Pergamon

European Journal of Cancer Vol. 31A, No. 9, pp. 1406–1409, 1995

0959-8049/95 $9.50+0.00

0959-8049(95)00285-5

Review

The Economics of Reimbursement and Technological Change in Cancer Care

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INTRODUCTION

THE RECENT evolution towards prospective financing systems may be an important mechanism for cost-containment in healthcare, but the potential interactions with technological innovations in healthcare have, up to now, largely been ignored. Prospective reimbursement is likely to be more conducive to cost-reducing rather than to quality-improving medical innovations. Furthermore, it may slow down the overall pace of technological innovations since funding clinical research, especially phase III projects, may become increasingly difficult. This article concludes with some suggestions to cope with these problems.

THE IMPACT OF TECHNOLOGICAL INNOVATIONS ON HEALTHCARE FINANCING SYSTEMS

The current directions in medical research and development and technological innovations in healthcare affect the level and nature of reimbursement questions that will be asked for in the future. As new treatment modalities for previously incurable or untreatable conditions, or complementing existing treatments (e.g. improved anti-emetics), are developed, pressure for extended reimbursement coverage will emerge, and thus annual healthcare expenses may increase (annual expenses need not increase, e.g. when treatment is life-extending, lifetime health expenses will rise, but annual expenses may diminish; see [1] for a full discussion). Healthcare financing companies, private as well as public, may, for example, experience increasing pressure to cover new expensive drugs in cancer care, such as docetaxel and paclitaxel.

When new treatment modalities replace standard procedures, they may imply diminishing or increasing future healthcare expenses. Expenses will diminish, if the new treatment is cheaper than the conventional one. For instance, peripheral blood progenitor cell transplantation (PBPC) is expected to be cheaper than autologous bone marrow transplantation (ABMT) in leukaemia patients. Filgastrim (r-metHuG--CSF) treatment is expected to reduce the costs of ABMT, mainly because of the reduction in hospital stay for neutropenia and complications [2, 3]. Expenses will rise if the new treatment modality is more expensive, or if the indications for treatment are enlarged, such as if PBPC is used not only for leukaemia but also for advanced solid tumours such as mammary carcinoma, or if rHUG-CSF is used not only in cancer patients at risk of severe neutropenia, but also, for instance, in patients with severe aplastic anaemia, non-neutropenic infections and HIV-related infections [4].

Furthermore, especially for public health insurance systems, the cost structure of the new technology, or more precisely, the ratio of fixed to variable costs, may also affect the political willingness to extend health insurance coverage to new treatment modalities. When fixed costs are high relative to variable costs, a large share of total costs will fall on the current legislation's budget and hence will reduce their willingness to cover these costs. To take a simple example, assume a new cytostatic agent and a new piece of radiotherapy equipment (e.g. 3D-planning system) have been developed. Assume that it can be perfectly forecast that both will have the same level of total costs over the next 10 years. In this situation, the political willingness to reimburse the new drug may be larger than to install the new piece of equipment, since for the latter the upfront expenses, weighing on the current government budget (e.g. equipment subsidies) are large, while for the former the expenses will be spread more uniformly over the 10 year period, and thus fall on future legislations' budgets.

THE IMPACT OF REIMBURSEMENT MECHANISMS ON INNOVATIONS IN MEDICAL CARE

The reimbursement system similarly affects the rate and nature of technological innovations in health care. Actual reimbursement systems affect the rate and nature of technological adoption and diffusion of existing (i.e. already developed) medical technologies, while the expected future reimbursement systems may influence the focus of current research and development, and hence the nature and type of new emerging technologies. In order to clarify this point, a brief overview of reimbursement systems is first provided.

