

National Cancer Control Programmes

Policies and managerial guidelines

2nd Edition



World Health Organization

NATIONAL
CANCER
CONTROL
PROGRAMMES

POLICIES AND MANAGERIAL GUIDELINES



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MESSAGE FROM THE DIRECTOR-GENERAL OF THE WORLD HEALTH ORGANIZATION

CANCER. The word still conjures up deep fears of a silent killer that creeps up on us without warning. Cancer, evoking such desperation that it has become a metaphor for grief and pain, a scourge straining our intellectual and emotional resources. The numbers are such that each of us will be touched either as a patient, a family member or a friend. There are over 20 million people living with cancer in the world today. The majority live in the developing world.

Yet, there is much that can be done in every country to prevent, cure and relieve this suffering. With the existing knowledge it is possible to prevent at least one-third of the 10 million cancer cases that occur annually throughout the world. Where sufficient resources are available, current knowledge also allows the early detection and effective treatment of a further one-third of those cases. Pain relief and palliative care can improve the quality of life of cancer patients and their families, even in very low resource settings thanks to effective, low-cost approaches.

Understanding and controlling malignant disease have very broad dimensions. It involves scientific knowledge and experience ranging from the complexities of intracellular molecular regulation to individual lifestyle choices. It also requires competent management and the best use of available resources for planning, implementing and evaluating disease control strategies. Cancer prevention and control are among the most important scientific and public health challenges of this era.

Our goal is to reduce the morbidity and mortality from cancer and improve the quality of life of cancer patients and their families, everywhere in the world where the cancer burden is high or there are rising trends of cancer risk factors. We have learned that no matter what resource constraints a country faces, a well-conceived, well-managed national cancer control programme is able to lower cancer incidence and improve the lives of people living with cancer. A comprehensive national cancer programme evaluates the various ways to control disease and implements those that are the most cost-effective and beneficial for the largest part of the population. It should promote the development of treatment guidelines, place emphasis on preventing cancers or detecting cases early so that they can be cured, and provide as much comfort as possible to patients with advanced disease.

We already know that at least one-third of all the new cases of cancer every year can be prevented. Tobacco, the single largest preventable cause of can-

cer in the world today, is responsible for about 30% of all cancer deaths in developed countries and a rapidly rising proportion in developing countries and in underprivileged communities. It is the only consumer product available which kills half its regular users.

In addition to strong, comprehensive tobacco control measures, dietary modification is another important approach to cancer control. Overweight and obesity are both serious risk factors for cancer. Diets high in fruits and vegetables may reduce the risk for several types of cancer, while high levels of preserved and red meat consumption are associated with increased cancer risk.

Our era has seen and continues to see great scientific advances in cancer treatment. Treatment for some cancer sites is becoming increasingly effective, yet poor availability of treatment and delays in seeking medical attention contribute to lower survival rates in many developing countries. Increasing awareness of the signs and symptoms of cancer is important to facilitate early detection of the disease. Where appropriate tests and facilities are available, screening of apparently healthy individuals can disclose cancer in early or precursor stages, where treatment may be most effective. But all too often, limited resources are used to treat patients with far-advanced disease, who really do not benefit from the treatment.

We have also learned important lessons in the field of palliative care. Millions of people around the world suffer not only from cancer, but from other chronic, life-threatening conditions in advanced stages. In these cases where prevention efforts have failed and patients and their families have little access to curative treatment, the devastation is great. These diseases affect people on all human dimensions: physical, psychological, social and spiritual. Solitude and stigma only add to physical suffering. Fortunately, there are low-cost, community approaches that can reduce this suffering and meet this urgent humanitarian need. Measures for good palliative care are essential elements in every national cancer control programme.

WHO's approach to noncommunicable disease prevention and control places emphasis on the rising impact of cancer in low-income and middle-income countries, and the disproportionate suffering it causes in poor and disadvantaged populations. Two years ago we reviewed the progress in implementing national cancer control programmes, as part of a strategy launched about a decade ago. Based on experience from Member States and our collaboration with other partners, we discussed the strengths and constraints of this strategy. While many Member States recognize the need to develop national cancer control programmes, few in the industrialized world and even fewer in developing countries have yet done so. As a result many people die from preventable cancers and suffer unnecessarily from pain and anguish at the end of their lives.

Lack of a comprehensive, systematic approach, weaknesses in organization and priority-setting, and inefficient use of resources are obstacles to effective programmes in both industrialized and developing countries. In far too many cases, primary prevention, early detection and palliative care are neglected in favor of treatment-oriented approaches, regardless of whether they are actually cost-effective or whether they improve patients' quality of life. This happens because of lack of knowledge, lack of political will and lack of national capacity in policy development and programme implementation.

I believe it is the responsibility of the World Health Organization to dig deep to find the best knowledge on cancer control and to facilitate the sharing of successful country experiences among governments and other partners. As the world's leading repository of public health knowledge, we are committed to translating this knowledge into action. But we must work with others – health is a shared responsibility.

We have initiated a process for promoting and reinforcing the development of national cancer control programmes as the best known strategy to address the cancer problem worldwide. Updating and disseminating effective policies and guidelines on national cancer control programmes and providing guidance on the development of these programmes are key components of this strategy.

This document presents WHO's latest recommendations and findings. This edition will provide an updated framework for policy development and programme management that can be adapted to socioeconomic and cultural contexts in all countries. It provides the information needed to guide the development of feasible, equitable, sustainable, and effective national cancer control programmes.

I know what we are seeking to do is not easy. But the constraints and difficulties are far outweighed by the opportunities to reduce the death and suffering caused by cancer. I hope this report makes a contribution to ending the isolation and desperation of cancer patients on the one hand and strengthening national options for comprehensive cancer control on the other. I believe we can act, and we must.

Gro Harlem Brundtland
Geneva
May 2002

PREFACE FROM THE SECRETARY GENERAL OF THE INTERNATIONAL UNION AGAINST CANCER

CANCER IS AND WILL BECOME an increasingly important factor in the global burden of disease in the decades to come. The estimated number of new cases each year is expected to rise from 10 million in 2000 to 15 million by 2020. Some 60% of all these new cases will occur in the less developed parts of the world.

Improved cancer control will, to a substantial degree, relate to prevention strategies and early detection programmes, including information campaigns and population-based screening programmes. Success of the early detection programmes will rely on effective and optimal use of treatment possibilities. In spite of the explosion in knowledge of tumour biology, another decade will probably elapse before its application through new drugs and treatment principles will significantly reduce cancer mortality. The aspects of cancer control must therefore be seen within the context of a systematic and comprehensive approach, that is, the cancer control plan or strategy.

Forces in the fight against cancer include the government sector, the nongovernmental sector, the private sector and the professional organizations. Their common objective is to reduce morbidity and mortality from cancer. Each sector plays an important role within a national cancer control programme/plan/strategy, though the relative extent of that role varies depending on the situation in the country.

The nongovernmental sector is involved in cancer research, cancer registration, cancer prevention activities, treatment and care facilities, and programmes. This involvement implies either direct provision of the services or acting as funding institutions. Again, the extent of the different activities will vary from country to country. In some countries, funds for treatment come from the national government and funds for disease prevention and screening come from the state government. In other countries, nongovernmental organizations focus on the prevention and early detection of cancer. It is very important for all organizations to be aware of the complexity of cancer control, and of the role they should play in achieving the goals of the cancer control programme or strategy, through a unified effort with other sectors.

The nongovernmental sector is an important source of technical know-how, skills and resources relevant for cancer care and research. Furthermore, nongovernmental organizations provide an important ability to reach out to the professional and public communities. Community participation in

cancer care is essential. This need is particularly acute in the developing countries, given the constrained resources and operational limitations of the government health care systems. Major portions of healthcare budgets in developing countries, which are largely insufficient to begin with, are dedicated to the control of communicable diseases, leaving small margins for allocation to noncommunicable disease control programmes. Nongovernmental and voluntary organizations can, therefore, play a significant role in assisting the efforts of the government health system in reducing disparities in coverage with regard to cancer care services.

In close collaboration with the World Health Organization, the International Union Against Cancer (UICC) promotes the participation of nongovernmental organizations in the development and implementation of national and regional cancer control strategies, and helps to build the capacity in these organizations in the areas of cancer prevention and early detection, particularly through educational and training programmes. By its participation in establishing a national cancer control strategy or plan, the nongovernmental sector will be able to better understand its own role in providing cancer care services, including support of cancer research. The comprehensive and systematic approach to the cancer problem, as presented in a national cancer control programme, gives all providers of cancer care and research the optimal possibility of giving the right focus and proportions to their own work.

The second edition of the WHO publication on national cancer control programmes is an important tool in promoting cancer control strategies. The different elements of a cancer plan are well described, and appropriate organizational aspects discussed. As was the case with the first edition, this publication will be of great value for the establishment and implementation of national cancer control plans.

Stener Kvinnsland
Oslo
May 2002

FOREWORD

THIS MONOGRAPH aims to provide a framework for the development of national cancer control programmes. Its underlying approach is the application of science to public health practice, providing a concise statement of what is feasible and desirable in cancer prevention and control, with the ultimate goal of reducing cancer morbidity and mortality, and improving quality of life in the targeted population. It is intended primarily for policy-makers in health and related fields, but will also be of interest to health ministries and academic institutions and, more generally, to oncologists and other health professionals who need to be aware of developments in cancer control.

The first edition of this monograph was produced following the meeting of a Working Group on National Cancer Control Programmes, 25–29 November 1991, at WHO headquarters in Geneva, Switzerland. The second edition of this monograph has been produced by the Cancer Control Programme of the Department of Management of Noncommunicable Diseases, WHO, following a meeting on national cancer control programmes in developing countries, held in Geneva in December 2000. Editorial guidance for both editions has been provided by Professor Anthony B. Miller. Dr Kenneth Stanley provided editorial assistance for the second edition. We would also like to acknowledge the seminal work of Dr Jan Stjernswärd, former Chief of the WHO Cancer Unit. While it is not possible to acknowledge all contributions of the countless individuals and organizations that gave so freely of their expertise, the participants at the major WHO meetings on the theme of this monograph are listed at the end of this report.

The timeliness of this updated publication is underlined by the fact that the World Health Organization has designated noncommunicable diseases, including cancer, as a priority area. Moreover, WHO Member States, in their work towards health for all, are continuing to formulate and implement national health strategies, of which plans for cancer control must form an increasingly important part. The WHO regional offices, and the WHO country representatives throughout the world, are providing valuable technical assistance for these initiatives.

In developing national cancer control programmes, it will be important for each country to create optimal conditions while undertaking a strategy development process for cancer control. These conditions include politi-

cal will and commitment, collaboration among key national organizations, participatory processes in programme planning, critical assessment of the scientific evidence and costs of proposed programmes, and an approach based on maximizing the desired outcome, principally reduction in mortality from cancer. WHO can play a facilitating role with member countries that decide to develop or revise a national cancer control programme, by collaborating with them to advocate cancer control as a priority public health issue, by providing technical assistance during the development and implementation of cancer control guidelines, interventions and strategies, and by assisting with evaluation of programmes.

While this monograph provides guidance about what elements should be taken into account in establishing and maintaining national cancer control programmes, we are conscious that it does not provide comprehensive operational models for how to implement these recommendations. Although many countries will be able to successfully adapt the present guidelines to their particular situations, others, especially those with complex realities and constrained resources, will need further guidance in applying effective, operational methodologies for assuring adequate and sustainable performance of national cancer control programmes.

Considering this, and the suggestions from experts involved in revising this monograph, efforts will be made in the near future to develop a complementary volume that will focus on the “how”, based on successful demonstration areas and specialized expertise. We are certain that such an initiative will be useful for those facing more challenging settings.

Cecilia Sepúlveda
Coordinator, Cancer Control Programme
World Health Organization
Geneva

EXECUTIVE SUMMARY

THIS MONOGRAPH outlines the scientific knowledge that is the basis for national cancer control programmes, and offers guidance on their establishment and organization. Much of its content derives from experience gained in the various countries that have already instituted or are planning their own national cancer control programmes.

Enough is now known about the causes of cancer and means of control for suitable interventions to have a significant impact. At least one-third of the 10 million new cases of cancer each year are preventable by such means as controlling tobacco and alcohol use, moderating diet, and immunizing against viral hepatitis B. Early detection, and therefore prompt treatment, of a further one-third of cases is possible where resources allow. Effective techniques are sufficiently well established to permit comprehensive palliative care for the remaining, more advanced, cases. The establishment of a national cancer control programme, tailored to the socioeconomic and cultural context, should allow countries to effectively and efficiently translate the present knowledge into action.

