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Economic Aspects of Cancer Care

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The use of techniques of economic analysis in improving the efficiency of cancer services is both complex and poorly understood. Like many other areas of health care, there are large variations in treatment patterns, a reluctance to invest in prevention, inadequate data about effectiveness, and a reluctance to invest in cost-effectiveness analysis to inform purchasers' choices. Without the deployment of such techniques and the basing of treatment choices on a balancing of costs and effects, resources will continue to be used inefficiently and to the detriment of patients' welfare.
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INTRODUCTION

CANCER HAS been dreaded throughout history. The English word comes from the Greek word for crab, and was introduced into the medical vocabulary by Hippocrates around 500 BC. Between 500 BC and AD 1700, cancer treatment was a combination of crude surgery, blood letting, purges, herbal "remedies", cauterisation and salves (including corrosive agents such as arsenic). Gedron, by introducing description and classification based on careful observation and measurement in the 18th century, reduced previous confusion, and concluded that only localised cancers and their offshoots were curable: thus rediscovering what was well known to Hippocrates and his contemporaries.

Since Gedron's work cancer knowledge has expanded rapidly, and in the last two decades major advances have been made in the treatment of cancers such as leukaemia and Hodgkin's disease. However, much of the cancer industry's activities remain speculative and poorly evaluated. The purpose of this paper is to map the ways in which the application of techniques of economic analysis may be useful in the cancer field. Because the scope of such work is considerable, the goal is to be illustrative and general rather than specific and narrow.

WHAT ARE THE PROBLEMS?

Introduction

There are four major problems in cancer of interest to economists and policy makers:

(i) much is known about the cause of premature death due to cancer, but the formulation and implementation of national health policies to affect these risks is slow and ineffective;
(ii) there are large variations in the treatment offered to patients with particular cancers, but little agreement about the appropriateness of treatments;
(iii) little is known about the cost effectiveness of cancer screening and treatment interventions;
(iv) trial design is contentious as is the role of economic evaluation.

Cancer-related premature mortality

Aetiology and epidemiology provide poor estimates of the causes of death in any country. Using attribution factors taken from Almer and Dull [1], and using an arbitrary definition of premature mortality of death before the age of 65 years, the attributable life-years lost due to cancer in any country can be guestimated. The data for England and Wales in 1989 are shown in Table 1 (updated from [2]). The role of tobacco in causing premature mortality in most of these cancer sites, and in particular in lung cancer, is significant. The application of relatively simple and uncostly primary prevention policies might reduce this premature mortality, and some guestimates are presented in Table 2 (another exploration of this issue can be found in [3]).

Table 1. Attributable life-years lost due to cancer (to 65 years old): England and Wales 1989

Type	Total number of life-years lost	Factor	Attributable life-years lost
Cervical	29 651	Syphillis	2135
		Onset of coitus < 17	8658
		Two or more sexual partners	14 766
		Herpes	9874
		Smoking	7858
		Oral contraceptives	5841
Bladder			
(M)	10 156	Smoking	4751
(F)	4816	Coffee	3774
		Occupation (high risk)	2336
Pancreatic			
(M)	16 619	Smoking	8231
(F)	15 284	High-fat diet	7657
		Diabetes	2034
		Coffee	6987
Laryngeal			
(M)	4476	Smoking	5414
(F)	1028	Alcohol	930
Lung			
(M)	115 751	Smoking	139 619
(F)	68 686	Occupation (high risk)	22 132
Breast	150 282	Weight (> 60 kg)	45 085
		Age at first pregnancy < 20	44 033
		Diet	30 057
Colorectal			
(M)	44 516	Beer	3507
(F)	38 981	Diet	16 550

The attributable risk factors (ARFs) used in this table are from [1].
M, male; F, female.

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Table 2. Estimates of the proportion of 'avoidable' life-years lost amenable to primary prevention; selected cancer sites, 1989

		Attributable risk (%)	Life-years lost
Lung	Smoking	75.9	139 619
	Occupation	12	22 132
Colorectal	Diet	20	16 550
Breast	Diet	20	30 057
Cervix	Smoking	24.1	7858
Pancreas	Smoking	25.8	8231
Bladder	Smoking	39.0 (M) 16.4 (F)	4751
	Occupation	23	2336
Larynx	Smoking	74	5414
	Alcohol	16.9	930
Total			237 878

M, male, F, female.