Typology of financing systems

Most reimbursement systems applied in practice can usefully be classified somewhere between two polar cases: retrospective, cost-based versus prospective financing systems. The historically dominant mode of healthcare financing was the retrospective, cost-based system, whereby providers receive payment, quasi-automatically, for all costs they cause. Revenues for providers

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Received 22 Feb. 1995; accepted 15 Mar. 1995.

are determined endogenously: as they provide more services, i.e. generating higher costs, they receive higher payments. Typical examples include the reimbursement of all approved accounting costs for hospitals, or fee-for-service reimbursement systems for medical doctors, whereby the physicians receive a fixed fee for each service (consultation, operation, blood count) provided. Since healthcare policymakers are increasingly worried about the level and growth rate of healthcare expenses, a growing part of providers' revenues is being determined prospectively: providers receive an annual budget, or a fixed sum of money per patient (e.g. DRG-case payments) independent of the actual level of services provided.

Efficiency, quality and accessibility implications

Prospective systems may stimulate providers' cost-conciousness, but this may come at the price of deteriorating quality or accessibility of healthcare services [5–9]. Since cost-based, retrospective financing systems automatically reimburse all costs/all services, providers are not encouraged to restrict their level of services: each service that is expected to generate some (even minor) benefits in some patients may be provided; for example, if 3D-treatment planning or magnetic resonance imaging (MRI) costs would be automatically reimbursed for any radiotherapy patient, the radiotherapist would not experience any financial pressure to judge whether each patient needs such sophisticated planning or imaging; oncologists would be encouraged to prescribe a new cytostatic to all eligible patients, even if the tumour shows partial response only in some patients.

At the other extreme, if the radiotherapy department has to be run from a prospective global budget (i.e. a fixed annual sum of money), providers will be encouraged to think more carefully about how to spend the budget. As the total budget is smaller, stricter treatment priorities will have to be determined; for example, the department may decide not to install 3D-planning or a multileaf collimator, or to choose carefully which patients should undergo computed tomography (CT) or MRI instead of traditional imaging techniques, or to limit the indications for which fixation techniques or shielding blocks will be used. Furthermore, providers may have an incentive to select patients for financial reasons, such as to refuse admission to patients who are expected to generate high costs, a problem referred to as 'adverse selection' by economists, which would erode the accessibility of healthcare.

The above typology only identifies the efficiency, quality and access implications of the extreme cases of financing systems. How strongly each of these implications occur in practice will depend on the practical arrangements of the financing system. For instance, a prospective system supplying generous budgets is not likely to erode quality significantly, while—in principle—a retrospective system that is very reluctant to cover cost increases, will automatically encourage efficiency [10, 11].

Recent studies reveal a shift towards prospective financing systems in many industrialised countries [12, 13]. With respect to cancer care, an empirical survey on the reimbursement systems applied in radiotherapy in the different countries of the European Union [14] revealed that both types of systems are in use in many countries. Eight of the 11 countries providing radiotherapy (Luxembourg does not have radiotherapy facilities) apply some form of prospective (budget) financing system, although in some countries only for public hospitals. In most of these countries, a global budget is allocated to the hospital, and it is decided within the hospital how much of these resources flow to the radiotherapy department. Furthermore, 7 of the 11 countries apply some form of retrospective (fee-for-service) system, and that is more prevalent in private than in public practice.

Impact on innovations in healthcare

The rate and nature of technological innovations in healthcare are obviously determined by many factors, such as the state of scientific knowledge or funding for basic research, but one factor, the healthcare financing system, has so far often been ignored. Cost-based reimbursement systems are more conducive to the rapid adoption and diffusion of quality-improving innovations (often new "products"), irrespective of their costs, while prospective reimbursement systems typically favour the introduction of cost-reducing technologies (often new "processes"), provided they do not hamper quality excessively [1, 15, 16].

Under cost-based reimbursement, providers are stimulated to adopt new technologies as long as these are expected to improve the health status of the patient (in economic terms, as long as their expected marginal revenue is non-negative), irrespective of their (marginal) costs, because the costs are reimbursed anyway. Under prospective reimbursement, providers are more likely to weigh the expected marginal benefits against the marginal costs before deciding to adopt a certain technology. They would only be inclined to implement the (higher cost) treatment if sufficient (i.e. high enough) benefit can be demonstrated, or put differently, if the additional costs are outweighed by additional benefits (i.e. improved treatment outcomes). As improved outcome in cancer care very often requires years before being proven, this could create significant difficulties in implementing such financing modalities.