A national cancer control programme is a public health programme designed to reduce cancer incidence and mortality and improve quality of life of cancer patients, through the systematic and equitable implementation of evidence-based strategies for prevention, early detection, diagnosis, treatment, and palliation, making the best use of available resources.

The nature of cancer

The term cancer is used generically for more than 100 different diseases including malignant tumours of different sites (such as breast, cervix, prostate, stomach, colon/rectum, lung, mouth, leukaemia, sarcoma of bone, Hodgkin disease, and non-Hodgkin lymphoma). Common to all forms of the disease is the failure of the mechanisms that regulate normal cell growth, proliferation and cell death. Ultimately, there is progression of the resulting tumour from mild to severe abnormality, with invasion of neighbouring tissues and, eventually, spread to other areas of the body.

The disease arises principally as a consequence of exposure of individuals to carcinogenic (cancer-causing) agents in what they inhale, eat and drink, and are exposed to in their work or environment. Personal habits, such as tobacco use and dietary patterns, rather than inherited genetic factors, play

the major roles in the etiology of cancer, as may occupational exposure to carcinogens and biological factors such as viral hepatitis B infection and human papillomavirus infection. Knowledge of many of these factors can serve as the basis of cancer control. Vaccination against hepatitis B, for instance, can protect against liver cancer.

Cancer is profoundly associated with social and economic status. Cancer risk factors are highest in groups with the least education. In addition, patients in the lower social classes have consistently poorer survival rates than those in the higher social classes.

The burden of cancer

Of the 10 million new cancer cases each year, 4.7 million are in the more developed countries and nearly 5.5 million are in the less developed countries. Although the disease has often been regarded principally as a problem of the developed world, in fact, more than half of all cancers occur in the developing countries. In developed countries, cancer is the second most common cause of death, and epidemiological evidence points to the emergence of a similar trend in developing countries.

Cancer is currently the cause of 12% of all deaths worldwide. In approximately 20 years time, the number of cancer deaths annually will increase from about 6 million to 10 million. The principal factors contributing to this projected increase are the increasing proportion of elderly people in the world (in whom cancer occurs more frequently than in the young), an overall decrease in deaths from communicable diseases, the decline in some countries in mortality from cardiovascular diseases, and the rising incidence of certain forms of cancer, notably lung cancer resulting from tobacco use. Approximately 20 million people are alive with cancer at present; by 2020 there will probably be more than 30 million.

The impact of cancer is far greater than the number of cases alone would suggest. Regardless of prognosis, the initial diagnosis of cancer is still perceived by many patients as a life-threatening event, with over one-third of patients experiencing clinical range anxiety and depression. Cancer can be equally if not more distressing for the family, profoundly affecting both the family's daily functioning and economic situation. The economic shock often includes both the loss of income and the expenses associated with health care costs.

Prevention of cancer

Prevention means eliminating or minimizing exposure to the causes of cancer, and includes reducing individual susceptibility to the effects of such

causes. It is this approach that offers the greatest public health potential and the most cost-effective long-term cancer control.

The present and potential burden of tobacco-induced cancer is such that every country should give highest priority to tobacco control in its fight against cancer. Tobacco use in all forms is responsible for about 30% of all cancer deaths in developed countries, and this percentage is rising steadily in developing countries, particularly in women. The best approach to preventing tobacco-related cancer is preventing the uptake of tobacco. Tobacco dependence is listed in the WHO ICD-10 as a chronic condition. Tobacco is responsible for 80–90% of all lung cancer deaths, and probably some of the deaths from cancer of the oral cavity, larynx, oesophagus and stomach. In some Asian countries, oral cancer is a common tumour, and is associated with tobacco chewing habits. A comprehensive strategy involving legislative action to raise the tax on tobacco products and limit access and promotion, education of youth and adults to promote healthy life styles, and cessation programmes has a demonstrated ability to reduce tobacco consumption in many countries.

In recent years, substantial evidence has pointed to the link between overweight and obesity to many types of cancer such as oesophagus, colorectum, breast, endometrium and kidney. It is therefore strongly recommended to control weight and to avoid weight gain in adulthood by reducing caloric intake and by performing physical activity. The latter has also been seen to have a protective effect in reducing the risk of colorectal cancer. The composition of the diet is also important since fruit and vegetables might have a protective effect by decreasing the risk for some cancer types such as oral, oesophageal, gastric and colorectal cancer. High intake of preserved meat or red meat might be associated with increased risk of colorectal cancer. Another aspect of diet clearly related to cancer risk is the high consumption of alcoholic beverages, which convincingly increases the risk of cancer of the oral cavity, pharynx, larynx, oesophagus, liver and breast.

Thus, conducting a cancer prevention programme, within the context of an integrated noncommunicable disease prevention programme, is an effective national strategy. Tobacco use, alcohol, nutrition, physical inactivity, and obesity are risk factors common to other noncommunicable diseases, such as cardiovascular disease, diabetes, and respiratory diseases. Chronic disease prevention programmes can efficiently use the same surveillance and health promotion mechanisms.

Occupational and environmental exposure to a number of chemicals can cause cancer of a variety of sites; examples include lung cancer (asbestos), bladder cancer (aniline dyes), and leukaemia (benzene). A number of infections or infestations cause certain types of cancer: viral hepatitis B and C cause cancer of the liver, human papilloma virus infection causes cervical cancer,

the bacterium *Helicobacter pylori* increases the risk of stomach cancer, while in some countries the parasitic infection schistosomiasis increases the risk of bladder cancer, and in other countries liver fluke infection increases the risk of cholangiocarcinoma of the bile ducts. Exposure to ionizing radiation is also known to give rise to certain cancers, and excessive solar ultraviolet radiation increases the risk of all types of cancer of the skin.

National policies and programmes can be enacted to reduce exposure to these risks and implement preventive interventions. Care needs to be taken to ensure that the public has a clear understanding of these major risks and is not overwhelmed by the minor risks that are described in their local media on a virtually daily basis.

Early detection of cancer

Early detection comprises early diagnosis in symptomatic populations and screening in asymptomatic, but at risk, populations. Increasing awareness of the signs and symptoms of cancer contributes to detection of the disease in less advanced stages. Where tests for cancer of specific sites are available, and facilities are appropriate, screening of apparently healthy individuals can disclose cancer in early or precursor stages, when treatment may be most effective. Early detection is only successful when linked to effective treatment.

With early detection, there is a greater chance that curative treatment will be successful, particularly for cancers of the breast, cervix, mouth, larynx, colon and rectum, and skin. It is therefore critical that people are taught to recognize early warning signs of the disease, such as lumps, sores that fail to heal, abnormal bleeding, persistent indigestion, and chronic hoarseness, and urged to seek prompt medical attention. This can be promoted in all countries by public health education campaigns and through training of primary health care workers.

Population screening (mass application of simple tests to identify individuals with asymptomatic disease) is another approach to early detection. However, screening programmes should be undertaken only when their effectiveness has been demonstrated, when resources (personnel, equipment and so on) are sufficient to cover nearly all of the target group, when facilities exist for confirming diagnoses and for treatment and follow-up of those with abnormal results, and when prevalence of the disease is high enough to justify the effort and costs of screening. At present, in countries with high levels of resources, screening can be advocated only for cancer of the breast and cervix. Efforts should concentrate on women at greatest risk of developing invasive cancer: those aged 35 years and over for cervical cancer and those aged over 50 years for breast cancer. In developing countries, organized screening should only be considered for cervical cancer and should

focus primarily on providing a limited number of screenings with maximum population coverage, because the women at greatest risk for cervical cancer are in general the last to approach the health care services.

Diagnosis and treatment of cancer

Cancer diagnosis is the first step to cancer management. This calls for a combination of careful clinical assessment and diagnostic investigations including endoscopy, imaging, hystopathology, cytology and laboratory studies. Once a diagnosis is confirmed, it is necessary to ascertain cancer staging, where the main goals are to aid in the choice of therapy, prognostication, and to standardize the design of research treatment protocols.

The primary objectives of cancer treatment are cure, prolongation of life, and improvement of the quality of life. A national cancer control programme should therefore establish guidelines for integrating treatment resources with programmes for early detection, and provide therapeutic standards for the most important cancers in the country.

Care of cancer patients typically starts with recognition of an abnormality, followed by consultation at a health care facility with appropriate services for diagnosis and treatment. Treatment may involve surgery, radiation therapy, chemotherapy, hormonal therapy, or some combination of these. An initial priority, especially in developing countries, should be the development of national diagnostic and treatment guidelines to establish a minimum standard of care, and promote the rational use of existing resources and greater equity in access to treatment services.

Optimal treatment of people diagnosed with certain types of cancer detected early, for example, cancers of the uterine cervix and corpus, breast, testis, and melanoma, will result in 5-year survival rates of 75% or more. By contrast, survival rates in patients with cancer of the pancreas, liver, stomach, and lung are generally less than 15%. Some treatments require sophisticated technology that is available only in locations with substantial resources. Since the cost of establishing and maintaining such facilities is high, it is desirable that they should initially be concentrated in relatively few places in a country to avoid draining resources that could be devoted to other aspects of the national cancer control programme. Facilities can be expanded when additional resources are available.

Palliative care

Palliative care is an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identifica-

tion and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual.

Improved quality of life is of paramount importance to patients with cancer. Pain relief and palliative care must therefore be regarded as integral and essential elements of a national cancer control programme, whatever the possibilities of cure. Since these services can be provided relatively simply and inexpensively, they should be available in every country and should be given high priority, especially in developing countries where cure of the majority of cancer patients is likely to remain beyond reach for years to come.

Health workers and family care givers can be trained to deliver palliative care effectively. Primary health care settings can respond to the majority of patients' needs and, in many developing countries with poor infrastructure, home-based care will make an essential contribution to achieving the necessary coverage.

Effective guidelines for the relief of cancer pain and other symptoms have been developed by WHO. The WHO ladder for cancer pain relief is a key strategy for pain management that can relieve cancer pain for about 90% of patients. Analgesics are administered by mouth, using a three-step strategy of strengthening the analgesic when a lower level is insufficient to relieve pain, and medication is provided by the clock, rather than waiting for the effect of the previous dose to have fully worn off. The widespread availability of morphine for oral administration is critical to pain relief, and should be ensured by appropriate legislation and policy.

Managing national cancer control programmes

With careful planning and appropriate priorities, within the scope of prevention, early detection, treatment and palliation, the establishment of national cancer control programmes offers the most rational means of achieving a substantial degree of cancer control, even where resources are severely limited. It is for this reason that the establishment of a national cancer control programme is recommended wherever the burden of the disease is significant, there is a rising trend of cancer risk factors and there is a need to make the most efficient use of limited resources.

Effective and efficient cancer control programmes need competent management to identify priorities and resources (planning), and to organize and coordinate those resources to guarantee sustained progress to meet the planned objectives (implementation, monitoring and evaluation). Good management is essential to maintain momentum and introduce any necessary modifications. A quality management approach is essential to improving the performance of the programme. Such an approach has the following principles:

- *goal orientation* that continuously guides the processes towards improving the health and quality of life of the people covered by the programme.
- *focused on the needs of the people*, which implies focusing on the target population (customers) while addressing the needs of all stakeholders and ensuring their active involvement.
- *systematic decision making process*, based on evidence, social values, and efficient use of resources that benefits the majority of the target population.
- *systemic and comprehensive approach*, meaning that the programme is a comprehensive system with interrelated key components in the different levels of care sharing the same goal, integrated with other programmes and the health system and tailored to the social context, rather than a vertical programme operating in isolation.
- *leadership* that creates a clarity and unity of purpose, encourages team building, ample participation, ownership of the process, continuous learning, and mutual recognition of efforts made.
- *partnership*, enhancing effectiveness through mutually beneficial relationships, built on trust and complementary capacities, with partners from different disciplines and sectors.
- *continual improvement, innovation and creativity*, to maximize performance, and to address social and cultural diversity, and the new needs and challenges in a changing environment.

The motivation to initiate a national cancer control programme or improve the performance of an existing programme can come from different sectors within the country or can be a combined effort with international organizations. Governmental and nongovernmental leaders in the cancer field need to work closely together to develop a successful programme. With appropriate mobilization of all the stakeholders, it is possible to develop cancer control policies that are acceptable to the people for whom they are intended, affordable, integrated with other national health programmes, and linked effectively with sectors other than health that are relevant to cancer control.

