efficiency of Medicaid programs is guided by cost-control considerations. For instance, prior authorization for the use of expensive drugs is now the primary method by which Medicaid programs control drug expenditure. The design and evaluation of such control mechanisms suggest that consequences in terms of cost reduction are the major outcome-indicators to be considered [10].

One may argue that a final problem for the use of the results of economic appraisal studies in actual decision-making is the potential 'conflict of interest', faced by the individual health care provider, who should treat his patient in the best possible way. Most doctors would agree now that they have a responsibility to all their potential patients, and not only to their individual presenting patients. Doctors have learned to consider opportunity costs and how to include economic arguments in their judgement regarding different treatments. Results of the multi-disciplinary prospective studies performed in the context of the Investigational Medicine Program in the Netherlands quickly find their way in medical protocols for new forms of treatment.

In summary, we observe that economic appraisal as a method is still in an early phase of diffusion among actors involved in resource allocation at the regional level. The primary obstacle for further diffusion seems to be a lack of incentives to act in line with a societal perspective on cost-effectiveness. Another hurdle is

probably a lack of knowledge and experience in this field, which should be tackled by educational programs targeted at these regional actors.

3. Linking research and policy making

Drummond [11] mentioned a number of ways to increase the relevance of economic appraisal results:

- maintaining methodological standards;
- producing economic evidence in a timely fashion;
- increasing the local validity of study results;
- increasing the decision-maker involvement in the study;
- improving the dissemination of study results;
- taking note of the availability of policy instruments;
- recognizing the conflicts and incentives surrounding the study.

Rather than addressing all these issues, we would like to select two important issues, to which we may be able to add further and provide illustrative examples.

3.1. Interpretation of study results

The first of these issues is the interpretation of results from an economic appraisal and the subsequent use in policy-making. A number of authors [12–14] have commented on the use of cost-effectiveness league tables and pointed to the problems associated with their use in policy-making. This has led to a recommendation to policy-makers not to use cost-effectiveness estimates in a mechanistic fashion and to carefully investigate whether the reported cost-effectiveness ratio is relevant to their policy context. Moreover, very little is actually known about how policy-makers use information on cost-effectiveness. It would be particularly difficult for them to select the most cost-effective version of a health care program when a choice has to be made between various alternatives which differ in intensity or scale. The interpretation of differential cost-effectiveness ratios becomes burdensome in such cases.

Let us illustrate this with two examples, the first of which actually led to a clear policy-decision. This example is drawn from a study from De Koning et al. [15] in Rotterdam, who reported on the cost-effectiveness ratio of introducing breast cancer screening in the Netherlands. For the calculation of the costs, it was assumed that the screening program would have started in 1990 and that it would end in 2017. The costs and effects of mass screening in this period, occurring after 2017, are computed until all women, who may have benefited from the screening program, will have died. Table 2 provides the results of the study for different screening policies, using different age groups and different screening intervals. The 2-yearly screening program for women aged 50–70 is predicted to detect 26% of all diagnosed breast cancers in the population. The table shows that the screening option for age group 50–65 with an invitation interval of 3 years is most

Table 2
Effects on mortality, costs, cost-effectiveness and cost-utility for different breast cancer screening policies (1990–2017) in The Netherlands

	Age group and screening interval				
	50–70; 2 years	40–70; 2 years	50–70; 1.3 years	50–75; 2 years	50–65; 3 years
Difference in costs	233	346	328	265	133
Breast cancer deaths prevented	6000	6115	6780	6790	3770
Life-years gained	61 000	64 000	70 000	64 500	41 000
Quality-adjusted life years gained (QALYs)	57 500	59 500 ^a	66 000	59 500	39 300
Cost (US\$) per life-year gained (CE ratio)	3825	5385	4670	4100	3235
Cost (US\$) per QALY	4050	5815 ^a	5000	4450	3400

Costs in millions US\$ (unless stated) with 5% discount rate; cost amounts are expected differences between situation with and without screening (prices 1990); source: De Koning et al. [15].

^a No age-specific data for treating women < 50 years.

cost-effective, followed by the option for the age group 50–70 and a 2-year interval. These cost-effectiveness ratios relate to the reference situation without systematic screening. An infinite number of options and associated cost-effectiveness ratios could have been reported, and without a clear decision-rule it would be very difficult to select the best option from a policy perspective. In this case, the initial preference by field experts for the age group 50–70 and a 2-year invitation scheme settled the matter and could be defended on the basis of the results. The cost-effectiveness ratio as compared to a situation without screening is only slightly higher than in the 50–65 years/3-year interval case and the number of QALYs gained in the former case is, of course, much higher than in the latter case. Note that in this case it would have been necessary to define rather precisely the cut-off point for incremental cost-effectiveness to arrive at the same conclusion. The obvious lesson from this case is that policy-makers want to act on more detailed information than only a reported incremental cost-effectiveness ratio.