Under prospective, financing systems, cost-reducing technological innovations (i.e. with lower marginal costs) are most likely to gain rapid adoption, as long as they do not significantly erode the quality of care (i.e. perceived marginal benefits do not decrease too much). Those quality aspects that are difficult (costly) to evaluate by patients or their representatives (e.g. technical skills of the surgeon or radiation physicist, treatment precision of the radiotherapist, cytostatics and anti-emetics "know-how" of the oncologist) are more likely to suffer than those quality items that can be evaluated easily and accurately (e.g. physical accessibility of the oncology day clinic, waiting times in the radiotherapy department, hospital meals). This problem will even be aggravated to the extent that the difficult-to-evaluate quality items often have a crucial impact on the final patient outcome (rate of cure), while the impact of the easy-to-evaluate items on outcome may be much less significant, or even negligible [17], since they affect more patient comfort and satisfaction than treatment result. Obviously, providers cannot afford to diminish quality too much, and they are being restricted by healthcare legislation, ethical codes, the threat of malpractice suits, the threat of losing patients to rivals, etc.

For instance, it is quite likely that the positron emission tomography (PET)-technology would have been developed and diffused more rapidly had it been introduced in a period of mainly cost-based reimbursement, where proof of medical effectiveness (e.g. for oncology: more correct tumour staging and hence better fine tuning of treatment to tumour stage, more precise judgment of tumour response to treatment) would have been sufficient for providers to adopt the technology, irrespective of its costs. The diffusion of paclitaxel might have been more rapid in an era of cost-based reimbursement, where it was sufficient to know that paclitaxel treatment may produce some

benefit for some cancer patients. The same may hold for radiation treatment with heavy particles, such as proton, BNCT (boron neutron capture therapy) and light ion therapy.

Similarly, if manufacturers of healthcare (related) products expect prospective reimbursement to prevail in the future, their research and development efforts may be more directed towards cost-reducing (and perhaps quality-decreasing), than towards quality-improving (and often cost-increasing) technologies because the former have a much larger chance of being adopted on a wide scale. Prospective financing provides strong encouragement for manufacturers of healthcare technologies (drugs, devices, equipment) to search for cost-reducing innovations. To the extent that these technologies are simultaneously quality-augmenting (or at least not deteriorating), this is beneficial for society. However, the evolution towards prospective financing may also require downgrading of our expectations regarding potential future improvements in cancer care and cure. If healthcare providers working under tight budget constraints are (financially) unable to adopt more expensive new technologies, the manufacturers will no longer be stimulated to develop quality-improving technologies, if these are cost-increasing. They will mainly be stimulated to develop cost-reducing technologies, which may be accompanied by a deterioration in the quality, or accessibility, of medical care.

Limited research funding

Additionally, the diffusion of all new medical technologies may be slowed, since it will become increasingly difficult to fund the research on comparative efficacy of new technologies (phase III trials) under prospective reimbursement. In Europe, most clinical research is carried out within the healthcare system, only the marginal cost is supported through research money. Hence, research is funded only partially through designated budgets; the remaining part weighs—implicitly—on the clinical budget (e.g. through higher nursing and physicians workloads for trial patients) [18, 19]. Under prospective reimbursement, the opportunities to fund this clinical research may become much more limited, thereby slowing the overall pace of technological innovations in medicine. Institutions performing clinical research will face increasingly difficult times to perform research, since insurers may be inclined to finance only the routine clinical activities.