Although it is clear that objectives and priorities need to be tailored to the specific country context, the planning processes to be undertaken in all countries should follow four basic steps: assessing the magnitude of the cancer problem, setting measurable control objectives, evaluating possible strategies for cancer prevention and control, and choosing priorities for initial cancer control activities. Assessing the magnitude of the cancer problem requires analysis of the cancer burden and risk factors, as well as capacity assessment (analysis of facilities, personnel, programmes and services). Once evidence-based strategies are identified there is the need to choose those that are feasible to implement and that are acceptable and relevant to the

society. It is useful to classify priority areas in two groups: activities that can be introduced or improved without the need for additional resources, and activities that will require extra resources.

The national cancer control programme policy should be formulated once the planning process has been completed. This will provide a solid platform for implementing and maintaining a national cancer control programme. A policy is the explicit commitment by government and its partners that provides objectives for a balanced cancer control programme, specifies the relative priority of each objective and indicates the resources and measures required to attain the objectives.

Good leadership of the programme is key to its competent management. The national programme coordinator should be able to work in a team and facilitate or reinforce the building of a network of local coordinators, backed by their own teams, who will take a leadership role in their areas or regions. It is essential to build effective teams, that are results oriented and committed to the project objectives, goals and strategies, as most of the managerial, clinical or community activities in a cancer control programme require teamwork

Processes should be managed to meet the requirements and needs of customers, providers and other stakeholders. Clear roles and responsibilities must be established for managing the process and the interrelations with other programmes must be identified. The processes must align with the national cancer control programme objectives and should include continual improvement of performance. Decisions and actions should be based on the analysis of data and information to improve results and not rely merely on opinions.

Some key processes to be considered in implementing a national cancer control programme are:

Demonstration area

It is often advisable to start small and consider that success breeds success. Efforts can concentrate in a demonstration area, which has a good likelihood of successfully implementing the priority areas.

Step by step implementation

Implementation of a national cancer control programme may proceed in a series of stages, each stage having clear measurable objectives and representing the basis for the development of the next stage, permitting visible and controlled progress. Every stage should involve decision-makers and operational staff from the different levels of care that need to actively participate.

Optimizing existing resources

It is essential that at a first stage the programme considers re-allocation of existing resources according to the new strategies, and foresees the development and incorporation of new technologies that are cost-effective, sustainable and of benefit to the majority of the targeted population.

Organizing activities with a systemic approach

Activities carried out according to the selected priorities should be tailored to the population at risk and adequately organized so as to make the best use of the available resources. Furthermore, it is important to take a systemic approach to ensure that the various interrelated components of the intervention strategy are coordinated, directed to achieving the objectives and integrated with other related programmes or initiatives.

Education and training

Programmes to educate and train health care professionals, customers, and other stakeholders should be tailored to the type of audience, to the local situation and the momentum in the programme development so as to ensure that they can contribute to improving the programme.

Monitoring and evaluation

Evaluation activities can be seen as part of a continuum that supports the decision-making process in all stages of programming: planning, implementation and outcome evaluation. Continuous evaluation of national cancer control programme processes (monitoring) and outcomes should be considered an essential tool for assessing its organizational progress and enhancing its effectiveness.

Programme monitoring is intended to assess whether a national cancer control programme is performing as intended, and whether or not the programme is reaching the target population and meeting the needs of customers. Programme performance can be assessed by different methods, depending on how comprehensive an evaluation is required and which quality dimensions are of interest (effectiveness, efficiency, competence, appropriateness, accessibility, and so on). *Outcome indicators* for a national cancer control programme are concerned with the quality of life of cancer patients, disease recurrence rates, disease-free survival rates, overall survival rates among treated patients, incidence, and mortality rates. Reliable baseline data on the common types of cancer, their stage at diagnosis, and the

outcome of disease are essential if valid programme outcome measures are to be set. Evaluation is completely dependent on adequate information systems that should be developed as early in the programme as possible in order to monitor processes and indicate changes to improve them. They should be linked to population-based cancer registries in the areas where they exist so that outcome measures can be provided by the surveillance system.

National cancer control activities based on resource realities

Some of the previously described cancer control strategies may be far beyond the resources of many countries. Nevertheless, there is a clear benefit in implementing a national cancer control programme, regardless of the fiscal situation in a country. The programme process will ensure the most efficient use of existing resources in the control of cancer.

In general, the majority of cancer patients in developing countries are diagnosed at advanced stages of the disease, because of the lack of awareness of the need for rapid action if a cancer symptom or sign is detected, the lack of early detection programmes, and the limited resources for diagnosis and treatment. However, developing countries do not constitute a homogeneous group. Important differences can be encountered with regard to the epidemiological situation, and to economic, social and health system development. The various settings need to be taken into account when addressing the cancer problem and organizing a programme at the national or state level. Further, there are often large social inequalities within a specific country. While a considerable proportion of the population of a developing country will be poor and face major barriers to social development, in contrast a small percentage is likely to be wealthy and in many cases to enjoy a standard of living and health level comparable to those in developed countries.

A flexible approach is needed, as political, socioeconomic and epidemiological situations vary and evolve. With this in mind, three separate scenarios are provided to help guide countries toward what is possible with their limited level of resources (low, medium or high). As well as being relevant to individual countries, the scenarios can be used to identify specific actions relevant to regions or different population groups within a country.

Low level of resources (Scenario A)

This scenario refers to low income countries where resources for chronic disease are completely absent or very limited. Many such countries may

have great political and social instability. A considerable proportion of the population is rural. Infant and adult mortality rates are high. Communicable diseases and malnutrition are a major cause of morbidity and mortality, especially for children. Life expectancy is relatively low. Cancer is not one of the main problems in general, but over 15 years of age it can be one of the leading causes of death. The majority of cancer patients are diagnosed in advanced stages. Exposure to cancer risk factors such as tobacco or environmental carcinogens other than aflatoxin may be low but almost invariably rising. Exposure to infectious causes of cancer will usually be high (human papillomaviruses and hepatitis B virus, and sometimes schistosomiasis). Health care services are often delivered by informal means, and alternative medicine is a major component. Infrastructure and human resources for cancer prevention or control are non-existent or very limited in quantity, quality and accessibility.

What can be done in such circumstances? The first immediate action is to establish a basis for prevention of cancer and other chronic diseases by limiting the extent to which the health scourges of the industrialized world – tobacco use and the “western diet” – can enter the country. There are already enough health problems within the country without importing those from outside. The general public and health care workers can be made aware of the early warning signs of cancer and other diseases. This will ensure that cases are identified, referred and treated early in the course of disease, before they become advanced and incurable. The process of establishing national diagnosis and treatment guidelines has the dual purpose of determining effective patient management standards as well as promoting equitable access to the limited treatment resources. Perhaps the most significant contribution of a national cancer control programme in this scenario is establishing a basis for pain relief and palliative care of individuals with advanced disease to ensure that they maintain a high as possible quality of life. Allocation of available resources in a cost-effective manner is of greatest concern in areas with a low level of resources, and is assured by the quantitative-based strategy evaluation process of establishing a national cancer control programme.

Medium level of resources (Scenario B)

Countries in this scenario are often considered “middle-income” countries. The majority of the population is urban and life expectancy is over 60 years. The country has been through the epidemiological transition, and cancer is usually one of the leading causes of disease and mortality. There is a high exposure to risk factors, especially tobacco, diet, infectious agents, and carcinogens in the workplace. Infrastructure and human resources for

developing cancer prevention, early detection, diagnosis, treatment, and palliative care are available but with limitations in quantity, quality, and accessibility. Weaknesses can be identified in organization, priority setting, resource allocation, and information systems for adequate monitoring and evaluation. Primary prevention and early detection are usually neglected in favour of treatment-oriented approaches, without much concern regarding their cost-effectiveness.

In general, the primary prevention activities needed in this type of setting are tobacco control, reduction of alcohol use, and promotion of healthy diet and physical exercise. Special attention should be paid to carcinogens in the workplace, and to infectious agents such as human papilloma virus. Promotion of the warning signs for the common cancers should be encouraged. If, as is common in this scenario, rates of cervical cancer are high, the highest priority for a screening programme is cervical cytology screening, focusing mainly on covering a high proportion of the women at risk. Screening for other types of cancers should be discouraged. Cancer treatment should focus on cancers that are curable, and clinical trials should be encouraged to evaluate relatively low-cost approaches that eventually can be provided to all patients irrespective of their socioeconomic condition. More sophisticated approaches, such as radiotherapy and chemotherapy, should be introduced in specialized centres. Major efforts should be made to achieve the highest coverage for pain relief and palliative care, using low cost drugs (oral morphine) and other interventions.

High level of resources (Scenario C)

This scenario is appropriate for industrialized countries with a relatively high level of resources for health care. In these countries life expectancy is over 70 years, and cancer is a major cause of death for both men and women. Many elements of a cancer control programme are in place, but they may not be well integrated into a comprehensive national system. Further, coverage of the population may be uneven, with particular groups such as those in rural areas, indigenous people and recent immigrants having difficulty accessing services. Reorganization of the system could bring benefits in terms of greater cost effectiveness and improved reach and acceptability of services.

Comprehensive health promotion programmes, including in schools and workplaces, should be implemented in collaboration with other sectors. While there should be a concerted effort to promote awareness of the early warning signs for cancer, national screening programmes should, in general, only be implemented for cervical and breast cancer, as screening for other cancers has not yet been proven to be cost-effective. In spite of a high level of resources, industrialized countries often have serious deficien-

cies with respect to providing easy access to pain relief and palliative care services. Implementation of a comprehensive surveillance system ensures rapid response to changes in disease patterns and weaknesses in service provision.

*Executive
Summary*

Knowledge gained over the past decades provides enormous scope for controlling cancer throughout the world, and the most appropriate mechanism for exploiting that knowledge is through the establishment of national cancer control programmes.

The recommendations for minimum essential actions by national cancer control programmes, in countries with different levels of resources, are summarized in Table 13.1. A more detailed coverage of these recommendations is provided in Chapter 13.

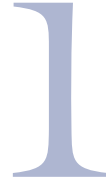
Challenges Facing Cancer Control Programmes

THE AIM OF CANCER CONTROL is a reduction in incidence and mortality of cancer as well as an improvement in the quality of life of cancer patients and their families. This requires sound knowledge of the carcinogenesis process and the factors that influence the course of the disease, and an understanding of the social, economic and organizational factors that govern how that knowledge can be put to effective use. The word “control” does not imply that cancer can be eradicated in the way that an infectious disease can be eradicated by immunization, but rather that control can be exercised over its causes and consequences. The concept of cancer control empowers society to achieve mastery over the disease.

The magnitude of the cancer problem, and its growing importance in almost all countries, coupled with the knowledge now available, are compelling reasons for the development of national strategies for cancer control.

Chapter 1 deals with the biological and social aspects of the group of diseases known as cancer. Chapter 2 considers the causes of cancer and their relative importance in terms of public health. Chapter 3 reviews cancer patterns and trends, and their socioeconomic impact.

BIOLOGICAL AND SOCIAL ASPECTS OF CANCER



BIOLOGICAL ASPECTS OF CANCER

Cancer is the generic term for a group of diseases that can affect any part of the body. Malignant tumours of the brain, lung, breast, prostate, skin, and colon are among the diseases known as cancer. Other examples of cancers include leukaemia, sarcomas, Hodgkin disease and non-Hodgkin lymphoma. Certain common morphological features differentiate all forms of cancer from other types of disease, including other noncommunicable diseases and diseases caused by toxic agents. Yet there are links between cancer and these other diseases. In particular many noncommunicable diseases share causal factors, such as tobacco use, unhealthy diet, obesity, and lack of physical exercise. Approaches to prevention are therefore often identical.

Cancers share several biological characteristics. One defining feature is the proliferation of abnormal cells. The process of cell turnover is normally well controlled throughout life by basic biological mechanisms. In cancer, however, the control mechanisms go awry. Cells in the affected part of the body grow beyond their usual boundaries, invade adjoining tissues, and may spread to secondary organs or tissues as metastases.

Advances in molecular biology have improved researchers' understanding of the mechanisms of normal cell growth, making it possible to investigate the aberrant cell proliferation and failure of programmed cell death (apoptosis) that constitute cancer. Cell growth is under the control of a class of genes known as the proto-oncogenes or suppressor genes. If gene mutation or translocation occurs within a chromosome, a proto-oncogene may lose its capacity to regulate cell replication and become an oncogene. Such genetic changes, triggered by a variety of factors, may constitute the final common pathway in the biological mechanism of cancer.

A malignant tumour originates from one altered cell and initially proliferates at the primary site. Subsequently, it usually spreads through various pathways, such as by local infiltration in the neighbourhood of the organ of origin, lymphatic system (lymph nodes) or the vascular channels, leading to metastasis. Metastases are the major cause of death from malignant diseases.