The tobacco market is highly regulated by the state in the U.K. Whilst the price elasticity of demand for tobacco is low (e.g. −0.5 in the U.K.) the use of fiscal policy has significant effects on consumption. But such policies also affect employment and trade [4]. European agricultural policy (CAP) has subsidised tobacco production in Italy and Greece, and has been so effective that production has risen. Unfortunately, there has been no demand for this tobacco in Europe, and it is now sold off in Africa: European taxpayers are, in effect, paying to produce lung cancer in Africans!

The United States Government has forced some countries to open up their markets to U.S. tobacco producers in the name of "free trade". This vigorous support has affected prices and consumption in some countries adversely from the health perspective (*Economist*, May 18th, 1992), but is now leading to a reaction with, *inter alia*, the World Bank adopting a vigorous anti-smoking policy both in terms of agricultural subsidies and taxation programmes.

The successful design and implementation of fiscal, agricultural and advertising tobacco policies can lead to the efficient restructuring of tobacco markets, with measurable effects on use, morbidity and mortality, but the political obstacles to such change are considerable.

Variations in cancer treatment

Variations in practice are *prima facia* evidence of a lack of agreement concerning best treatment modalities and the inefficient use of resources. U.K. radiotherapists were asked in a survey to report how they would treat patients with particular, clearly specified presentations. This survey revealed large variations in treatment practices [5]. For instance, respondents reported treatments for a 65-year-old woman with metastatic breast cancer experiencing pain ranging from 1 to 15 fractions, with a median of 5. For a 50-year-old man with inoperable cancer of the bronchus and distressing symptoms, the survey revealed a range of treatments from 1 to 36 fractions, with a median of 10.

The use of similar survey questionnaire techniques to identify the practices of radiotherapists across mainland Europe, Canada and the U.S.A. has revealed similar large variations. For instance, a uniform presentation of brain metastases generated median responses of 5 fractions in the U.K. and 16 and 16.5, respectively, in Germany and Italy. The U.K. respondents also revealed much lower treatment levels in bone metastases and lung cancer.

These very large variations in radiotherapy are paralleled by variations in chemotherapy, both in terms of the duration of treatment and the drug combinations used. With such variations within and between countries, and with a correlation between supply levels and intensity of treatment, the pertinent question is what fractionation and chemotherapy treatment levels are effective and appropriate?

Cost effectiveness is unknown

There is a large volume of literature measuring clinical end points and survival following alternative cancer treatments. Furthermore, this literature rarely includes the economic consequences of treatment or the quality of life of patients and carers. Little is known about the costs of different interventions, and it remains common for clinical trial results to be presented without reference to the resource consequences of the competing therapies. Where costs are reported, there are large variations in the estimates for the same treatments. Goddard and Hutton [6] reviewed the literature and reported estimates of the costs of radiotherapy varying from £9 to £37 per fraction (1988 U.K. £). The estimated costs of radiotherapy treatment for lung cancer varied from £415 to £3956 (1988 U.K. £).

It is curious not only that many trialists fail to estimate the costs of treatments, but they also ignore their effects of interventions on the quality of life. Perhaps three quarters of chemotherapy and half of radiotherapy treatments aim to palliate not to cure, yet only recently have trialists begun increasingly to measure the effect of intervention on the quality rather than the quantity of life.

An example of this reluctance to measure the quality of life is the area of head and neck cancer. Here interventions can be "heroic", for instance major disfigurement by removal of the jaw by "commando surgery", with significant implications for social, psychological and physical functioning. Morris' review [7] of quality of life studies in head and neck cancer showed that the majority of studies were retrospective, largely descriptive, based on small samples and focused narrowly on functional disability.

The literature on the measurement of the quality of life in general, and in particular in cancer is now vast [8, 9], and there is an emerging consensus about best practice. Collaborative work, within the EORTC, has led to the construction of a core cancer QoL instrument with additional modules for specific cancer areas [10].

