Cost escalation in health-care technology — possible solutions

G. G. JÁROS, D. A. BOONZAIER

Abstract **Solutions to cost escalation due to health-care technology are proposed. It is argued that proper systems analysis, technology assessment, and planning would result in net savings and improved cost-benefits. Identification of needs early in the technological life cycle can positively influence the final form of the chosen technology. A national centre for technology assessment is proposed. Arguments in favour of a local medical equipment manufacturing industry, emulating overseas examples, are advanced, appropriateness being the main criterion. Analysis of the cost breakdown of imported technology suggests ways of reducing costs considerably, while stimulating the local economy. Digital telecommunications technology and its application to rural health care is cited as an example of a potentially worthwhile investment in making overall coverage more equitable.**

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In a previous paper we identified and discussed the more compelling problems associated with the application of technology in health care.[1] We argued that the situation is serious indeed, and that if not addressed, could soon approach crisis level, bringing the entire health-care system to a standstill.

In this paper we highlight three possible approaches by means of which the situation could be resolved.

Systems analysis, technology assessment and planning

If the challenges of health maintenance are to be met, emerging technologies will have to be considered in the context of the total health-care system.[2] In the best traditions of systems analysis, all relevant aspects of a technology will have to be properly considered and placed in perspective. Such analysis demands that needs be comprehensively assessed in the area where the introduction of technology is contemplated. The development, implementation and management of technology need to be properly planned at an early stage.

It is the developers of health-care technology who should do this. Those scientists and engineers who have traditionally been responsible only for technological detail should widen their vision to include the issues highlighted in our previous paper; not only economic but ethical, legal and other social implications have to be addressed. It is no longer sufficient to demonstrate that a certain physical or engineering principle *can be* applied to biology or medicine and to develop an apparatus or technique that simply *works*. It is also no longer tenable to assess and evaluate a technology *after* it is marketed. This process should be completed *before* commercialisation. The Congressional Office for Technology Assessment and several other agencies in the USA have been collecting vast amounts of pertinents information on available technologies.[3] Although many of these data might not be entirely applicable in the South African situation, a great deal could nevertheless be useful under certain conditions. We do not take advantage of this and other sources of information in our health-care planning process.

It is of the utmost importance that formal, up-to-date procedures be used in equipment planning and management. In the USA a process for health-care technology assessment is provided by the Health Promotion and Disease Prevention Amendment of 1984. Federal funding has been authorised, on a matching basis, for a private sector consortium to serve as a clearing house in the development and evaluation of assessment criteria, to promote the continued use of existing cost-efficient medical technologies and to identify and eliminate obsolete and inappropriate technologies. An initial grant has been authorised to create a council on health-care technology for this very purpose. In South Africa a similar route should be followed.

Local solutions for local problems

A large percentage of medical equipment is imported and costs the country several hundred million rand in foreign exchange. In spite of rapidly escalating costs, in part due to the falling value of the rand, imported technology is in many cases not appropriate to local conditions, especially in the less developed areas. Both these problems, viz. expense and inappropriateness, could judiciously be addressed by identification of certain devices and providing incentives for local manufacture.

Locally produced equipment has not generally found favour with the medical profession. Since doctors tend to be conservative, they prefer technology that bears well-established trade names, and are not willing to take chances with unproven devices from unknown manufacturers. This is understandable, given the exacting requirements for clinical reliability and patient safety. Another oft-cited argument against local manufacture is the allegedly small South African market. This view can be countered in two ways: a population of 30 million people does not constitute a small market! Furthermore there are many more people with similar needs elsewhere in Africa and the rest of the developing world who could benefit from technologies produced in South Africa *for our particular situation.* Many smaller countries, such as Israel, Denmark and Hungary, have built up successful health-care technology industries and have in time become major exporters of medical devices. There is no reason why South Africa could not emulate them, since it possesses the necessary expertise and resources. What is needed are entrepreneurs who can appreciate and exploit the considerable opportunities in this market. The recent winding-down of the defence industry should be providing additional incentives.

Unfortunately, where technology is concerned South Africans seem to have an inferiority complex and assume that 'things made elsewhere are necessarily better'. This attitude must change. A proper feasibility study for the creation of a health-care technology indus-

Department of Biomedical Engineering, Groote Schuur Hospital and University of Cape Town
G. G. JÁROS, PR. ENG., M.SC. (ENG.), D.SC.
D. A. BOONZAIER, M.B. CH.B., D.I.C.