Phases in the development of cancer

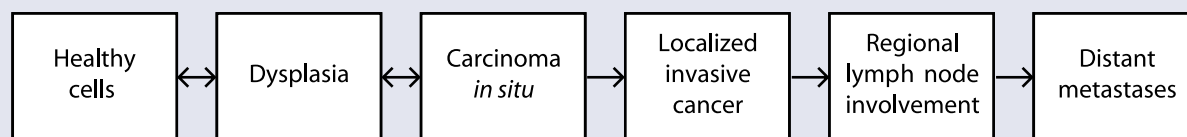
Cancer develops in several phases, depending on the type of tissue affected. Typically, these phases are: dysplasia, cancer *in situ*, localized invasive cancer, regional lymph node involvement, and distant metastases (see Figure 1.1).

The first indication of abnormality is a change in the character of cells, known as dysplasia. The lesion may regress spontaneously at this stage, and sometimes even at the next, carcinoma *in situ* (as indicated by the arrows in both directions). The term “carcinoma *in situ*” is used when microscopic examination discloses cells with certain characteristics of cancer, that is, changes in the cell nuclei, but with no penetration of the underlying (or basement) membrane that holds them in the tissue of origin. The term carcinoma *in situ* is usually reserved for changes that affect the full thickness of the epithelium.

When the abnormal cell growth reaches areas underlying the tissue of origin, the cancer is regarded as invasive. With further growth, there is increasing invasion and destruction of adjacent tissues. Often, the cancer extends to the regional lymph nodes that drain the area. Cancer cells may also spread through the blood or lymphatic system to affect other organs (distant metastases). For example, cancer in the colon may spread to the liver or lungs.

With sufficient multiplication of abnormal cells, the cancer becomes apparent to the individual or to the physician. It commonly takes the form of a lump that may be seen or felt in the organ involved, for example skin, breast, or prostate. Sometimes, even before detection, the cancer will have spread to lymph nodes or, if rapidly progressive, will have already caused detectable distant metastases. The growth of the cancer can involve blood vessels and cause bleeding, which will be apparent if the cancer reaches part of an organ

Fig. 1.1 Typical phases of cancer development



that is in direct or indirect contact with the exterior. For example, there may be blood in the sputum from lung cancer, blood in the stools from bowel cancer, or blood in the urine from bladder cancer. The growth of a cancer may also cause functional disturbances: for example, cancer of the brain may give rise to neurological symptoms and signs. In advanced cancer, one of the most severe symptoms is the pain induced by pressure on nerves.

Implications of biology for cancer control

The genetic changes that characterize cancer sometimes occur as a consequence of defective hereditary material. However, hereditary forms of cancer are relatively rare, and more commonly the relevant genetic changes take place as a result of an external influence.

One approach to preventing cancers is to identify the external agents and factors responsible for the cell changes that lead to cancer. Certain chemicals, for example, are known to be carcinogenic; that is, they induce the cellular changes characteristic of cancer. Controlling exposure to such chemicals, or to complex mixtures (such as tobacco smoke) that contain many carcinogens, may, therefore, prevent some cancers. Interfering with the transmission of an infectious agent such as a virus may prevent other cancers. Still other cancers may be prevented by using an agent that directly interferes with the carcinogenic process – an approach termed chemoprevention.

Even after the malignancy has started, it may still be possible to prevent progression to the invasive form of the disease. Techniques have been developed to detect the early phases of certain cancers, notably those of the uterine cervix, before symptoms are manifest. Timely recognition and excision of dysplasia or *in situ* cancer can prevent the progression to invasive cancer. Even when cancer has become invasive, arrest or cure can be effected in some cases by removing cancer surgically or destroying the cancer cells by radiation or chemotherapy.

SOCIAL ASPECTS OF CANCER

Cancer arises largely as a result of lifestyle, and is thus a consequence of the conditions in which individuals live and work. For some cancers, specific causal relationships to chemicals are well established; leukaemia as a result of exposure to benzene used in tyre manufacture is one example. Lifestyle influences are relevant for most cancers. The changes in incidence of different forms of cancer among migrants who have moved from one part of the world to another probably reflects major lifestyle changes resulting from acculturation to the way of life in the host country.

Where people live

A striking feature of cancer is its geographical and temporal variability. The population of a particular place at a specific time exhibits a certain pattern of cancer, with more cases of one type and fewer of another. In another place, or at another time, the pattern of cancer in the population will be different. This is illustrated by the following examples.

The incidence of liver cancer in sub-Saharan Africa and south-east Asia is high compared with that in western Europe. During the early part of the twentieth century, residents of North America and Europe suffered only rarely from lung cancer, but succeeding generations living in the same areas have experienced a lung cancer epidemic because of the widespread adoption of cigarette smoking. This epidemic is now expanding rapidly to Asia as a consequence of Asians increasingly taking up the smoking habits of the West.

Stomach cancer is significantly more common among the people of Chile, northern China, Japan, and the countries of eastern Europe than among those living in other parts of the world. These differences are probably largely attributable to changes in dietary patterns and means of food preservation, although differences in the prevalence of infection with the bacterium *Helicobacter pylori* may also be a contributory factor. Social aspects are, however, also evident: the incidence of stomach cancer among people of low socioeconomic status is greater than among those who are more socially advantaged.

In a few rare cases, the location in which people live may give rise to cancer. This is true of certain parts of Turkey, where the incidence of mesothelioma is extremely high because people live where the earth's crust is composed of erionite, an asbestiform material (Artvinli and Baris, 1979). Exposure during early life appears to lead to the disease decades later.

Changes people make in the world

Wherever people settle, part of the way they adapt to prevailing conditions is to exploit the earth for its resources. This may expose them to cancer-causing agents or influences not previously encountered. Industrial workers have suffered most severely. For example, more than half of certain groups of miners who worked in the Joachimsthal and Schneeberg mines of central Europe during the latter part of the nineteenth century died of lung cancer, a rare disease at that time, as a result of exposure to radioactivity in the mines.

The manufacture of dyestuffs can also lead to cancer. The manufacture and use of 2-naphthylamine, for example, causes bladder cancer. Exposure to 2-naphthylamine was at first concentrated in North America and Europe. It has now largely ceased there, only to reappear in southern Asia. Industrial

development has often exported risks to areas where local people do not recognize those risks.

Implications of lifestyle for cancer control

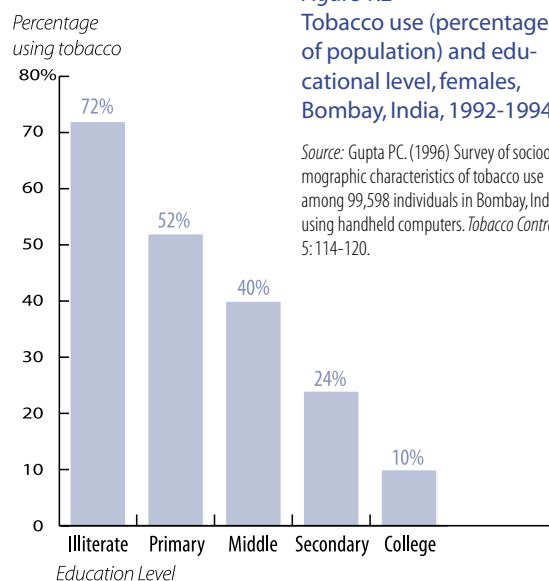
Human existence is characterized by behaviour patterns—what people do to meet their biological, psychological, and social needs. These patterns may include certain ways of preparing and consuming food, physical inactivity, and the development of dependence on tobacco products, alcohol, and drugs. Many of these patterns have an impact on cancer, as well as on other diseases. Adopting a healthy lifestyle that includes a healthy diet, physical exercise, appropriate body weight, and avoidance of risk-associated behaviours can lead to a long active life.

Social and economic inequities

Cancer and other chronic diseases are profoundly associated with social and economic status. Tobacco use, displacement of vegetables and fruit by high-fat/low-fibre foods, reduced physical activity, and alcohol abuse are highest in groups with the least education (Yach, 2001). For example, as shown in Figure 1.2, for females in Bombay, India, the lower the educational level, the higher the proportion of tobacco use (Gupta, 1996). Poorer groups are often explicitly targeted in the marketing of unhealthy products, and are also the least likely to be reached by preventive and promotion measures.

Primary health care services have always focused on acute care for infants and mothers, rather than evolving to deal with the rising rates of cancer and other noncommunicable diseases. The consequences of limited access to health services are evident in reduced survival rates and more pain for cancer patients. Patients in the lower social classes have consistently poorer survival rates than those in the higher social classes. Social class is associated with access to care. For cancer patients, access to care is in turn associated with survival and quality of life.

Strategies for cancer control must take into account the limitations imposed, as well as the opportunities created, by the social aspects of the problem. Understanding how particular features of people's social circumstances and development contribute to cancer can point the way to avoiding or correcting the socioeconomic factors that are mainly responsible for the disease.



CAUSES OF CANCER

2

BIOLOGICAL AND GENETIC FACTORS

The cellular changes that characterize cancer are initiated by various degrees of interaction between host factors and exogenous agents.

Although host factors other than genes play a role in the development of the disease, some of these are increasingly being recognized as also being under genetic influence. These include hormonal patterns and immunological capacities. The common cancers of sex-specific organs – especially the uterus, breast, ovary and prostate – are influenced by levels of sex hormones. There is a positive link, for example, between breast cancer and elevated levels of the hormone estradiol. Suppression of immunological function, such as that required following organ transplantation or occurring in acquired immunodeficiency syndrome (AIDS), enhances the incidence of certain lymphomas and perhaps other cancers.

Genetics and cancer

Cancer occurs because of mutations in the genes responsible for cell multiplication and repair. This does not mean that the disease is heritable. Indeed, it now seems clear that even the rare so-called heritable cancers caused by genes of high penetrance, and transmitted through Mendelian laws, mostly require a particular interaction with environmental factors for induction. Although the distinction between high and low penetrance genes obscures a continuum of susceptibility at the biological level, it is possible at the operational level to identify a small number of genes (high penetrance genes) in which pathological mutations are sufficiently predictive of cancer risk to influence clinical management. In contrast, any allelic variant of the “major” genes, or alteration in other interactive genes or in environmentally sensitive polymorphisms that would not be sufficiently penetrant to affect clinical practice, is categorized as low penetrance. Nevertheless, as knowledge expands and the capacity to test multiple genes simultaneously becomes commonplace, high penetrance “genotypes” comprising several low penetrance genetic variations may be recognized.

Genetics may therefore eventually play an important role in the control of cancer, including:

- identification of individuals at risk for a specific cancer, leading to preventive or screening strategies for an individual or family members;
- identification of cancer subtype so that treatment can be tailored to target that specific disease.

The potential role of genetics should not, however, be overstated. Studies have shown that the primary determinants of most cancers are lifestyle factors, such as tobacco, dietary and exercise habits, and infectious agents, rather than inherited genetic factors. For example, probably only 5% of all breast cancers occur in women with a genetic predisposition to the disease.

At present, the major practical role for cancer genetics is the identification of individuals at high risk for cancer. Information on the history of cancer in a family should be routinely collected in all countries. Routine DNA-based genetic testing for high penetrance genes (such as BRCA 1 or 2 for breast cancer) is currently only feasible in some of the most affluent countries.

Family history and DNA screening can identify individuals at moderately increased risk of cancer and individuals from cancer-prone families. Identification of such people allows them to make informed decisions regarding reproduction, lifestyle and clinical risk-reduction strategies. When genetic information indicates an increased risk of a cancer, those at risk may undergo more intensive or more frequent early detection interventions than are routine, in an attempt to detect a cancer at a more treatable stage.

While cancer-prone families are quite rare, the risk of a specific cancer within such a family can be very high. Genetic testing of a person with cancer can help clarify the risk to offspring. It can also serve as the basis for subsequent genetic counselling of the offspring or family, with a view to increasing their understanding of the medical situation and encouraging them to adopt strategies to minimize subsequent cancer risk.

