



PII: S0959-8049(99)00290-7

European Journal of Cancer
**Millennium
Review
2000**

Developing a Global Strategy for Cancer★

K. Sikora

World Health Organisation Cancer Programme, International Agency for Research on Cancer, 150, cours
Albert Thomas, 69372 Lyon, Cedex 08, France



Karol Sikora is Chief of the World Health Organisation Cancer Programme, based in Lyon, France and Professor of International Cancer Medicine at Imperial College School of Medicine, Hammersmith Hospital, London. For 12 years he was Clinical Director of cancer services at the Hammersmith Hospital and Honorary Director of the Imperial Cancer Research Fund (ICRF) Molecular Oncology Unit.

Over the next 25 years there will be a dramatic increase in the number of people developing cancer. Globally, 10 million new cancer patients are diagnosed each year and this will be 20 million by the year 2020. Cancer is now the public's most feared disease. Billions of dollars are spent annually on cancer research by the drug industry, cancer charities and governments, but a cure for cancer appears elusive. And yet, we are in the midst of a revolution in our ability to image parts of the body, painlessly and in fine detail. We also now understand the intricate workings of the human genome—ultimately responsible for controlling all biological processes in health and disease. By the year 2003 the entire DNA sequence of the human genome will be determined. Powerful computer networks will allow detailed comparisons of genetic structure, so identifying new risk factors. Gene chips will detect minute code changes of considerable relevance. Novel screening technologies will allow us to detect just a few cancer cells in a patient. Robotically guided destructive processes will target abnormal cells in patients long before any cancer-related symptoms develop. And all this is likely by the first quarter of the next century. How are people, society and healthcare systems going to deal with these tremendous technological advances for cancer? Detailed information will be available in every home through easily understandable computer links. Choices now made by professionals will be equally understandable to all. Public education on health will be strengthened allowing a more critical and realistic assessment of media reports on new technologies. But as technology becomes more complex, the gap between the global rich and poor could widen. The export of unhealthy lifestyles—cigarette smoking, dietary habits and sedentary occupations will disproportionately increase cancer in many developing countries, which can least afford the treatment costs. The WHO Cancer Programme is developing a strategy to identify priorities in cancer prevention, detection and treatment in a wide range of epidemiological and economic settings. © 1999 Elsevier Science Ltd. All rights reserved.

Key words: cancer-prevention, treatment, care, health economics, epidemiology

Eur J Cancer, Vol. 35, No. 14, pp. 1870–1877, 1999

*Reprinted from *Eur J Cancer* 1999, 35(1), 24–31. Please use this reference when citing this article.

E-mail: sikora@iarc.fr

Received 14 Oct. 1998; accepted 16 Oct. 1998.

INTRODUCTION

THE GLOBAL incidence of cancer is soaring due to rapidly aging populations in most countries. By the year 2020, there will be 20 million new cancer patients each year. 70% of them will live in countries that between them will have less than 5% of the resources for cancer control (Table 1). We have seen an explosion in our understanding of the disease at a molecular level and are now poised to see some very significant advances in prevention, screening and treatment.

Dramatic technological change is likely in surgery, radiotherapy and chemotherapy leading to increased cure rates, but at a price [1]. The completion of the human genome project will almost certainly bring sophisticated genetic risk assessment methods requiring careful integration into existing screening programmes [2]. Preventive strategies could considerably reduce the global disease burden at low cost. And palliative care to relieve pain and suffering should be a basic right of all cancer patients. The next 25 years will be a time of unprecedented change in the way in which we will control cancer. However, the optimal organisation of prevention and detection programmes as well as treatment services are universal problems in all economic environments.

The world is in a health transition. Infection as a major cause of suffering and death is giving way to new epidemics of non-communicable disorders such as cardiovascular disease, diabetes and cancer [3]. Different countries are in different stages of this transition depending on their age structure and economy. Some countries are faced with a double burden with increasing infection problems compounded by surging cancer rates. This is fuelled in part by the globalisation of unhealthy lifestyles [4]. The WHO is responding to these new challenges by giving greater priority to the control of non-communicable diseases including cancer [5].

The original WHO Cancer Unit started in Geneva in 1961. Over the last decade it concentrated mainly on the provision of palliative care facilities and training, becoming the Cancer and Palliative Care Unit. The Cancer Programme is now housed in the International Agency for Research on Cancer in Lyon, France. This research institute is funded by 18 countries to carry out research into the epidemiology and causes of cancer. The mission of the current Cancer Programme is to reduce the incidence, morbidity and mortality of cancer in each of the 191 countries belonging to the United Nations.