STRATEGIES

With the evolution towards managed care and managed competition in many countries, healthcare insurers will try to select the lowest cost providers. Higher cost providers only have a serious chance of being selected, if they can prove they offer better quality and better outcomes. All of this requires that providers should start thinking much more seriously about documenting the consequences, the outcome of their medical—preventive, diagnostic or therapeutic—interventions. They need to be able to demonstrate that their higher volumes or more expensive services are worthwhile since they generate improved patient outcomes. Especially in cancer care, this poses a serious problem, since many of the relevant endpoints take a long time to unfold (e.g. disease-free survival, avoidance of late side effects) or may be difficult to quantify (e.g. the impact of palliative care). Hence, it takes a long time before the superiority of new treatments of higher quality can be demonstrated. For instance, improved patient outcomes (lower complication rates and higher cure rates) are expected from 3D-planning, multileaf collimators or other forms of conformal radiotherapy augmenting treatment precision, but it will take many years to demonstrate these benefits (e.g. avoided complications), especially as results of suboptimal treatment conditions are not monitored in any systematic way. Most registries do not have enough detailed information to carry out such assessments. Furthermore, questions have been raised about the ethical acceptability of demonstrating such improved outcomes through randomised prospective studies, since it requires denying part of the patients a treatment that is truly expected to be superior (and cannot be inferior) to the conventional treatment. Hence, providers have to start building up their armoury against healthcare financing institutions. If the evolution towards prospective financing proceeds, the only way to avoid serious budget cuts is by proving their quality, and by collecting information that proves the superior outcome of the selected treatment path, rather than cheaper options.

Although providers will increasingly be forced to demonstrate the superiority of new treatments and prove it fast, the resources to perform the necessary research will become more scarce than under retrospective financing systems. Providers will have to confront the trial sponsors with their deteriorating financial position, pointing out that if the sponsors are not willing to fund trial research more extensively, their new products and services may never make it to the market. If trial sponsoring is left only to the parties having a stake in the outcome, there will be a bias developing in the type of questions that can be tackled. This stresses the fact that healthcare structures have to provide adequate budgets for critical and independent research as a guarantee for balanced long-term development of the system.

International co-operation for the delivery of highly specialised, costly treatments, such as radiotherapy with heavy particles (i.e. one facility, treating patients from several countries) may be another way to decrease the costs of research, development and treatment for each country to an acceptable level, relative to the expected patient benefits. But such co-operation will require a new legislative approach, since traditionally healthcare delivery and insurance have been national, or even regional, issues [20].

Policy-makers should be made aware of the fact that their search for cost containment strategies in healthcare, for example through switching to prospective payments, may not only decrease the level of healthcare expenses—as intended, but may also reduce the accessibility of healthcare and erode its quality, especially in those aspects that are difficult to evaluate. Recent research suggests that healthcare reimbursement systems, consisting of a mixture of retrospective, cost-based elements and prospective aspects, may prove to be the most desirable arrangement, bringing the efficiency and quality and access issues in line with each other and safeguarding the possibilities of funding clinical R&D [6, 9, 21, 22]. A survey on radiotherapy reimbursement in Europe [14] showed that such mixed systems have not yet penetrated widely. The countries that apply both cost-based and prospective systems, often apply them for different types of providers (e.g. private versus public hospitals). Up to now, few countries (e.g. Belgium) apply a mixture of retrospective and prospective reimbursement for the same type of providers.

The modifications in healthcare financing systems may be an additional factor why initiating or imposing the implementation of quality assurance and promotion stategies in healthcare delivery, through medical audits and peer review, is becoming more urgent to protect the quality of our healthcare systems.

Finally, all of these observations should obviously not imply that the chosen level of quality and accessibility of healthcare

should not be organised as efficiently as possible. It is quite likely that there is still ample room for efficiency improvements in many healthcare systems, but across-the-board prospective financing is definitely not the only mechanism that should be used to realise these efficiency gains, and can only be implemented if, together with budget planning, carefully defined criteria for quality assurance, control and audit are integrated. Moreover, providing healthcare as efficiently as possible will yield the highest chances of being able to maintain high levels of healthcare delivery in the future.

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Acknowledgements—The critical comments from E. van der Schueren and the financial support from the Belgian Science Policy Office (PE/01/023) are gratefully acknowledged.