In practice, the type of high risk genetic susceptibility caused by high penetrance genes transmitted in a Mendelian fashion is uncommon, and the proportion of cancers caused by such predisposition is low (about 5% for breast or colon cancer and less for most other cancers, except for retinoblastoma in children). In contrast, it is now appreciated that so-called metabolic polymorphisms, that is differences in the way people metabolize chemical carcinogens, can explain differences in the susceptibility of individuals to cancer, and that these polymorphisms are controlled at a cellular level by mutations in specific genes. A major research endeavour is now under way to characterize these genetic polymorphisms. It is already clear that there are multiplicities of such genetic changes, that they are caused by genes of low penetrance, and that the classic Mendelian laws of inheritance do not apply. However, it seems likely that collectively these polymorphisms explain much of the innate susceptibility to cancer, and that consequently their potential

contribution to the occurrence of cancer is large. Furthermore, interactions with environmental factors seem to be frequently associated with genetic changes. Thus it may be eventually possible to identify those individuals at special risk of tobacco or diet-associated cancers, and also those susceptible to the effects of environmental contaminants.

It is also anticipated, but not yet proven, that genetic testing may eventually provide information that will be used to determine the best course of treatment for some cancers. Certain cancers currently classified as a single disease may ultimately be classified into different types, each best managed by a different therapeutic strategy. Beyond the drawback of the high costs of genetic testing, there are also potential problems associated with patient privacy and discrimination. Who should have access to genetic information and for what purposes should such information be used? The potential for discrimination regarding employment and access to health insurance is considerable. Safeguards against inappropriate use are, however, being developed. If the full potential of the human genome project is to be realized, it is important to avoid erecting barriers that will block the potential advances in cancer prevention, diagnosis and therapy that might be achieved through such testing.

EXTERNAL AGENTS

The wealth of current knowledge about the influence of external environmental determinants of cancer provides significant potential for cancer control. These external factors can be categorized as follows:

- *physical*, for example, solar radiation (which can give rise to skin cancer), and ionizing radiation (which induces cancer of the lung and certain other organs);
- *chemical*, for example, vinyl chloride (which can cause liver cancer), 2-naphthylamine, (which can cause cancer of the bladder), and benzopyrene (which can cause tobacco-related cancers);
- *biological*, for example, hepatitis B virus (which is a cause of liver cancer), and human papilloma virus (which is a cause of cancer of the cervix).

Cancer typically arises many years after initial contact with the etiological agent. For example, exposure to asbestos can result in the development of mesothelioma several decades later.

A dose-response gradient generally governs the development of cancer following exposure to a carcinogen. The greater the extent of exposure, the more likely it is that the disease will occur. Thus, people who lived close to the centre of the atomic blast in Hiroshima were exposed to higher radia-

tion levels and suffered greater incidence of various forms of cancer than people who lived towards the periphery of the affected area (Kato and Schull, 1982).

Carcinogenic risks, though encountered almost universally, are not the same in all parts of the world. In developed countries, for example, the extensive use of X-rays for diagnostic and therapeutic purposes is generally well accepted, even though the radiation may contribute to the development of certain types of cancer, especially leukaemia. In the same countries, food-handling methods—another lifestyle factor—minimize accumulation of the mould that produces aflatoxin, which is a liver carcinogen (IARC, 1993). In many African countries, by contrast, there is little or no danger from medical X-radiation, but people continue to store food under conditions that favour the production of aflatoxin.

Physical carcinogens

Both ionizing and non-ionizing radiation can cause cancer. Small amounts of ionizing radiation occur naturally, specifically in cosmic rays and in radioactive materials in the earth. Exposure may thus result from this “background” radiation, from medical and occupational contact with radiation, from accidents at nuclear power stations, or from the use of nuclear weapons in war. Some types of leukaemia and cancers of the breast, lung, and thyroid are specifically associated with exposure to ionizing radiation. However, ionizing radiation may also increase the likelihood of cancer of most other sites, including the stomach, large intestine, and bladder. Ionizing radiation does not, however, increase the likelihood of chronic lymphatic leukaemia.

Exposure to non-ionizing ultraviolet radiation in sunlight gives rise to the common forms of skin cancer in Caucasian populations (IARC, 1992). Burning from solar radiation is associated with the rarer, but more fatal, melanoma. Individuals with light complexions are especially at risk.

Certain materials have physical properties that are the cause of a number of forms of cancer. In the case of asbestos, for example, the length and toughness of the constituent fibres seems to be important in causing lung cancer, mesothelioma and probably cancer of the larynx, as well as many forms of gastrointestinal cancer.

Chemical carcinogens

Extensive evidence of chemical carcinogenesis has come from studies of people whose occupations bring them into contact with various substances (Table 4.2). Excessive alcohol use (IARC, 1988), and certain drugs (IARC, 1996) also increase the risk of some cancers. Vaginal cancer among young

women was found to be due to diethylstilbestrol, a synthetic hormone that had been given to their mothers to prevent miscarriage during pregnancy (Lanier et al., 1973). Overshadowing all these, however, is the critical role of tobacco smoking as a leading cause of cancer in many countries (IARC, 1986).

Biological carcinogens

Examples of cancer caused by living organisms include bladder cancer resulting from infection with the parasite *Schistosoma haematobium* (IARC, 1994a), liver cancer following viral hepatitis B and C infection (IARC, 1994b), gastric cancer following infection with *Helicobacter pylori* (IARC, 1994a) and cancer of the uterine cervix following human papilloma-virus infection (IARC, 1995).

Dietary factors

Several studies indicate that vegetables and fruits contain substances that provide protection against some cancers. Similarly, studies indicate that excessive amounts of animal products in the diet, such as red meat, increase the risk of colorectal and perhaps breast cancer and other forms of the disease (World Cancer Research Fund, American Institute for Cancer Research, 1997). Among the diet related factors overweight/obesity convincingly increases the risk of several common cancers such as colorectal and breast cancer (Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases, in preparation).

Occupation

The impetus for identifying occupationally-induced cancers has come from three principal factors:

- increased competence in recognizing and demonstrating occupational hazards;
- social pressures;
- the growing diversity of industrial processes and the concomitant exposure of workers to physical and chemical carcinogens.

Among the industries in which there is evidence of carcinogenic risk are the following: agriculture, construction, demolition, shipbuilding, shipbreaking, petroleum, metal and rubber (Tomatis et al., 1990; IARC, 1990).

Development of an effective strategy for the prevention of occupationally-induced cancers requires detailed knowledge of which exposures carry

significant risk. The aim of the strategy will then be to modify or, if necessary, abandon certain operations so as to reduce or eliminate those risks.

Air and water pollution

Throughout the world, carcinogenic agents are released into the air and into surface and ground waters as a result of industrial processes and the accidental or deliberate dumping of toxic wastes. According to current evidence, however, these relatively common forms of pollution seem to be less significant than lifestyle factors in causing cancer. A small number of people are at high risk of exposure to carcinogenic pollutants, but for most the risk is minor and difficult to quantify. Verification of a cause/effect relationship in the latter case would involve measuring the exposure of very large numbers of people and then observing them to determine the consequences of exposure (Committee on Environmental Epidemiology, 1991).

The role of medical services and care

Although rare, some incidences of cancer have been iatrogenically induced. For example, routine use of X-ray fluoroscopy to follow the course of tuberculosis induced breast cancer in some patients (Miller et al., 1989). Further, some drugs used to treat cancer are carcinogenic, while estrogens – used to counteract menopausal symptoms – increase the risk of endometrial and breast cancer (IARC, 1999). It is essential, therefore, to carefully weigh up the benefits of these methods against the risks inherent in their use.

RELATIVE IMPORTANCE OF VARIOUS CAUSES OF CANCER

Cancer of the oral cavity, which is the commonest form of the disease in much of south-east Asia, accounts for half the total incidence of cancer in some parts of India, with 90% of cases attributable to smoking or chewing tobacco (Tomatis et al., 1990). A quarter of all cancer deaths in North America are from lung cancer, and 80-90% of these are the result of cigarette smoking. Table 2.1 shows the estimated percentages of cancer deaths attributable to various causes in people under the age of 65 years in the United States of America. These estimates probably apply to most industrialized countries, although the figures may well underestimate the proportion of cancers caused by occupational factors, many of which become apparent only after workers have retired. Recent evidence suggests that the proportion of cancers related to diet is less than 35%, although a definitive value is not yet available. Diet-related factors are now thought to account for about

30% of cancers in developed countries and perhaps 20% of cancers in developing countries. Infectious agents may account for about 15% of cancers in the world. The vast majority of these cases occur in developing countries where communicable diseases are much more prevalent. There would be 21% fewer cases of cancer in developing countries and 9% fewer cases in developed countries if these cancer related infectious diseases were prevented (Pisani et al., 1997).

With regard to occupational risks, one estimate for Canada was that 9% of cancers at all ages were a result of occupation (Miller, 1984). It seems probable that the proportion of cancer resulting from occupational factors is decreasing in many developed countries, due to the introduction of appropriate control measures towards the end of the 20th century. The challenge for many developing countries, as they undertake the process of industrialization, is to ensure that they do not import the carcinogenic hazards related to various occupations.

One of the most common malignancies in sub-Saharan Africa and south-east Asia is cancer of the liver. The majority of these cases are a consequence of infection with hepatitis B virus or consumption of aflatoxin-contaminated

Cause of cancer (or contributory factor)	Best estimate	Range of acceptable estimates
Tobacco	30	25–40
Alcohol	3	2–4
Diet	35	10–70
Reproductive and sexual behaviour	7	1–13
Occupation	4	2–8
Pollution	2	1–5
Industrial by-products	1	1–2
Medicines and medical procedures	1	0.5–3
Geophysical factors	3	2–4
Infection	10	1–?

Table 2.1
Causes of Cancer
Deaths in the
United States of
America (under
age 65 years)

Source: Adapted from Doll R, Peto R. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. *Journal of the National Cancer Institute*, 1981, 66: 1191–1308

food (IARC, 1993, 1994b). In industrialized countries, primary liver cancer – though relatively uncommon – is mainly the result of excessive alcohol consumption (IARC, 1988).

The incidence of oesophageal and lung cancer and cancers of the colon and rectum, breast and prostate increases in parallel with economic development (Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases, in preparation). In developing countries, increased development is usually associated with many changes in diet and lifestyle. As a result, patterns of cancer tend to shift towards those of economically developed countries. Changes in lifestyle are also clearly associated with a greatly increased risk of ischaemic heart disease. This lifestyle is also clearly associated with a greatly increased risk of ischaemic heart disease. The risk of cancer can also be multiplied by risk factors acting simultaneously. For example, the effect of alcohol on oral, pharyngeal, laryngeal and oesophageal cancer risk is multiplied by the combined use of tobacco.

BURDEN OF CANCER

3

CANCER AS A WORLD HEALTH PROBLEM

Worldwide, there are over 10 million new cases of cancer and more than 6 million deaths from cancer annually. Two decades ago, these figures were 6 million and 4 million (Tomatis et al., 1990).

Of the 10 million new cancer cases each year, 4.7 million are in the more developed countries and nearly 5.5 million are in the less developed countries. Although the disease has often been regarded as a problem principally of the developed world, in fact, more than half of all cancers occur in the developing countries. In developed countries cancer is the second most common cause of death, and epidemiological evidence points to the emergence of a similar trend in developing countries. Cancer is currently the cause of 12% of all deaths worldwide (Table 3.1). In approximately 20 years time, the number of deaths annually due to cancer will increase from about 6 million to 10 million (see Table 3.2).

Table 3.1 Global and regional patterns of annual deaths, by cause, 2000

	Deaths from all causes (thousands)	Deaths from infectious & parasitic diseases (%)	Deaths from cancer (%)	Deaths from circulatory diseases (%)	Perinatal deaths (%)	Deaths from injury (%)	Deaths from other causes (%)
World total	55 694	25.9	12.6	30.0	4.4	9.1	18.0
More developed countries	13 594	6.0	21.6	47.9	0.7	7.9	15.9
Less developed countries	42 100	32.3	9.8	24.2	5.6	9.5	18.7
Africa	10 572	61.7	5.1	9.2	5.5	7.1	11.5
South and Central America	3 097	14.6	14.0	28.5	4.3	12.3	26.2
North America	2 778	6.3	23.8	41.0	0.6	6.4	21.9
Middle East	4 036	32.0	6.1	26.9	7.5	8.4	19.0
South-East Asia	14 157	29.9	8.0	28.9	7.1	9.7	16.4
Western Pacific	11 390	10.6	18.6	31.2	2.8	10.7	26.0
Europe	9 664	5.4	19.8	51.5	0.8	8.5	14.1

Source: WHO (2001c) *The World Health Report 2001*. WHO, Geneva

There are four principal reasons for the increase in cancer mortality:

- deaths from cardiovascular diseases are declining in developed countries;
- more people are surviving to old age, when cancer is more likely to occur;
- increasing tobacco use in recent decades has led to greater incidence of cancer of the lung and certain other sites;
- changes in diet, decreasing physical activity and increasing obesity have most likely contributed to an increase in various forms of cancer.