WEALTH AND HEALTH

Cancer is often thought to be the problem of rich countries. The 1998 WHO World Health Report [3] life expectancy data in 1997 and World Bank data on per capita gross national product expressed in US dollars (pcGNP\$) was obtained for 155 countries. We used *Cancer in Five Continents* [6] and the electronic database for cancer to collect incidence

Table 1. The global cancer burden	
●	Current population 6bn 10 m new cancer cases—6 m deaths 50% in developing countries with 5% resources
●	2020—population 8bn 20 m new cancer cases—12 m deaths 70% in developing countries



Figure 1. Longevity and wealth in 155 countries. pcGNP, per capita gross national product.

figures for 1990 and those predicted for 2020 [7]. Incidence for men and women were analysed separately. The ratio of cancer incidence per 100 000 population in 2020 to 1990 was compared and correlated to wealth.

Longevity and wealth

Figure 1 examines the relationship between life expectancy at birth for both men and women and wealth of the 155 countries studied. There is a clear relationship between increasing GNP and longer life. There are relatively large gains for small increases in pcGNP\$ in the poorer countries, reflecting reduced infant and childhood mortality. Above a pcGNP\$ of 1000, the proportional gain in longevity is markedly reduced. This almost certainly reflects the importance of basic measures such as vaccination, good water supply, improved health education and access to simple medical care. After this longevity continues to increase with wealth but increasingly slowly reflecting the biological determinants that cause disease and death in all human populations.

There are two interesting clusters (Table 2). The first are those countries where longevity is significantly less than expected for their relative wealth with a pcGNP\$ of above 2000 but a longevity of less than 60 years. These are three African countries—Namibia, Botswana and Gabon. The high level of HIV-related disease is the responsible factor [3]. The second cluster are those states with a higher than expected longevity of greater than 65 years but a pcGNP\$ of below 1000. These 20 countries are listed in Table 2. Common factors are efficient public health systems, low infant and childhood mortality and an integrated primary care system. A further confounding factor are the relatively recent reductions in pcGNP\$ in these countries caused by external factors and political change. Clearly there is a long incubation period between the factors responsible for longevity and the outcome. Major changes over the last decade will have considerable impact over the next 25 years.

Table 2. Longevity and wealth	
Longevity lower than expected pcGNP\$ > 2000 Longevity < 60	Longevity higher than expected pcGNP\$ < 1000 Longevity > 65 years
Namibia, Botswana, Gabon	Egypt, Trinidad, Honduras, Nicaragua, Vietnam, Mongolia, Indonesia, China, Surinam, Kyrgistan, Sri Lanka, Tajikistan, Turkmenistan, Uzbekistan, Armenia, Georgia, Azerbaijan, Albania, Macedonia, Solomon Islands

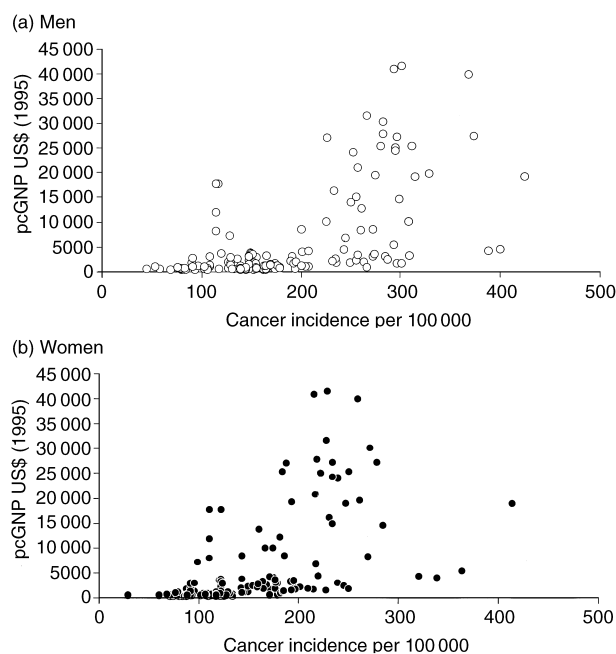


Figure 2. Cancer incidence in (a) men and (b) women related to wealth in 155 countries. pcGNP, per capita gross national product.