Another example comes from a recently completed study by Michel [16] on the relative cost-effectiveness of various diagnostic strategies for patients with suspected pulmonary embolism in the Netherlands. Five different diagnostic tests with various cut-off points and a clinical decision-rule were considered in combination, which led to 11 605 alternative diagnostic strategies. Relative costs and effects were calculated for each of these strategies, and 11 563 of these were identified as inferior, meaning that they produced less benefits and more costs than an alternative strategy. The remaining 42 superior strategies were compared with a strategy recommended by a 1992 Dutch consensus meeting. In 12 of the remaining 42 superior strategies less investments than in the consensus strategy yielded more QALYs, as shown in Fig. 1. Again, it is difficult to draw a firm conclusion here. One may say that the strategies on top of the small notches of the line are the most appealing strategies,

like numbers 3, 8 and 12. They combine relatively few costs with many QALYs in comparison with the neighbouring strategies. Again, a fairly sophisticated decision-rule is necessary to arrive at a conclusion and an educated policy-maker would like to see the position of all dominant strategies rather than the conclusion that strategy 13 is the preferred choice if a marginal cost-effectiveness ratio of less than NLG 55 000 per QALY in all steps from strategies 2–13 is deemed acceptable.

3.2. Extrapolation of study results

As resources and even more so expertise to conduct economic appraisal studies are scarce, it is obviously not possible to perform a specific study for each local setting. However, policy-makers would prefer information on the cost-effectiveness of various strategies, which is as much as possible adopted to their policy problem. In the draft version of the most recent Australian guidelines [17], it is stated in the preface, that 'the results of overseas trials of sufficient quality are a reasonable basis for economic evaluations relevant to the Australian health care system. However, an economic evaluation performed overseas will often not be suitable because of major differences in unit costs, the patterns of resource use and the way in which health care is funded. Companies are therefore encouraged to submit an evaluation which is relevant to local conditions'. These guidelines further specify how modelling may help in extrapolating from clinical trials:

- to link the surrogate outcomes measured in the trials to final outcomes;
- to extrapolate the outcomes measured beyond the duration of the trials and duration of therapy within the trials to the likely duration of use;
- to examine the impact of differences between the eligibility criteria and settings of the trials and those that pertain to patients likely to obtain the drug on the Pharmaceutical Benefit Scheme;

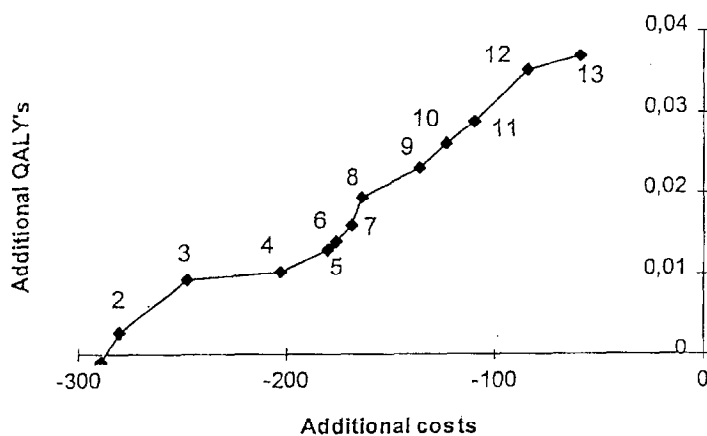


Fig. 1. The non-decreasing function of QALYs relative to costs for the 12 'superior' diagnostic strategies, compared to the consensus strategy. Source: Michel [16].

- to modify resource use patterns measured in the trial to reflect more closely those in Australia;
- to include any relevant differences in resource consumption not measured in the trials and to exclude ‘protocol derived’ resource consumption.

The fourth of these suggested applications of modelling relates directly to extrapolation across countries, but the others may also contain country specific elements. For instance, extrapolating from the surrogate outcome reduced cholesterol level to the final outcome life years gained as a consequence of reduced incidence of cardiovascular disease may be done differently in Europe than in the U.S., using country specific epidemiological databases and country specific mortality statistics.

Given the clear need of policy-makers to have at their disposal technology assessments relevant to their specific policy context, it is surprising that there has been little discussion in the literature on the methodology of extrapolation. One of the exceptions is a paper by Drummond et al. [18], who explored these issues in the context of the evaluation of a new drug to prevent gastric ulcers in people experiencing symptoms during long-term non-steroidal anti-inflammatory drug use. This particular evaluation was performed in Belgium, France, the UK and the USA using identical methodology. Their conclusion was that extrapolation of results from country to country is greatly facilitated if the economic evaluation is structured in a decision tree format. This enables data particular to the individual countries to be introduced in order to examine the impact on estimates of costs and benefits. In this case, despite great variation in the costs of outpatient care and inpatient care in the various countries, the overall expected costs of 3 months prophylaxis were found to be remarkably similar in the four countries studied.

A contrasting result was found by Van Hout et al. [19], who compared the differences in costs for the heart transplant programs in the UK and the Netherlands. They found that the variable costs during the first year of treatment including transplantation in the Netherlands exceeded those in the UK by more than 70%, when corrected for general differences in purchasing power in both countries (Table 3).