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try in South Africa would go a long way towards dispelling doubts and building entrepreneurial confidence.

Some of the arguments for the promotion of local manufacture are as follows: the main components of the cost of a new technology are: (*i*) research and development; (*ii*) safety and efficacy of testing procedures; (*iii*) manufacturing, including components, labour and overheads; (*iv*) distribution/marketing; and (*v*) provision of after-sales support/service facilities.

It is important to note that manufacturing costs are probably the lowest. In fact, we tend to object to the eventual high price of a technology on the basis of a false perception of production costs. Development cost vary greatly depending on the stage of maturity which a certain technology has reached. For example, it is fairly easy to add extra features to a defibrillator; the financial outlay is relatively low, as most of the basic clinical and technical problems have already been sorted out. On the other hand, it would cost considerably more to develop such a device from scratch.

Distribution and marketing costs usually double the base price determined by the first three components. The reasons for this high mark-up are complex, but are mainly the result of the essentially non-free (captive) market conditions that govern the sale of medical equipment, and the high training level and relatively large number of sales and support personnel.

Safety and efficacy testing costs are surprisingly high. Given that the well-being of the patient is the top priority, it must be proved that technology will function in a reliable and safe manner in a wide rang of clinical conditions, including unintentional misuse. In the USA, litigation in medical liability cases (not necessarily implying malpractice!) involving technology, had a domino effect: not only did it push up the price of exhaustive safety and efficacy testing procedures, but also forced manufacturers to cover themselves against future legal action by further increasing prices.

When medical equipment is imported, the 'buyer' must pay for all the above items including over-designed 'safety' measures prompted mainly by fear of litigation and, of course, overseas litigation costs themselves. In effect the local end-user is compelled to subsidise those costs dictated by the sophisticated and litigious health-care markets of the countries of origin. Payment must of course be made in foreign currency and in times of unfavourable exchange rates, this further exacerbates the situation. In an importing country the following additional overheads are incurred: (*i*) freight cost; (*ii*) import duties, surcharges and taxes; and (*iii*) cost of supply of infrastructure, support, consultancy, etc. — often provided by manufacturers overseas at no additional cost.

Purchasing and freight costs must obviously be settled in foreign currency, but since the cost of setting up comprehensive local infrastructure is generally prohibitive, high-level repair and maintenance are frequently also done overseas with consequent further exchange losses.

Naturally, these costs are eventually passed on to the patient, who seems prepared to 'buy health' irrespective of cost. Patients are clearly not free to 'shop around' in acute situations and are not in any case purchasers in the usual sense of the world.

In short, most health-care technology, both capital and otherwise, is imported from overseas, costing the country many hundreds of millions of rand in foreign exchange. This cost could be cut considerably by the judicious encouragement of local manufacture; this would provide jobs and also stimulate the economy. It must be stressed, however, that it is neither possible nor sensible to attempt to make South Africa completely independent of foreign imports in the health-care field, especially in the area of capital-intensive, specialist, low-volume items.

Nevertheless, it is worth keeping in mind that large X-ray, magnetic resonance imaging (MRI) and computed tomography (CT) machines have all been manufactured in comparatively small countries, such as Israel and Hungary, and very successfully marketed worldwide.

Apart from costs, the main benefit of local manufacture is the production of technologies that best match local needs and capabilities. This is especially important in the rural and peri-urban areas — particularly in the fields of preventive/promotive medicine and rehabilitation, where needs remain relatively unmet. A conscious effort should be made to channel technology effectively into these areas. 'Effective' technology is not necessarily 'high-tech' or 'cutting-edge', but certain emerging microcomputer-based technologies show great promise of being cost-effectively deployable in primary health-care setttings.

Rehabilitation is an area where technology can play a pivotal role. In general, one can regard technology 'as a means to extend human capabilities'. In the disabled, some of these capabilities are below the norms expected of a healthy person and the complementing of residual abilities by carefully matched technology can have a profound impact on quality of life, independence and employment. Apart from the solving of mobility problems, the greatest contribution to date has been enhancement of abilities of speech-, hearing- and writing-disabled people by electronics — especially microprocessors and computers. For example, totally paralysed, non-speaking people can already communicate freely with others, write, and control their home environments. There are indications that within the next 10 years, simple but unaided gait could be achieved in paraplegia by functional electrical stimulation. One can foresee ever more cost-effective devices that make use of these technologies in future, and promote greater independence and enhanced quality of life for disabled and aged members of the community.