Wealth and cancer incidence

Figure 2 shows the relationship between wealth and cancer in men and women. There is a clear correlation between increasing wealth and cancer incidence. This is almost certainly due to the influence of tobacco and dietary factors as well as other more complex lifestyle factors together with increased longevity of the population. Exceptions include a cluster with a pcGNP\$ of greater than 5000 and a cancer incidence of less than 150 per 100 000. These are all Arabian Gulf states (Table 3). This almost certainly reflects the benefit of the traditional lifestyle maintained by the majority of the population. The second cluster are the former socialist countries of Europe, certain former Soviet republics and South Africa where the cancer incidence exceeds 250 per 100 000 but the pcGNP\$ is less than 5000. This reflects increased longevity due to good public health and efficient healthcare systems, a Western lifestyle and again a reduction in real pcGNP\$ due to political factors.

Wealth and the change in cancer incidence over the next 20 years

Figure 3 shows the ratios of cancer incidence in 2020:1990 for both men and women correlated to relative wealth. The largest changes in incidence are clearly predicted for poorer countries with a good correlation between poverty and greatly

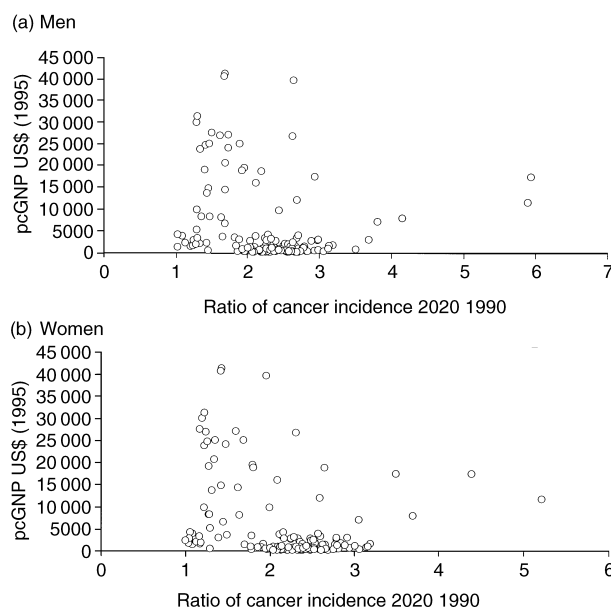


Figure 3. Change in cancer incidence in (a) men and (b) women by 2020 related to wealth in 155 countries. pcGNP, per capita gross national product [3, 7].



Figure 4. Over-stretched facilities—a ward at the National Cancer Centre in Colombo, Sri Lanka.

Table 3. Cancer incidence and wealth

Lower incidence than expected pcGNP\$ > 5000 Incidence < 150 per 100 000	Higher incidence than expected pcGNP\$ < 5000 Incidence > 250 per 100 000
Kuwait, Qatar, Saudi Arabia, Bahrain, UAE	Bulgaria, Czech Republic, Hungary, Poland, Romania, Russian Federation, Kazakstan, Belarus, Slovakia, Ukraine, Estonia, Croatia, South Africa, Albania

increased incidence. Countries with the greatest increase will have the least facilities to deal with the healthcare problems posed by the disease (Figure 4). In many parts of the world patients usually present with late stage disease not amenable to simple surgery (Figure 5).

The challenge of cancer

Cancer care, like airline travel, petrochemicals and telecommunications, has become a truly international endeavour. It is costly—often way beyond the purchasing power of many countries whose people earn low incomes. There are many misconceptions of the relative effectiveness of many interventions. Increasingly sophisticated techniques are becoming available to measure the relative benefits of different approaches. We now have many currencies of suffering; person years of life lost—PYLL; quality adjusted life years—QALY and disability adjusted life years—DALY all with their protagonists and innate value judgements [8]. All approaches demonstrate that cancer will continue to become an increasingly important component in the global burden of disease as we enter the next millennium.

Our track record in the control of infectious diseases is impressive. The eradication of smallpox and the rapid decline in poliomyelitis are public health triumphs of our times on par with John Snow's removal of the Broad Street pump handle in 1854*. Better sanitation, education and the expanded programme of immunisation, which now reaches 80% of the world's children, have had a great impact on global health [9]. We even seem able to meet new infectious challenges as diverse as AIDS and Ebola fever. Cancer cannot be contained or eradicated in the same way. Indeed our success in other areas of public health has led to increased longevity and thus, cancer's soaring global incidence.