In developed countries, cancer generally accounts for about one-fifth of all deaths with mortality figures second only to those for cardiovascular diseases (see Table 3.1). Currently, infections and perinatal problems together account for less than 7% of the total mortality in developed countries, and the proportion is dropping. In these countries, of all major conditions that result in death, cancer is one of the very few for which the proportion is rising significantly (see Table 3.3).

In developing countries, cancer is now responsible for about one in 10 deaths (see Table 3.1), but incidence of the disease is increasing. As living standards improve and life expectancy is extended, the incidence of communicable diseases declines and noncommunicable diseases such as cancer assume greater importance.

CANCER OF VARIOUS SITES

Among men, lung and stomach cancer are the most common cancers worldwide, while prostate cancer is largely seen in more developed countries (see Table 3.4). For women, the most common cancers worldwide are breast and cervical cancer, although cervical cancer is primarily seen in less developed countries. Lung, colorectal and stomach cancer are among the five most common cancers for both men and women, in both more developed and less developed countries.

Further insights may be gained by considering the incidence of cancer of various parts of the body in different countries (see Table 3.5).

Table 3.2 Numbers of cancer deaths and new cancer cases in the world as estimated for 2000 and predicted for 2020¹

Year	Region	New cases (millions)	Deaths (millions)
2000	More developed countries	4.7	2.6
	Less developed countries	5.4	3.6
	All countries	10.1	6.2
2020	More developed countries	6.0	3.5
	Less developed countries	9.3	6.3
	All countries	15.3	9.8

Source: Ferlay J. et al. *GLOBOCAN 2000: Cancer incidence, mortality and prevalence worldwide*. IARC

¹ (based on population projections)

Table 3.3 Deaths from various major causes in selected countries, 1960, 1980 and 2000

	1960						1980						2000					
	Deaths from cancer (%)		Deaths from circulatory disease (%)		Deaths from other causes (%)		Deaths from cancer (%)		Deaths from circulatory disease (%)		Deaths from other causes (%)		Deaths from cancer (%)		Deaths from circulatory disease (%)		Deaths from other causes (%)	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Australia	15	16	52	56	33	28	22	21	48	55	30	24	29	24	39	45	32	31
Chile	7	9	13	16	80	75	14	18	24	30	62	52	22	25	27	32	51	43
Japan	14	14	33	35	53	51	25	21	40	46	35	33	35	27	30	40	35	33
Portugal	9	10	26	33	65	57	16	14	39	47	45	39	25	20	40	53	35	27
Sweden	18	20	51	53	31	27	22	23	54	55	24	22	24	22	49	51	27	27
United Kingdom	20	18	49	56	31	26	24	21	49	51	27	28	27	23	42	43	31	34
USA	15	17	53	55	32	28	21	21	47	53	32	26	25	22	39	43	36	35

Sources: WHO (1963) Annual Epidemiological and Vital Statistics 1960 Geneva; WHO (1981) World Health Statistics Annual 1980–81 Geneva; WHO (2001c) The World Health Report 2001 Geneva

	Males			Females		
	Rank	Cancer	New cases (thousands)	Rank	Cancer	New cases (thousands)
World	1	Lung	902	1	Breast	1050
	2	Stomach	558	2	Cervix	471
	3	Prostate	543	3	Colon/rectum	446
	4	Colon/rectum	499	4	Lung	337
	5	Liver	398	5	Stomach	318
More developed countries	1	Lung	471	1	Breast	579
	2	Prostate	416	2	Colon/rectum	292
	3	Colon/rectum	319	3	Lung	175
	4	Stomach	208	4	Stomach	125
	5	Bladder	164	5	Corpus uteri	114
Less developed countries	1	Lung	431	1	Breast	471
	2	Stomach	350	2	Cervix	379
	3	Liver	325	3	Stomach	193
	4	Oesophagus	224	4	Lung	162
	5	Colon/rectum	180	5	Colon/rectum	154

Table 3.4 Incidence of most common cancers, 2000

Source: Ferlay J. et al. GLOBOCAN 2000: Cancer incidence, mortality and prevalence worldwide. IARC

Cancer of the oral cavity is particularly common in India and adjacent areas as a consequence of chewing tobacco. Stomach cancer is more common in China, Japan, and some countries of South and Central America and eastern Europe. Colorectal (large bowel) cancer is common in western societies, but has also become increasingly common in Japan. Liver cancer, though rare in most parts of the world, occurs more commonly in parts of Africa, eastern Asia, and the western Pacific. The incidence of lung cancer is high in North America and Europe and in Shanghai (China), but low in Africa. Epidemic levels of cigarette smoking account for the very high incidence of lung cancer in most of the developed countries, and recently this has become increasingly true of other parts of the world (Miller, 1999). Breast cancer, the commonest female cancer in the world, is very high in the West. Cervical cancer is more common in the developing than in the developed countries, and in many developing countries is the most frequent form of cancer in women. Prostate cancer is also common in the West. In the United States, the reported incidence of prostate cancer is extremely high, largely as a result of early detection through screening.

CANCER TRENDS OVER TIME

Ideally, a picture of a trend in a disease should be derived from data concerning incidence, that is, the number of new cases per population unit (usually

Table 3.5 Age-standardized cancer incidence: selected sites, selected registries, per 100 000, by sex

Registry	Oral		Stomach		Colorectum		Liver		Lung		Breast	Cervix	Prostate
	M	F	M	F	M	F	M	F	M	F	F	F	M
China (Shanghai)	1.0	0.8	46.5	21.0	21.5	18.1	28.2	9.8	56.1	18.2	26.5	3.3	2.3
Colombia (Cali)	2.3	1.4	33.3	19.3	11.9	10.8	2.6	2.2	24.4	9.5	38.8	34.4	32.7
England & Wales	1.5	0.7	16.1	6.3	33.9	23.7	2.0	1.0	62.4	22.8	68.8	12.5	28.0
India (Bombay)	6.2	4.6	7.7	3.8	7.6	5.6	3.9	1.9	14.5	3.7	28.2	20.2	7.9
Japan (Miyagi)	0.9	0.5	82.7	32.8	41.5	24.8	15.4	5.4	39.6	10.3	31.1	6.4	9.0
Uganda (Kyadondo)	1.0	1.7	5.4	3.2	7.5	5.1	9.9	4.7	4.2	0.4	20.7	40.8	27.7
Slovakia	5.4	0.4	24.5	10.3	40.6	23.6	7.2	3.1	79.1	8.7	38.6	16.4	22.0
USA, SEER (White)	3.0	1.6	7.5	3.1	42.4	29.5	3.0	1.2	61.3	33.8	90.7	7.5	100.8
USA, SEER (Black)	5.4	1.9	14.5	5.9	46.4	35.3	6.5	2.0	99.1	38.5	79.3	12.0	137.0

Source: Parkin DM et al. *Cancer incidence in five continents, Vol. VII*, Lyon, International Agency for Research on Cancer, 1997 (IARC Scientific Publications, No. 143).

100 000) per unit of time (usually per year). Unfortunately, such data can be obtained only from cancer registries or cancer surveys, both of which are relatively recent. Cancer mortality data, on the other hand, have been available for many countries during most of the 20th century, and can be used to study both geographical patterns and temporal changes in the disease.

Cancer deaths represent incidence indirectly, since they reflect the failure of treatment as well as the occurrence of the disease. For those forms of cancer for which available treatments are less effective, for example lung and stomach cancer, deaths reflect incidence quite accurately. Since 1950, the incidence of stomach cancer has declined by more than 50% in most countries. Lung cancer, by contrast, rose dramatically throughout the 20th century, more than 10-fold in North America for instance, although incidence in men began to decline in the 1980s, as it had earlier in the United Kingdom (Miller, 1999). Thus, cancer epidemics tend to rise to a peak and then recede over several decades. As a consequence, the time periods involved tend to conceal the epidemic nature of the trend.

Predictions of cancer prevalence, incidence, and mortality are important bases for cancer control activities. Together with predictions for other diseases, they are useful for setting national health priorities. As indicated in Chapter 1, major increases in cancer incidence and mortality are predicted for the developing countries.

PSYCHOSOCIAL AND ECONOMIC IMPACTS OF CANCER

Regardless of prognosis, the initial diagnosis of cancer is still perceived by many patients as a life-threatening event. Over one-third of patients experience clinical range anxiety and/or depression (Epping-Jordan, 1999). Surprisingly, disease severity, prognosis, and type of treatment do not seem to have a large impact on psychosocial adjustment to cancer. However, patients who can find a sense of meaning in what is happening to them and who can achieve mastery over their illness adjust well to their cancer.

Cancer can be equally, if not more, distressing for family and friends. Family income loss, social isolation, family tensions, and adverse effects on daily functioning in the family may follow closely on the occurrence of cancer. Similarly, health care providers are not immune to the psychosocial effects of caring for people with cancer. Workers who frequently see sick and dying patients, or who cannot provide assistance to their patients in the manner they want, are at risk for “staff burn-out”. This syndrome is characterized by emotional exhaustion and de-personalization of the patient, and has been linked to job absenteeism, insomnia, substance abuse and physical complaints (Ullrich, Fitzgerald, 1990).

The economic burden of cancer is most obvious in health care costs, such as those for hospitals, other health services, and drugs. Indirect costs arise from loss of productivity as a result of the illness and premature death of those affected. Direct costs may be estimated fairly readily in situations where the nature and extent of services provided to cancer patients are known. Calculation of indirect costs, however, involves making assumptions concerning both expected future earnings and a discount rate to convert potential earnings into a current amount. One estimate of direct cancer care costs in the United States of America in 1990 was US\$ 27.5 billion, the corresponding indirect costs of premature mortality from cancer amounting to almost US\$ 59 billion (Brown, Hodgson, Rice, 1996).

Beyond these numbers, the common reality, especially in poor areas, is a profound economic family crisis. A diagnosis of cancer in one of the adults in a family may lead not only to the loss of a source of income, but also all too frequently to exhausting the family's remaining income and resources in seeking treatments. Perhaps saddest of all are the futile frantic searches and large amounts of money paid by the family for treatments that cannot prolong the life of the family member with advanced cancer. If families feel abandoned by their formal health care system, they may spend their remaining resources seeking assistance from well-meaning or unscrupulous individuals who falsely promise to help.

Approaches to Cancer Control

The four principal approaches to cancer control are:

Prevention Prevention means eliminating or minimizing exposure to the causes of cancer, and includes reducing individual susceptibility to the effect of such causes. This approach offers the greatest public health potential and the most cost-effective long-term method of cancer control. Tobacco is the leading single cause of cancer worldwide and in the fight against cancer every country should give highest priority to tobacco control.

Early detection Increasing awareness of the signs and symptoms of cancer contributes to early detection of the disease. Where tests for cancer of specific sites are available, and facilities are appropriate, screening of apparently healthy individuals can disclose cancer in early or precursor stages, when treatment may be most effective. Early detection is only successful when linked to effective treatment.

Diagnosis and treatment Cancer diagnosis calls for a combination of careful clinical assessment and diagnostic investigations. Once a diagnosis is confirmed, it is necessary to ascertain cancer staging to evaluate the extension of the disease and be able to provide treatment accordingly. Cancer treatment aims at curing, prolonging useful life and improving quality of life. Treatment services should give priority to early detectable tumours and potentially curable cancers. In addition, treatment approaches should include psychosocial support, rehabilitation and close coordination with palliative care to ensure the best possible quality of life for cancer patients.

Palliative care In most of the world, the majority of the cancer patients present with advanced disease. For them, the only realistic treatment option is pain relief and palliative care. Effective approaches to palliative care are available to improve the quality of life for cancer patients.

The scientific basis for these approaches to cancer control is considered in Chapters 4–7 of this monograph. Cancer control research is briefly discussed in Chapter 8, while Chapter 9 reviews cancer surveillance, the basis for cancer control planning, monitoring and evaluation.

PART II

PREVENTION

4

Cancer prevention should be a key element in all national cancer control programmes. Prevention not only focuses on the risks associated with a particular illness or problem but also on protective factors. Among prevention activities, emphasis should be placed on:

- tobacco control;
- healthy diet;
- physical activities and avoidance of obesity;
- reducing alcohol use;
- reducing carcinogenic occupational and environmental exposures;
- immunization against hepatitis B virus;
- combating schistosomiasis;
- avoidance of prolonged exposure to the sun;
- health education, relating to sexual and reproductive factors associated with cancer.

Action on tobacco use is universally needed, but the priorities accorded to other components of the programme will depend on the results of a situation analysis of the country concerned, covering the actual and forecast burden of cancer cases in the country, and the estimated proportion of potentially preventable cases. A broad range of health promotion activities are appropriate to cancer control and these are examined in detail at the end of this chapter.