Digital telecommunications

During the last 30 years electronics has developed at an unprecedented rate. In 1950 the only means of electronic amplification, the vacuum tube, performed a single function at a unit cost of about R6. Since then we have witnessed the emergence of transistors and integrated circuits of ever-increasing complexity. To date, a density of 100 000 functions per chip has been achieved at a cost of a fraction of a cent per function and we can expect millions of functions per chip at even lower unit prices in the near future.

Micro-electronic technology promises the greatest advances throughout the full spectrum of health care. In the image processing and transmission field the implications of micro-electronics are tremendous. To transmit the information contained in a chest radiograph (36 × 43 cm) from coast to coast in the USA at present takes a few minutes by telephone when fax technology is used. This will soon be reduced to a fraction of a second via the use of coaxial cables, satellites and fibre optics for digital transmission. Storage and retrieval can be done on a high-density optical laser disc at a cost of less than R1 per image. CT, MRI and other sophisticated devices are bound to benefit from these and other developments and cost per investigation should be considerably reduced. There are many clinical areas where commensurate benefits can be expected and these areas should be identified soon and actively addressed in the context of our specific needs and resources.

At the other end of the health-care delivery scale, technology could play a fundamental role in supporting the provision of adequate care in the primary areas of prevention and rehabilitation. There have been complaints about the shortage of doctors in rural areas everywhere. Russia and India have responded to the problem by introducing the *feldscher* and 'barefoot doctor', respectively. In South Africa this option has been resisted for a long time because of fears that the high standard of medicine will be threatened by 'third-rate' doctors. It is certain that we will not be able to persuade doctors to move to the rural areas. The allure of city life is just too great, even for those who originally came from the countryside. Technology provides a means to extend capabilities and make medical services more equitable by overcoming challenges of geographic distribution. The health problems of the Third World can be solved in part by technologies specially created to address them and developed in that context.

As an example, let us look at the concept of a computerised mobile health-care clinic for rural areas. Beyond obvious diagnostic-therapeutic benefits, such a unit would have the parallel purpose of gathering up-to-date health-care information for planning, together with efficient patient records and follow-up systems. In addition, it could offer a computer-aided diagnosis system to assist the community nurse. This would have obvious positive educational spin-offs. The most important part of mobile clinic's technology would clearly be the special-purpose computer hardware and software, which would need to be resilient, reliable and portable. With the aid of such equipment, a trained nurse could supervise accurate collection and analysis of clinical information. An 'expert system' included in the computer could help the nurse to screen for unusual or complex diseases. Certain on-line inputs, such as temperature, ECG, blood pressure and lung function data could be recorded directly by the system. At the local community hospital batch-recorded data and automated diagnostic 'suggestions' could be verified by a medical doctor or modified accordingly. Patients so identified who require special treatment could be brought in and channelled to secondary hospitals. There could be a computer network with more distant specialised hospitals and this would provide access to still higher-level professional expertise. Updated health review information could also be transmitted regularly to facilitate optimal planning and resource allocation.

The computer and networking technology necessary to perform the above functions is at present available in this country and is becoming ever cheaper and more accessible. The expertise to develop the equipment needed for direct data collection and to write the necessary software for analysis exists, and communication networks (SAPONET and DIGINET) are suitable for transmitting information between local centres and large hospitals.

These ideas and others that make the benefits of new technology more equitable should be given serious consideration. Grand plans are difficult to put into practice and cannot be achieved overnight, but if such a system is to be implemented within the next 10 years, feasibility studies should be undertaken without delay.

Conclusions

Health-care technology is becoming of increasing concern to all of us. This concern exists not because of the technology itself, but arises from the haphazard and sporadic way it has been applied in health care. Through proper planning and consideration of non-monetary factors, technology could be better deployed and perceived as a useful ally by the medical profession. Local solutions to local problems must be sought, especially with regard to the application of newer microelectronic and digital telecommunication technologies, which are rapidly advancing and becoming cheaper. Planners must be encouraged by both medical and non-medical disciplines to work towards optimal health care for the whole country, using technological tools where and when appropriate.

The new VITALINK programme of the South African Research Council, which is a collaborative programme for the advancement of health care through technology, is certainly a step in the right direction. It aims to bring together all the role players in South African health-care technology in order to launch a concerted attack on the rising costs and inappropriateness we are witnessing today.

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