Tobacco

Optimal use of current knowledge could reduce the overall cancer incidence by at least 3 million. Tobacco control is the most urgent need. We need to look for long-term solutions here. The politics of tobacco is a complex conspiratorial web of industrialists, farmers, manufacturers, politicians and the

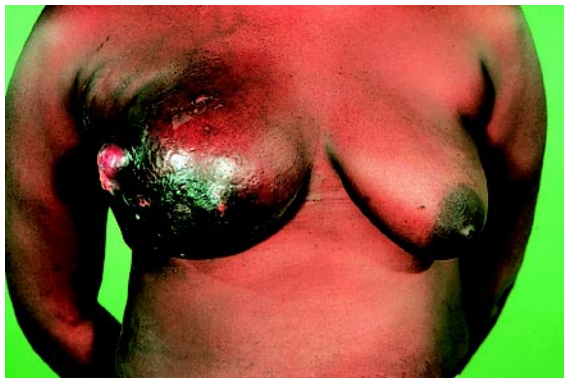


Figure 5. A woman presenting with advanced breast cancer in Lagos, Nigeria.

*In 1854, Dr John Snow, by mapping the location of deaths from cholera, suspected that the source of cholera outbreaks in London was one contaminated water pump at the intersection of Broad Street and Cambridge Street. By removing the handle to the pump, he ended the cholera epidemic in London. He was the first person to demonstrate that cholera was a water-borne disease.

pensions business all looking after their own interests [10]. Reduce cigarette consumption in many countries and the economy simply collapses. Governments are naturally cautious. In democracies they are subject to intense lobbying. In less democratic societies corruption, using the massive profits generated by the industry, usually achieves the desired endpoint. Advertising blatantly exploits the young of the developing world, associating images of sex, success and wealth with cigarettes as a lifestyle marker. The solutions are complex and require considerable political will. But with forceful and concerted international action against cigarette promotion, we could reduce cancer incidence by 20% by the year 2020.

Diet

Dietary modification could result in a further 30% reduction across the board [11]. The problem is refining the educational message and getting it right in different communities. Changing our current high fat, low fibre diet with a low fruit and vegetable intake are common themes for cancer prevention. But many features of the modern Western diet are now being adapted globally as branded fast food makers seek out new markets. Again, political will is necessary to reduce the costs to the public of healthy foods. We need to get more data so that we can make firmer recommendations. The European Prospective Investigation into Cancer and nutrition (EPIC) study currently in progress is a good example where painstaking data and serum collection on 400 000 Europeans could, over the years, provide a vast resource for investigating prospectively the complex inter-relationships between diet and cancer [12]. Cancer incidence varies enormously across Europe providing an excellent natural laboratory for such studies. Interventional epidemiology using rigorously controlled studies could produce the evidence that could lead to major changes. The current problem is the difficulty in making dietary advice specific and in some countries affordable. Although several groups have produced guidelines, there are so far few data about their uptake or significance in large populations. Table 4 provides a summary of the main consensus from several sources. Clearly more refined messages are going to be necessary if dietary interventions are really going to make a dent on cancer statistics.

Infection

Infection causes around 15% of cancer worldwide and is potentially preventable (Table 5). This proportion is greater in the developing world where an estimated 22% of cancer has an infectious cause [13]. Hepatitis B immunisation in children has significantly reduced the incidence of infection in China, Korea and West Africa. Shortly we will see if it has reduced the incidence of hepatoma, which begins in endemic regions by the third decade of life. The unconfirmed trends are already encouraging [14]. Cancer of the cervix, the commonest women's cancer in parts of India and Latin America, is clearly associated with certain subtypes of human papilloma virus. Vaccines are now becoming available and entering

Table 4. Common dietary guidelines for cancer prevention

- Avoid animal fat
- Increase fibre intake
- Reduce red meat intake
- Increase fresh fruit and vegetable intake
- Avoid obesity and stay fit

trial [15]. *Helicobacter pylori* is associated with stomach cancer. Here, without any intervention, there has been a remarkable downward trend in incidence worldwide. Dissecting out the complex factors involved including food storage, contamination, preparation and content is a considerable challenge. Other cancer causing infections are schistosomiasis, the liver fluke, the human T-cell leukaemia virus and the ubiquitous HIV. Although geographically localised, their prevention by lifestyle changes and vaccination programmes are realistic short-term goals. Clearly the effectiveness of any infection control or immunisation programme at reducing the cancer burden will depend on many factors and require careful research and field evaluation.