And finally, Van Ineveld et al. [20] have shown that it may be quite misleading to extrapolate in a straightforward way from one study performed in a particular country to other countries. They explored in detail the differences in cost-effectiveness of a national program on breast cancer screening in Spain, France, the UK and the Netherlands. It was found necessary to use country specific data on incidence, mortality, demography, screening organization and price levels in health care rather than performing a simple extrapolation of the cost-effectiveness ratio found for the Netherlands and the UK to the Southern European countries. Using their more sophisticated extrapolation technique they found that cost-effectiveness ratios in the UK, France, and Spain were 0.9, 2.7 and 4.6 times as large as the cost-effectiveness ratio for the Netherlands (Table 4). So a simple recommendation, based on the Dutch study, to implement nationwide screening in all European countries cannot be sustained.

Table 3
Costs during the first year after transplantation: the UK and The Netherlands

	UK (1984 US\$ ppp)			The Netherlands (1987 US\$ ppp)		
	Volume	Price	Costs	Volume	Price	Costs
Donor operation	1	1691	1691	1	1738	1738
Transplant operation	1	902	902	1	4165	4165
Inpatient days	47	224	10 511	44	235	10 247
Outpatient visits	18	24	435	27	57	1556
X-rays	72	9	627	35	23	803
Biopsies	13	47	600	15	367	5512
Catheterisations	0.37	142	53	2	798	1348
ECGs	34	9	329	44	20	889
T-cells assays	28	27	733	42	13	555
Cyclo-assays	34	9	329	48	13	635
Physiotherapy (h)	12	13	151	11	33	376
Gates bloodpool scans	1	9	9	3	111	308
Drugs			9702			12 702
Laboratory tests			3529			7485
Other services			813			4089
Total			30 413			51 769

Source: Van Hout et al. [19].

In conclusion, we suggest that studies should be designed, carried out and reported in such a way that extrapolation to other settings and across national borders is facilitated. In this respect it is helpful to clearly structure the analysis and provide the necessary details which may require modification in an extrapolation-exercise. For instance, regarding costing it is necessary to report on resource use by presenting natural units and unit prices separately. Increasingly international clinical trials incorporating prospective economic appraisal studies are being performed in such a way that the potential of drawing valid conclusions for the various countries participating in such a trial is maximized. We think that the 'art of extrapolation' will become a research area of its own with its specific methodology and informatics like the OHE and NHS/CRD data bases for economic appraisal studies in the UK.

Table 4
Cost-effectiveness of mass screening for breast cancer (1990–2017)

	Netherlands	UK	France	Spain
Uniform screening system ^a	2120	2000	3400	4900
National screening system ^b	2120	1800	5800	9700
% of GDP to health care	8.1	6.1	8.9	6.6

Discount rate, 5%; prices 1990, pounds sterling.

^aVertical, specialized organization of screening (Dutch model).

^bHorizontal, non-specialized organization in France and Spain.

4. A glance into the future

Although there is much talk about economic evaluation and medical technology assessment and their relevance for health policy, still little ground has been covered in actual practice. A recent OTA-report [21] mentions only Sweden out of a set of eight countries as showing a significant impact of technology assessment on health policy making. The systematic approach of the Dutch Health Insurance Executive Board to use economic appraisal for deciding on the health insurance package, and the requirement to submit economic appraisal studies for deciding on listing of drugs in Australia, are two examples of applications of economic evaluation, which may diffuse further across countries. For this to happen results of economic studies should become available in a timely fashion and be relevant to the policy context. An important hurdle that has to be taken is the lack of incentives to use results of economic evaluation studies, especially when central government regulation will become less important and the need to support these policies with evidence from economic appraisal studies will be reduced. When resource allocating authority is decentralized, regional and local parties in health care will require similar information and indeed Henshall and Drummond [22] argue that competitive forces may encourage individual parties to consider cost-effectiveness information. However, individual insurers or health care organizations may find it difficult to finance economic appraisal studies producing results of a more general value than only for one particular insurer or health care organization. A free rider problem emerges when such information is also freely available to others. If the information is clearly marked as having a commercial value, there will be obvious problems with the dissemination of such information. Devising and enforcing the right incentives to policy-makers at the regional and local level is vital to the further diffusion and greater use of economic appraisal studies.

At the level of the European Union, formal rules in pharmaceutical research and in procedures for registration have been in place since 1965. With respect to registration there is now a central and a multistage procedure, but these do not extend to economic considerations. With respect to central registration a trend towards a multiple step procedure can be observed: a quick registration on a conditional basis, resubmission of information at specified intervals to get re-registration and careful monitoring of developments in terms of effectiveness and safety. Maybe we will see reimbursement decisions follow this iterative process: a quick reimbursement and listing decision on the basis of cost-efficiency, preferably on the basis of a piggy-back study, monitoring of cost-effectiveness in actual practice by assessing real effectiveness, the diffusion of the drug across new or broadened indication groups and actual compliance of patients, and resubmission of cost-effectiveness data after a certain period of time using evidence from outcomes research, compliance studies, naturalistic economic studies, etc.

Finally, we observed a large variation in policy instruments used in various sectors within health care and different ways of using cost-effectiveness information. Increasing international cooperation, both in research and policy, will probably lead to some convergence of policy approaches around a few of the policy trends mentioned above.

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