Trial design is contentious

Often the size of cancer trials is too small and is inadequate to demonstrate statistical power. In addition, there remain some cancer trialists who deny the role of economic evaluation and quality of life measurement, and argue that the only relevant end point to be measured is an increase in the quantity of life (survival). Such "dinosaurs" do not accept that this is relevant for both researchers and health care purchasers to ask the question: what is the cost of this increase in life's duration and what is its quality?

A more reasonable argument is that major trials should be large, multi-centre, international and simple if effects on survival are to be detected. Such trials should be complemented by carefully designed subtrials to cost the options, and to identify the quality of life effects of the two options. The risk with this approach is that the "science" (the clinical trial) identifies survival benefits before the cost and quality of life effects of the alternatives are known. Some who espouse this approach of large clinical trials and separate economic subtrials, tend to pursue the former and leave out the latter! Thus a large international trial of the prophylactic use of tamoxifen in women with a high risk of breast cancer may produce

knowledge of "some effects" (enhanced survival) before knowledge of economic effects. This will make the task of the health care purchaser in halting the service development of the intervention until it is proved cost effective, very difficult. Providers, patients and the media will demand care, and if proven cost ineffective subsequently, the service will be difficult to terminate.

THE WAY FORWARD

Introduction

The mitigation of these problems requires changes in:

(i) economic aspects of health policy;
(ii) economic evaluation and health care policy;
(iii) changing behaviour; the translation of "best" practice into health care practice.

Health policy

Many nations have tried to design health policies in which targets for changes in health behaviours are set, and health care managers are induced to incorporate these policies into their strategies, e.g. the New Zealand Labour Government [11] and the recent attempts of the U.K. Government to articulate a health policy [12]. Most European governments have signed the World Health Organisation Agreement on Health for All (HFA) in the Year 2000. Many of these signatures will fail to meet the health targets in HFA 2000 with regard to tobacco and cancer.

The capacity of industry, especially the tobacco and alcohol industries, to countervail the health lobby in the political market is considerable. Health and industry interests will always be at variance in relation to the cancer-inducing effects of tobacco. Inherent in this debate are ideological positions (libertarian and collectivist) which have subtle effects both on the design of public policy and its implementation.

The role of economics is to dissect the policy rhetoric with careful measurement of relevant elasticities of supply and demand, and so to forecast the effects of alternative policies on consumption and production. Some good examples of this are (a) does advertising affect tobacco consumption? and (b) is tobacco taxation regressive? Resolving such issues raises methodological issues (see the debate about regressivity between Townsend [13] and Borren and Sutton [14] which requires careful estimation of price elasticities across social or income classes). These challenges require resolution and replication across countries to determine more fully the effects of health policy, and it is surprising how little this attracts the attention of economists and econometricians.

Health care policy

The paucity of evidence concerning the cost effectiveness of cancer treatments means that health care purchasers, in the managed health care system of the U.S.A. and the regulated market system of Europe, are ill informed [15].

In many countries, valiant attempts are being made to prioritise or ration health care (e.g. Oregon [16] and the Netherlands [17]). Such efforts are frustrated by the lack of adequate effectiveness and cost effectiveness data [18].

Can researchers mitigate this ignorance? The methods of economic evaluation have yet to reach a "steady state": there is no "gold standard" but some "good practice" rules exist [19–22]. There is a variety of contentious issues which has been highlighted by the plans of the Australian [23] and Ontario [24] governments to require pharmaceutical companies seeking reimbursement for new clinical entities to demonstrate cost effectiveness.

To meet such regulations, with what should a new chemical entity (e.g. a new type of chemotherapy) be compared? Should the comparator for a new chemotherapy be the least cost alternative in the market and the one which is the most generally used? Whichever comparator is used, should streams of costs and benefits over time be discounted, and if so at what rates? Parsonage and Neuburger [25] argue for zero discounting of benefits, and Cairns [26] opposes this view, as does Williams [27] who notes that there is no reason to use identical rates for both costs and benefit streams. The selection of the appropriate discount rate is an empirical issue awaiting more thorough research.