Targeting

The key to success in cancer prevention is careful targeting. Figure 6 shows estimates of the three main reversible cancer causing factors which between them are responsible for 7.5 out the 10.0 million new patients annually. Targeted prevention programmes are very cost effective and can be shared by different countries with similar cancer patterns. Countries with limited resources need not keep reinventing the wheel. Prevention packages can be tailored and adapted widely. To do this we need good data of incidence in relation to geography. Descriptive epidemiology provides a fertile hunting ground for patterns of carcinogenesis. Relating genetic changes in cancer to their cause and geography—the emerging discipline of molecular epidemiology—will complete the circle and point the way to specific interventions. The future of prevention will almost surely be about using such techniques to carefully target preventive strategies to those who would benefit most. In the post-genomic era it is likely that cancer prevention programmes, at least in developed countries, will be completely individualised—a combination of genetic, environmental and lifestyle data will be used to construct very specific personalised messages.

Detection

Screening in many countries is also an important tool. Careful targeting is required—breast cancer is simply not a major problem in many parts of the world. Again the cost of the technology required must match the gain. Low cost direct inspection techniques for oral and cervical cancer by health workers seem attractive to achieve tumour downstaging and, hence, better survival results [16,17]. Unfortunately, the evaluation of cervicospoty programmes in India and China have shown surprisingly poor results in terms of overall effectiveness [18]. It remains to be seen whether intravital staining using acetic acid can enhance specificity with little cost. A major cost in instituting any screening procedure is simply getting the message to the people and then developing the logistics, often under difficult conditions. Cultural barriers may be insurmountable without better education, espe-

cially of girls, who as mothers will become responsible for family health. Low technology tests have low specificity, so flooding already hard pressed secondary care facilities with patients with non life threatening abnormalities. Detailed field assessment, preferably in a randomised setting, is essential before firm recommendations can be made.

Treatment

Miracle machines and medicines for cancer help to fund research and fill newspaper columns but in reality usually make little impact. Dramatic changes have been seen in only a few cancers, but over the last 30 years there have been overall steady gains in the quality of care. Surgery has become more conservative due to technological improvements. Computers have made radiotherapy more precise with conformal therapy now routine for radical treatments. The role of chemotherapy has become more defined, its administration more pleasant and adapted to day-care settings.

From the laboratory, we have seen an explosion in our understanding of cancer at a molecular level. It is from a deeper understanding of growth factor binding, signal transduction, transcription and cell cycle control, apoptosis and angiogenesis that novel systemic therapies will almost certainly emerge. Over 2500 patients have already taken part in

Table 5. Infection and cancer	
HBV	Hepatoma
HPV	Cervix, anus
<i>Helicobacter pylori</i>	Stomach
EBV	Lymphoma, nasopharynx
HIV	Kaposi's sarcoma, lymphoma
Schistosomiasis	Bladder
Liver fluke	Cholangiocarcinoma

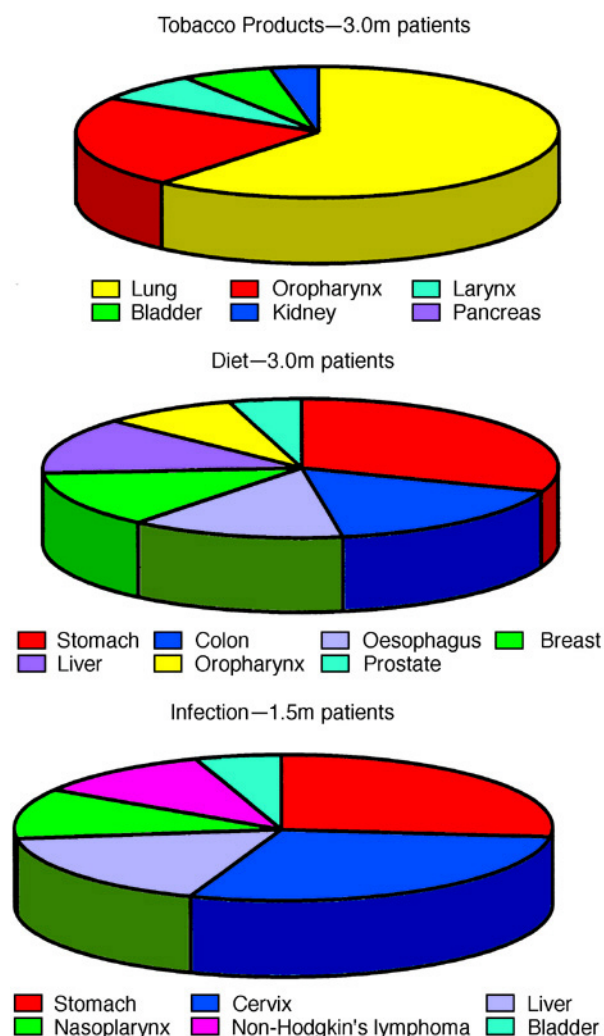


Figure 6. The major potentially reversible causes of cancer—tobacco, diet and infection.