TOBACCO

Tobacco dependence

Tobacco dependence is listed in the WHO ICD-10 as a chronic condition in the section on mental and behavioural disorders (WHO, 1992). Such dependence syndromes are described as a cluster of behavioural, cognitive and physiological phenomena that develop after repeated substance use and that typically include a strong desire to take the drug, difficulties in controlling its use and persistence in drug use despite harmful consequences.

The use of tobacco in any of its several forms has extended over much of the world. Young people usually encounter the practice among their peers, and may then take up the habit themselves. Typically, tobacco use begins through social contacts, but the habit is reinforced by the development of physiological dependence, derived from the nicotine content of tobacco. Cessation of tobacco use in those who are addicted produces withdrawal symptoms, typical of other addictions. Such symptoms can appear within hours of cessation and persist for weeks or months.

Tobacco is smoked, chewed and dipped in various forms around the world. Tobacco is also consumed frequently as a mixture with other substances. On the Indian subcontinent and adjacent parts of central Asia, for example, tobacco is often mixed in a quid with betel nut and lime, and retained in the mouth for long periods of time. In Sudan, the use of smokeless tobacco in the form of snuff, called toombak, is widespread. Toombak is dipped in the saliva of the oral cavity or, less frequently, sniffed into the nasal cavities. Today, in most parts of the world, cigarette smoking is the most common form of tobacco use.

Health significance of tobacco use

Although the adverse health consequences of tobacco use have been recognized for over 50 years, it is the major epidemiological studies that revealed the full extent of tobacco-related health damage (IARC, 1986).

Lung cancer was rare in North America and Europe during the early 20th century, but its incidence began to increase substantially about 15 years after the First World War, in the wake of heavy smoking among members of the armed forces. A similar increase in the incidence among women was noted in the 1960s, following 15–20 years of cigarette consumption that started during the Second World War. During the period 1950–2000, smoking accounted for 50 million deaths in males and 10 million in females in developed countries (Peto et al., 1994). Now, the epidemic is extending into many developing countries, where smoking has been encouraged by the marketing policies of national and multinational tobacco companies.

In industrialized countries, 80–90% of lung cancers are attributable to tobacco smoking. The longer a person has been smoking and the more packs per day smoked, the greater the risk. If a person stops smoking before a cancer develops, the risk remains at the same level or may even increase. Even after ten years, the ex-smoker's risk still does not equal the lower risk of a person who never took up smoking. Cigar smoking and pipe smoking are almost as likely to cause lung cancer as cigarette smoking.

A substantial proportion of cancer in the oral cavity, pharynx, larynx, pancreas, kidney, oesophagus, bladder, and probably stomach and cervix

uteri is also attributable to tobacco. Moreover, smoking is responsible for a large amount of chronic lung disease and contributes heavily to cardiovascular disease. Tobacco smoke contains approximately 4000 chemical substances, of which at least 438 can produce cancer. The most dangerous are nicotine, tobacco tar, and carbon monoxide. The most common cancer causing agents in tobacco are the polyaromatic hydrocarbon and nitroso compounds. The development of cancer in particular organs depends upon the sites that come into contact with the chemical constituents of tobacco and tobacco smoke. The lungs are the principal target when tobacco smoke is inhaled; when tobacco is chewed or kept in the mouth, the cheek, tongue, and other parts of the oral cavity are affected. The increased risk at other sites is probably a result of carcinogens being absorbed into the bloodstream from the lungs and transported to the relevant organ.

One critical aspect of tobacco relevant to cancer control is the effect of passive exposure to smoke in increasing the risk of cancer of the lung and possibly of other sites in non-smokers (IARC, 1986). Non-smokers who breathe in the smoke of others (also called second-hand smoke or environmental tobacco smoke) are at increased risk for lung cancer. A non-smoker who is married to a smoker has a 20–30% greater risk of developing lung cancer than the non-smoking spouse of a non-smoker. Workers who have been exposed to tobacco smoke in the workplace are also more likely to get lung cancer.

Action against tobacco

The need for effective global action against the tobacco epidemic is urgent, especially in developing countries. Hundreds of millions of people currently use tobacco, and tens of millions will suffer severely impaired health and shortened lives. Effective tobacco control begins with the realization that tobacco is powerfully addictive. The task of containing the spread of tobacco use and assisting individuals to overcome the addiction may be achieved in a number of ways, but must always take account of the widespread, longstanding, and deeply ingrained nature of the habit and the strong social factors that encourage it, as well as the political imperatives of many countries, especially those with a major indigenous tobacco industry.

Many countries have undertaken health promotion and health education programmes to inform people of the adverse effects of tobacco. However, these efforts are continually undermined by the tobacco industry (WHO, 1998c). Decades of experience demonstrate that health promotion and education measures are insufficient to combat the tobacco problem. For more effective results, health promotion and education must be accompanied by other actions, particularly legislation, tobacco taxes and tobacco cessation

programmes, that will reduce the social acceptability of tobacco use. Much depends on people having adequate understanding of both the short-term and long-term consequences of the habit, but simply imparting this knowledge is not enough. Equally important is the cultivation of attitudes that will be effective against smoking or other use of tobacco. These attitudes may reflect personal values regarding short-term effects (on personal appearance, for instance) as much as concern about long-term health damage. Young people are sensitive to the way in which tobacco remnants and the odour of smoke on their person and their clothes may affect their social relationships. In addition, they need psychosocial resistance skills, particularly in situations where there is substantial pressure to initiate or continue tobacco use. Education techniques have been developed to help in these situations. Teaching social resistance skills in school can do much to help youngsters aged 10–15 years to avoid cigarette smoking.

Overall, direct efforts to influence the behaviour of the individual with regard to tobacco have had, and will probably continue to have, only limited success. Mass education, however, and development of public attitudes against tobacco use have encouraged many cigarette smokers to give up the habit. In North America, where cigarette smoking is in decline, most people who have given up cigarettes report that they did so “on their own”; they took personal responsibility for their action. People with higher levels of education and greater concern about health, especially physicians and other health professionals, tend to be the first to give up smoking. In developing countries, the first people to become relatively affluent – and therefore to have the money for cigarettes – are also the first to start smoking. As they acquire knowledge of the threat to health, they are also the first to give up the habit. This diffusion of the tobacco epidemic extends throughout society, until it is the least well educated, and most socially disadvantaged segments of society that retain the habit, and the consequences to their health. The trend to resist smoking can also be accelerated by specific counselling and advice from physicians. Professional health workers should be influenced by the policies of the health services in which they work; they should avoid tobacco use of any sort in order to set an example to others.

Government action can do much to encourage people to give up cigarettes, by prohibiting smoking in workplaces, restaurants, and public buildings, and on public transport, for example, and by controlling the advertising of tobacco products, providing the regulations are enforced. Valuable use can be made of the media for mass education about the dangers of smoking and means of avoiding or overcoming the habit. In communities where smoking has become socially unacceptable and non-smokers are in the majority, there are major incentives not to smoke.

Government economic policy towards tobacco is highly relevant to indi-

vidual and mass education against tobacco use. The powerful commercial interests involved in production and distribution of tobacco products exploit people's dependence on tobacco in order to maintain sales. Their arguments include the preservation of "free" trade and of individual "freedom" to enjoy tobacco, as well as the need to avoid economic problems in the form of loss of jobs and material investment in the tobacco industry. Strong political and social initiatives to counteract these pressures are vital. Government action regarding land use, subsidies, taxes, and other leverage on prices also has a profound influence on the spread of tobacco use. The stringency of measures taken by some countries to prevent use of other dependence-producing substances contrasts with their policies on tobacco, yet tobacco is responsible for far more deaths than heroin and cocaine combined. A number of countries impose severe penalties on those involved in the illicit drug trade, yet continue to subsidize the tobacco industry. Increasing the price of tobacco products by taxation can help to reduce tobacco use, especially among young people and others whose purchases are strongly influenced by price. Elimination of tobacco prices as an element of the cost-of-living index in various countries would also be beneficial.

As national policies against tobacco use are established and implemented, it becomes important to guard against attempts by the tobacco industry to switch its manufacturing emphasis to products other than cigarettes. Snuff is an example of such a product, with sales primarily aimed at boys aged 10–15 years. The objective is seemingly to encourage dependence among young people on alternative tobacco products which pose less well-known threats to health and are, as yet, less deprecated than cigarettes. It is, therefore, essential to educate people about the dangers of such products, by means such as explicit warning labels on packages.

International aspects

International collaboration over taxation policies is essential, because international expansion is as much an objective of the tobacco industry as of any other industry. Heavy and unchecked pressure by multinational tobacco companies is helping to spread the habit of cigarette smoking in the developing countries. Around 1990, eight of the ten countries with the highest smoking rates among males (70–95%) were in the developing world, and included about one-quarter of the world's population. At that time the smoking prevalence rate for males was estimated to be 51% in developed countries and 54% in developing countries. The corresponding estimates for females were 21% and 8% (Stanley, 1993).

Companies based in the most technically advanced countries seek to expand both their markets and their opportunities for investment in tobacco

production. This is particularly true where home markets are declining in the face of public opinion and government legislation on smoking. International companies seek links with companies in the target countries as a means of strengthening political commitment to the tobacco industry in those countries. Such tendencies should be resisted where possible. Countries have a responsibility to avoid exporting carcinogens, in whatever form, to any other country, especially to less advantaged nations. The World Bank has exercised important leadership in refusing loans to countries for tobacco projects. In 1998, the Secretary-General of the United Nations designated an ad hoc Inter-Agency Task Force on Tobacco Control, under the leadership of WHO, to galvanize global support for tobacco control. Since the inception of the Task Force, new inter-agency partnerships have been initiated in several areas, including close collaboration between WHO, The World Bank, FAO and ILO on the economics of tobacco control, and supply and production issues.

Success in controlling tobacco use

Efforts to achieve control of tobacco have met with some success. Political will to tackle the issue is a paramount consideration and has been expressed in legislative action of various sorts by more than 70 countries. WHO is working to reinforce and strengthen national legislative processes by promoting an International Framework Convention for Tobacco Control (FCTC). In 1999, the World Health Assembly, comprising the 191 WHO Member States, adopted resolution WHA 52.18 initiating the development of the Framework Convention.

The FCTC holds the potential for advancing global cooperation for tobacco control. The principles, norms and standards laid down in the Convention establish priorities for national legislative action and multilateral cooperation for tobacco control. According to treaty law and practice, the FCTC standards will form the minimum content of national tobacco control legislation within parties, subject to any reservations under the treaty. This is without prejudice to stronger national legislation that countries may enact. Treaty institutions established under the Convention could stimulate financial, technical and other assistance programmes for national tobacco control legislation. By providing a multilateral and institutionalized forum for consultations on tobacco control, the FCTC will promote the adoption and implementation of effective tobacco control legislation and other strategies worldwide. The legislation is intended to:

- Set out government policy on the production, promotion, and use of tobacco;
- Encourage those who already smoke to stop, and dissuade others, particu-

- larly young people, from starting;
- Protect the right of non-smokers to be free from passive smoking and to breathe clean air;
- Contribute to the development of a social climate in which smoking is unacceptable;
- Provide a rational basis for the allocation of resources to effective anti-smoking programmes;
- Control smuggling of tobacco products.

Education programmes directed against smoking must be complemented by legislation. In Sweden, for example, strong health warnings on tobacco became mandatory in 1975, and the number of daily smokers fell from 43% of the population in 1976 to 31% in 1980. The decline was especially pronounced among teenagers, apparently in response to the compulsory education about smoking and health in schools. The remarkably high price elasticity of demand for tobacco products may be seen in the substantial decrease in cigarette consumption among teenagers that follows a price increase. Successive tax increases in South Africa resulted in substantial reductions in cigarette sales, and consumption in Canada declined markedly in response to increases in taxes in the 1980s, until perturbed by a reduction in tobacco taxes in an attempt to reduce smuggling of tobacco from the United States. In 1983, France began to levy a tax on alcohol and tobacco; proceeds go to the National Health Insurance Fund to help offset the extra health care costs resulting from the use of those substances. Countries such as Australia, Egypt, the Islamic Republic of Iran, and Thailand, and several US states, including California and Massachusetts, earmark a portion of tobacco taxes to fund tobacco control programme activities such as counter-advertising or broader public health activities.

The total impact of campaigns in various countries is already substantial. In the United States of America, the 1964 report of the Surgeon-General (US Department of Health, Education and Welfare, 1964) resulted in a campaign against cigarettes which led to a drop in cigarette smoking from 45% of the adult population to 30% two decades later, and the decline continued thereafter.