If specific quality of life measures are used, such as that designed by the EORTC group [10], should they be complemented by generic quality of life measures such as Short Form 36 [28] or the Euroqol [29]? Should the results from these instruments be "translated" into more general measures of the benefits of health interventions, e.g. the quality adjusted life year (QALY)? QALY estimates to date have been crude with all too little reporting both of confidence intervals and the effects of sensitivity analysis on the estimates and rankings within QALY league tables.

Practice varies in these areas and the results of economic evaluations may be sensitive to these variations. The reported results of trials may also be biased if adequate consideration is not given to sample size. Few economic evaluations in cancer or elsewhere in medicine discuss the issue of statistical power, sample size and the robustness of the results reported.

It is essential that the practice of economic evaluation is explicit and well reported in all studies so that their results can be used to inform efficiently purchasers seeking to make difficult investment choices within cancer services and between them and other treatment areas.

Changing behaviour

In 1986, the results of the British breast cancer consensus conference were reported in the *British Medical Journal* [30]. The panel advocated more extensive use of conservative surgical intervention (lumpectomy) and reduction in the use of the disfiguring alternative (mastectomy). This advice was based on evidence that the survival outcomes of the alternatives were similar, and the quality of life effects of the former were superior to the latter.

The effects of this and greater appreciation of the literature led many clinicians to reconsider their practices: only 40% continued to use mastectomy in the management of early breast cancer in 1985 [31]. This trend continued to the late 1980s. Furthermore, by 1989–1990 there was a considerable increase in the number of surgeons who would discuss breast reconstruction after mastectomy where this was the preferred treatment, more surgeons were offering their patients choice, and more surgeons had access to counsellors/nurse specialists, whose work has been demonstrated to enhance the quality of life of patients [32]. However, separately Morris [33] has shown that there appear to be geographical variations in surgical procedures, with apparently less conservative practices being offered more often in the north, particularly the north west of England.

These results show that effectiveness data can affect the behaviour of clinicians. However, like the ISIS trial of thrombolitics (tpa versus streptikinase), not only does the scientific data have to be of high quality, it also has to be boldly disseminated and "sold" to a conservative medical profession.

The pertinent issue is where such peer leadership is adequate to induce changes in clinical behaviour and where it is not, what is the efficient balance between professional regulation and the regulating activities of purchasers and competition? Whether competitive pressure, produced by managed and regulated compe-

tition, is efficient and appropriate, both Relman, former editor of the *New England Journal of Medicine* [34] and even Adam Smith, the alleged apostle of self interest and greed, doubted:

> Those general rules of conduct when they have been fixed in our mind of habitual reflection, are of great use in correcting the misrepresentations of self-love concerning what is fit and proper to be done in our particular situation. . .
>
> The regard of those general rules of conduct, what is properly called a sense of duty, is a principle of greatest consequence in human life, and the only principle by which the bulk of mankind are capable of directing their actions'
>
> Adam Smith, 1776 [35]

Perhaps faith in the clinician and the maintenance of a supportive doctor–patient relationship is particularly important in cancer where it appears to have effects both on the quantity and quality of life. However, such effects are not well documented and more precise exploration of these and other incentive issues by economists and other social sciences are noticeably few. Why are economists so reluctant to explore the incentive issues when their discipline and their rhetoric asserts are so important in cancer and other health care sectors?

CONCLUDING COMMENTS

Cancer is the second biggest killer after cardiovascular disease in most western countries, and the improvement of resource allocation in health and health care services is of great importance to health care purchasers, public and private, worldwide. The quality of information about costs and outcomes is inadequate throughout the health and health care sectors. This ignorance is particularly acute in the cancer field where the circumstantial evidence about inefficiency in health care provision is considerable. Many palliative and curative regimes appear to be of limited effectiveness and high cost, but a major industry, reinforced by powerful and charitable organisations, resists change from what appears to be cost ineffective treatment to potentially cost effective prevention. All activities, screening, prevention, treatment and terminal care, require major investments in evaluative research but the cancer industry appears to be reluctant to develop this work.

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