clinical gene therapy studies. Here DNA is used as a therapeutic vehicle utilising a variety of strategies either to correct a molecular abnormality or to act as a Trojan Horse, tricking the cancer cell into producing a toxic drug from a harmless prodrug. The current trials have produced interesting results, but finding effective, systemic vectors which specifically target cancer cells is still the main stumbling block. Such research is costly and requires a huge support network of computer databases, expensive reagents and laboratory equipment well outside the purchasing ability of the developing world.

The treatments of the next century will be rationally designed, less toxic and more effective, but the costs of cancer care as practised in the established market economies even now far outstrip the resources of many countries. We have to look at ways to keep costs down and yet provide the best possible care. There is good evidence that patients with potentially curable cancers such as Hodgkin's Disease, childhood leukaemia, Burkitt's lymphoma and testicular cancer fare less well in poorer countries (Table 6). Getting good results here has to be the priority. Adjuvant therapy is of proven value in breast and colon cancer and yet rarely given in many parts of the world. Guidelines for referral, treatment and care are urgently needed. Effective facilities for the safe administration of radiotherapy and chemotherapy are essential everywhere.

Care

All cancer patients require good psychosocial and palliative care within the context of their own culture. Health professionals now convey far more information to patients about cancer. This needs to be backed up by careful counselling of patient and carers. Empowering all health professionals, carers and those administering health systems is an essential part. Complementary therapies can improve the quality of life and put patients back in control. Nurses here have made dramatic strides in tackling the complex interfaces of palliative care. This needs to be exported to areas where nurses are still regarded as doctors' handmaidens. Pain control is a vital part of cancer management and yet, there are still many places in which morphine is unavailable for legal reasons. Ironically these countries are often the main sources of illicit opium derived products. Education, information and political persuasion are the key to the future.

Organisation

The pattern of cancer is intriguingly diverse. New trends are emerging continuously as lifestyles merge in a shrinking

world. Computer-based communication of sound, images and perhaps even emotions will revolutionise the next century, breaking down national borders with cheap information transfer. However, less than one third of the world's population has ever used a telephone—a statistic that is set to change rapidly. This means that cancer information; some accurate, some promotional and some simply incorrect will be freely available even in the most remote areas. We need to harness this communication revolution to provide a global platform for cancer prevention and treatment. The emphasis will differ, taking account of epidemiological, economic, cultural and geographical factors. Most countries have established one or in some cases several national cancer centres. Such centres need to develop a more holistic approach, setting up networks not just of care, but also to grasp the responsibility for the bottom line in the war against the disease.

INTERNATIONAL INITIATIVES

Several groups and organisations are attempting to devise strategies to reduce the global burden of disease caused by cancer. The most established are the educational programmes and fellowships provided by the Union Internationale Contre le Cancer (UICC), the European School of Oncology (ESO) and the US National Cancer Institute. Newcomers include the International Network for Cancer Treatment and Research (INCTR) based at the Pasteur Institute, Brussels. This consortium will foster collaboration by developing and seeking funding for clinical and basic research programmes carried out jointly between the developed and the developing world. Another initiative is the International Committee for the Establishment and Development of Oncology Centres (ICEDOC). This is the first truly 'virtual' organisation, conducting its affairs through a very responsive website based in Port Said, Egypt. It aims to provide technical expertise across a range of cancer related issues. Charity funding abounds in cancer care and research but there are few effective international charities. A new London based charity, Global Cancer Concern, aims to ensure the wider availability of effective pain control drugs and improved training in palliative care by wide ranging educational initiatives.

The Executive Board and World Health Assembly of the WHO have agreed this year to give priority to the prevention and treatment of non communicable diseases. The WHO has a tremendous advantage in many parts of the world in that it is still respected for its expertise and ability to provide impartial advice. For cancer it is necessary to produce a strategy that provides the catalyst for change. The way forward is through the development of National Cancer Programmes which establish priorities for development in each country [19]. These take into account the epidemiology of cancer, educational standards, existing resources and the economic status of the healthcare system (Table 7).

Table 6. Outcome differences between developing and developed countries

	Prevention	Detection	Therapy
Large differences			Hodgkin's Disease Testis Leukaemia
		Breast Cervix Colon	
	Lung Liver Stomach		
Small differences			

Table 7. Features of a national cancer programme

Components	Factors
● Education	● Geography
● Prevention	● Epidemiology
● Detection	● Culture
● Treatment	● Education standard
● Palliation	● Existing facilities
	● Economy

THE WHO CANCER PRIORITY LADDER

A series of 18 pilot projects are being set up with Health Ministries around the world. The epidemiological and economic spectra of the pilot settings differs considerably. A consortium of international agencies, unilateral aid providers, educational organisations, professional bodies, charities and the healthcare industry is being put together. The aim is to offer a comprehensive programme of expertise channelled through the Health Departments, but with the full involvement of professionals already involved in cancer care. It is vital that this process encourages rather than stifles local enthusiasm and innovation.

The central plank of this initiative will be the WHO cancer priority ladder (Table 8). This provides internationally agreed priorities for developing effective cancer control. It needs to be carefully adapted to local circumstance. Tobacco control is a ubiquitous problem but the methods used to achieve long-term control will differ. Furthermore, careful political consideration across a range of government departments will be necessary, especially in those countries where tobacco is a major source of employment and taxation. Infection control is an achievable target but is geographically very specific. Hepatitis B, for example, is fortunately rare in many developing countries and so universal vaccination strategies to reduce the incidence of hepatoma would be inappropriate. Encouraging healthy eating and discouraging food manufacturing practices that increase fat and lower fibre content is a cheap intervention that will reduce the burden of cardiovascular disease as well as cancer.

A curable cancer programme is essential as a tool for political persuasion. By looking at cancer positively people can be convinced to take action. Many in the past have been critical of the large sums spent on cancer patients by tertiary care facilities in poorer countries. But the effective organisation of services into a hub and spoke model similar to that currently being enacted in the U.K. [20] could focus care where it can be most effective. Ensuring the availability of basic cancer surgery, radiotherapy and chemotherapy for potentially curable cancers provides the first step in setting up a comprehensive cancer service. Agreed referral and clinical care guidelines which can subsequently be audited are an essential component. Furthermore this provides a cadre of interested professionals who can be encouraged to take a more holistic view of the cancer problem in their country. This may be enhanced by visiting review programmes such as the WHO

Cancer Advisory Programme. This scheme, piloted in Morocco and Vietnam, provides site visits over three years by a group of experienced oncologists and epidemiologists. This allows leaders of the local oncology community to review in an informal setting their future plans as well as make personal international contacts. As well as reviewing cancer treatment capability such programmes encourage the local ownership of comprehensive cancer control from prevention through to palliative care by those involved in resource allocation. Cancer registries can cost less than £7000 (\$10 000) per year to run and can provide an excellent database for time trends and measuring the impact of specific initiatives.

These developments must also embrace the private sector. Increasingly the emergent middle class in poorer economies are turning to the private sector for healthcare. If specialist services are not available then there is no choice but to travel abroad, often at considerable expense especially when compared to average earnings in many countries. Encouraging private sector involvement locally not only makes economic sense for future consumers but also provides for a technological trickle down effect.

Developing programmes to ensure the earlier detection of cancer is also important. These range from educational initiatives through to formal population based screening strategies. In many economic environments mammography and cervical cytology may be inappropriate interventions because of their cost. However, there are several potential interventions that can result in tumour downstaging and these need to be prioritised.

Specialist nurse education is a further priority. A major problem is the considerable variation in level of education expected and achieved in many countries. Utilising all professional skills to their best advantage must take precedence over turf wars. The use of nurses in chemotherapy delivery areas and radiographers in the delivery of radiotherapy can be enhanced by introducing basic clinical decision-making skills following preset guidelines. Psychosocial and information needs are best handled by those working closely with the patient and their family. Developing the role of the nurse must be a high priority in most settings.

Evaluation, audit, education and clinical research are all inter-related. Good research can be done anywhere provided the problem addressed is carefully chosen. Unfortunately there is a great tendency for physicians in developing countries to wish to emulate colleagues in the developed world. In doing so, unrealistic high technology projects are attempted which are doomed unless part of a pre-agreed international programme. Realistic assessment of research strategies with proper peer review is essential.

Platform technology programmes are the beginning of international aid. Once a successful National Cancer Programme is established many of its features can be adapted to neighbouring countries with similar characteristics. The WHO will continue to encourage this type of development alongside traditional methods of aid.

CONCLUSION

In an ideal world, we could potentially prevent a quarter of all cancers simply by applying existing knowledge. A third are curable using today's technology and this can be confidently predicted to rise to one half over the next 25 years. However, the appropriate expertise has to be in the right place at the right time and widely accessible. For those that cannot be

Table 8. *The WHO cancer priority ladder*

- Tobacco control
- Infection control
- Curable cancer programme
- Early detection programme
- Effective pain control
- Sample cancer registry
- Healthy eating programme
- Referral guidelines
- Clinical care guidelines
- Nurse education
- National cancer network
- Clinical evaluation unit
- Platform technology focus for region
- Clinical research programme
- Basic research programme
- International aid programme

Table 9. Overall benefit by 2020

	Incidence	Mortality
Expected	20	12
● Prevention	5	3
● Detection	0	1
● Care	0	2
Achievable	15	6

cured effective palliation of symptoms, especially pain, should be a basic human right. By taking effective action now we could reduce cancer incidence from 20 million in 2020 to 15 million and the death toll from 10 million to 6 million (Table 9). An effective strategy, political will, skilled persuasion, good media relations as well as international professional and industrial collaboration will be vital to achieve this target.

1. Imperial Cancer Research Fund, *A Vision for Cancer*. London, 1995.
2. Holtzman NA, Shapiro D. Genetic testing and public policy. *Br Med J* 1998, **316**, 852–856.
3. *The World Health Report*. Geneva, World Health Organisation, 1998.
4. Murray CJ, Lopez AD. *The Global Burden of Disease*. Boston, Harvard University Press, 1996.
5. WHO Executive Board, EB 102, WHO, Geneva 1998.
6. Parkin D, Whelan S, Ferlay J, Raymond L, Young J. *Cancer in Five Continents Vol. VII*. Lyon, International Agency for Research on Cancer, Scientific Publications, 1997.
7. *Cancer in Five Continents. Electronic Database for Cancer*. Lyon, IARC/WHO, 1998.

8. Murray CJ, Lopez AD. Regional patterns of disability free life expectancy and disability adjusted life expectancy. *Lancet* 1997, **349**, 1347–1352.
9. *State of the World's Vaccines and Immunisation*. WHO, Geneva, 1996.
10. Taylor P. *Smoke Ring—The Politics of Tobacco*. Bodley Head, London, 1984.
11. Doll R, Peto R. *The Causes of Cancer*. Oxford, Oxford University Press, 1985.
12. Riboli E, Kaaks R. European Perspective investigation into cancer and nutrition. *Int J Epidemiol* 1997, **26**(Suppl. 1), 6–14.
13. Pisani P, Parkin DM, Munoz N, Ferlay J. Cancer and infection: estimates of the attributable fraction in 1990. *Cancer epidemiology, Biomarkers and Prevention* 1997, **6**, 387–400.
14. Chang-MH, Chen-CJ, Lai-MS et al. Universal hepatitis B vaccination in Taiwan and the incidence of hepatocellular carcinoma in children. Taiwan Childhood Hepatoma Study Group *N Engl J Med* 1997, **336**, 1855–1859.
15. Monsonego J, Franco E. *Cervical Cancer Control. General Statements and Guidelines*. Paris, EUROGIN, 1996.
16. Nene BM, Deshpande S, Jayant K, et al. Early detection of cervical cancer by visual inspection. *Int J Cancer* 1996, **68**, 770–773.
17. Sankaranarayanan R. Health care auxiliaries in the detection and prevention of oral cancer. *Oral Oncol* 1997, **33**, 149–154.
18. Sankaranarayanan R, Wesley R, Somanthan T, et al. Visual inspection of the uterine cervix after the application of acetic acid in the detection of cervical carcinoma and its precursors. *Cancer* 1998, **83**, 2150–2156.
19. *National Cancer Control Programmes. Policies and managerial guidelines*. World Health Organisation, Geneva, 1995.
20. *Recommendations for Commissioning Cancer Services; Report of the Expert Advisory Group on Cancer*. London, Department of Health, 1995.

Acknowledgements—I would like to thank P. Kleihues, V. Koroitichouk, A. Narinesingh, S. Robles and J. Stjernsward for helpful discussion and S. Sikora for extracting the datasets.