The most favourable results have been seen in countries that have implemented comprehensive tobacco control policies and programmes that ban advertising, place strong warnings on packages, implement controls on the use of tobacco in public places, levy high taxes on tobacco, and provide effective education and cessation programmes. From 1970 to 1995, comprehensive tobacco control policies were implemented, maintained and upgraded in Australia, Finland, France, Iceland, New Zealand, Norway, Portugal, Singapore, Sweden and Thailand. Tobacco consumption has

remained low or is falling rapidly in these countries, providing clear evidence that the more comprehensive the policy, the more effective the solution. In other countries, partial tobacco control policies and programmes have produced only partial solutions.

A national cancer control programme is an ideal vehicle for tobacco control activities which, if undertaken in isolation, might be rejected for political reasons by ministries of finance and agriculture. Effective tobacco control activities will reduce the incidence of smoking-associated cancers, and also of other conditions for which tobacco is a risk factor, such as cardiovascular disease, respiratory disease, and perinatal mortality. The effect of passive smoking on the incidence of respiratory disease in infants and children, and of lung cancer and probably other cancers in non-smokers shows that tobacco use is not purely a personal responsibility. Serious commitment by the responsible authorities in each country is essential if effective measures to reduce tobacco use are to be implemented. Relevant decisions will have to be taken at the highest level of government to avoid any potential conflict between policies adopted by different ministries.

In developing tobacco control programmes, both general and specific objectives should be formulated. The general objective should take account of the fact that in developed countries about one-third of all cancers are tobacco-related, and thus might be stated as follows: *to reduce the incidence of the cancers caused by tobacco.*

More specific objectives may include the following:

- to reduce the number of young people starting smoking;
- to increase the number of people giving up smoking;
- to educate all schoolchildren about the effects of tobacco on health;
- to inform everyone in the population, smokers and non-smokers, of the risks of smoking;
- to inform smokers about the benefits of giving up smoking and how they can do so;
- to provide support and assistance to people who want to stop smoking;
- to create a smoke-free environment.

These objectives should be supplemented with a set of specific targets or quantitative goals that will enable progress to be assessed in the future. Targets will vary from country to country depending on the prevalence of smoking, but a typical target for the first specific objective might be:

- the proportion of young people who are regular cigarette smokers will be reduced from the 2002 level of x% to y% by the year 2012.

It is important to set realistic targets: failure to achieve them could have

adverse effects on public acceptance of the national cancer control programme as a whole.

Processes need to be set out to achieve the objectives of the programme. They may be relatively inexpensive to implement, but their effects are substantial. They include:

- establishing clear policy on legislative measures, particularly price increases and taxation on cigarettes;
- establishing a national, multidisciplinary tobacco control committee, with members drawn from all concerned government ministries and from non-governmental organizations that can advise on strategies appropriate to the national culture;
- developing human, financial and structural resources with long-term sustainability to support tobacco control;
- establishing a national focal point to stimulate, support and coordinate activities;
- establishing effective programmes of education and public information on tobacco and health, including smoking cessation programmes, with active involvement of health professionals and the media.

Evaluation of the programme's success in achieving expected outcomes requires the following:

- In the short term, a prevalence study of tobacco use to determine the proportion of adolescents and adults who regularly smoke or chew tobacco, as well as information from such a survey or from other data on:
 - the percentage of school curricula and adult literacy programmes that include information on tobacco;
 - the percentage of health professional education programmes and continuing education programmes that include information on tobacco.
- In the medium term, assessment of changes in the incidence of tobacco-associated conditions other than cancer, such as coronary heart disease, and cardiovascular and respiratory diseases.
- In the long term, assessment of the reduction in mortality resulting from lung cancer and other tobacco-linked cancers, and in chronic obstructive lung disease.

Sample sizes for prevalence studies should be sufficiently large to allow the monitoring of changes in risk groups, for example, male/female, urban/rural, young/old, high/low socioeconomic group. Such studies should be undertaken during implementation of the programme and at regular intervals thereafter.

Some patterns of food intake may be causally related to cancer while others may protect against the disease (World Cancer Research Fund, American Institute for Cancer Research, 1997; Key et al., in preparation). Evidence for a quantitative relationship between cancer and food or specific nutrients is, however, not as strong as the evidence for the relationship between cancer and tobacco, or alcohol, or some chemical exposures. Nevertheless, it is thought that dietary factors may be associated with about 30% of cancers in developed countries and perhaps 20% of cancers in developing countries (Key et al., in preparation). Therefore, serious consideration should be given to dietary modification as a means of preventing the disease. A summary of the most recent evidence on the relationship between diet and cancer is given in Table 4.1 (Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases, in preparation).

Fruits and vegetables

The incidence of a number of cancers is low in populations that consume substantial quantities of plant foods, especially of vegetables and fruit (World Cancer Research Fund, American Institute for Cancer Research, 1997). For colorectal cancer, the evidence for a protective effect of fruit and vegetable intake is relatively strong. For other cancers, evidence for a protective effect of some constituents of fruits or vegetables is growing, although for many of the cancer types the available data may only have permitted the analysis of a factor that should be regarded as an index of consumption of plant foods.

Table 4.1 Diet, physical activity and cancer: levels of evidence based on a recent review

Level of evidence	Decrease risk	Increase risk
Convincing	Physical activity ¹	Overweight and obesity ² Alcohol ³ Chinese-style salted fish ⁴ Some mycotoxins (aflatoxin) ⁵
Probable	Fruit and vegetables ⁶ Physical activity ⁸	Preserved meat and red meat ¹ Salt preserved foods & salt ⁷ Very hot food and drinks ⁹
Insufficient	Fibre, soya, fish, n-3 fatty acids, carotenoids, vitamins B ₂ , B ₆ , folate, B ₁₂ , C, D, E, calcium, zinc, selenium, non-nutrient plant constituents	Animal fats, heterocyclic amines, polycyclic aromatic hydrocarbons, nitrosamines

Source: Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases, in preparation

1. Colorectum

2. Oesophagus, colorectum, breast, endometrium, kidney

3. Oral cavity, pharynx, larynx, oesophagus, liver, breast

4. Nasopharynx

5. Liver

6. Oral cavity, oesophagus, stomach, colorectum

7. Stomach

8. Breast

9. Oral cavity, pharynx, oesophagus

For breast cancer, recent analyses of cohort studies have produced inconsistent results. Several studies on stomach cancer have produced consistent evidence of a protective effect of vitamin C. As discussed below, this is likely to reflect the efficacy of this vitamin in inhibiting nitrosamine production (Tomatis et al., 1990).

Protective effects against lung cancer were ascribed to betacarotene, although indices of consumption of betacarotene are largely derived from estimated intake of various vegetables. However, in trials of betacarotene as a chemopreventive agent in heavy smokers and asbestos workers, higher risks of lung cancer were seen in those receiving betacarotene than in the controls (The Alpha-Tocopharol, Beta Carotene Cancer Prevention Study Group, 1994; Omenn et al., 1996). IARC has concluded that betacarotene should not be used as a dietary supplement in humans (IARC, 1998a). It has also concluded that there is no good evidence that vitamin A *per se* is protective (IARC, 1998b).

Protective effects of fruit and vegetable consumption probably extend to oral, oesophageal and stomach cancers (Key et al., in preparation).

Dietary fat

International comparisons indicate a high correlation between dietary fat intake and the occurrence of cancer of the breast, prostate, uterus (body), ovary, and colon. These data parallel the results of animal experiments, as well as a number of epidemiological studies, though recently some cohort studies have failed to confirm the associations noted in previous case-control studies, especially for breast cancer (Hunter et al., 1996), thus casting doubt on the causal nature of the associations. Part of the difficulty could be in accurate quantification of dietary fat consumption at the relevant time in the natural history of many cancers, so that cohort studies may simply be failing to find an association due to a lack of precision in the measurement. In animal studies, polyunsaturated fat appears to increase risk; however the epidemiological studies do not support that in humans.

Meat

There is some evidence that consumption of red meat and, perhaps in particular processed meat, increases the risk of colon cancer (Key et al in preparation). Whether this is a direct effect of substances in red meat, such as saturated fat, or the effect of cooking or food processing methods is uncertain. In nearly every cancer site for which the effect of white meat (for example, chicken) or fish consumption has been evaluated, no increase in risk has been found.

Nitrites and salt

Studies of the declining incidence of stomach cancer have suggested that this trend is related to changes in dietary patterns, particularly the decrease in salting and pickling for food preservation, the increasing use of refrigeration and the associated increase in the availability of fruits and vegetables (and thus vitamin C) year round. Salting and pickling involve certain chemicals that are known to combine with amines in the stomach to produce nitrosamines—powerful carcinogenic agents. This mechanism may account for the high incidence of stomach cancer in some areas of Japan and certain other parts of the world, such as Chile and Costa Rica; the hypothesis is supported by epidemiological studies in North America and Europe (World Cancer Research Fund, American Institute for Cancer Research, 1997). Nasopharyngeal cancer, common in South Asia, has been consistently associated with a high intake of Chinese-style salted fish, a special product which is usually softened by partial decomposition before or during salting (Key et al in preparation).

Further prospective data are needed, in particular to examine whether some of the dietary associations may be partly confounded by *Helicobacter pylori* infection and whether dietary factors may modify the association of *Helicobacter pylori* with risk.

Contaminants

Certain substances naturally present in food and other substances generated during its preparation have carcinogenic potential. Additionally, food may become contaminated with chemicals capable of causing cancer. In Africa and some parts of Asia, for instance, the growth of mould on nuts and other foods under particular conditions of storage produces aflatoxin, a highly potent carcinogen strongly implicated in the high incidence of liver cancer (IARC, 1993). Generally, however, food contaminants are responsible for only a small amount of diet-induced cancer (Tomatis et al., 1990).

Additives

Substances added to food as preservatives or to enhance colour may also be carcinogenic. Since 1956, the Food and Agriculture Organization/World Health Organization (FAO/WHO) Food Standards Programme has set maximum levels for additives, contaminants, and pesticide residues to minimize this possibility. These standards are implemented by the Codex Alimentarius Commission. It seems unlikely that currently permitted additives have any significant effect in increasing the risk of cancer (Tomatis et al., 1990).

Promoting dietary modification

Prevention

Prevention of cancer by dietary means can be encouraged by observing the following public health goal (World Cancer Research Fund, American Institute for Cancer Research, 1997; Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases, in preparation): populations should consume nutritionally adequate and varied diets, based primarily on foods of plant origin.

In addition, the following measures should be advocated for individuals:

1. Maintain body mass index (BMI) in range of 18.5 to 25 kg/m², and avoid weight gain in adulthood.
2. Engage in regular physical activity.
3. Consumption of alcoholic beverages is not recommended: if consumed, do not exceed 2 units per day (1 unit is equivalent to approximately 10 g of alcohol and is provided by one glass of beer, wine or spirits).
4. Minimize exposure to aflatoxin in foods.
5. Chinese-style salted fish should only be eaten in moderation, especially during childhood. Overall consumption of salt-preserved foods and salt should be moderate.
6. Have a diet which includes at least 400 g/day of fruit and vegetables.
7. Meat: those who are not vegetarian are advised to moderate consumption of preserved meat (e.g. sausages, salami, bacon, ham etc.) and red meat (e.g. beef, pork, lamb). Poultry and fish (except Chinese-style salted fish, see 5. above) have been studied and found not to be associated with increased cancer risk.
8. Do not consume very hot foods or drinks.

Countries in which the traditional diet results in a low incidence of diet-associated cancers should take action to ensure that their patterns of food consumption do not change to those of North America and western Europe.

A national cancer control programme offers an opportunity to implement the recommendations of the WHO Study Group on diet, nutrition, and the prevention of chronic disease (WHO, 1990a), the World Cancer Research Fund and American Institute for Cancer Research (1997), and the recent WHO/FAO expert consultation (Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases, in preparation).

Among the measures to be considered to promote dietary modification are the following:

- government recognition of dietary factors in cancer etiology and consideration of the implications of those factors for the relevant ministries

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- (especially health and agriculture);
- appropriate education on diet in schools;
- public education campaigns about diet for adults;
- collaboration with representatives of the food industry (both production and service sectors) to ensure compliance with the nutritional objectives of the programme.

An international strategy comparable to that currently underway for tobacco can be envisaged.

ALCOHOL

Health significance of alcohol

Besides the toxicity of excessive alcohol intake, and the tendency for some individuals to become dependent on alcohol, investigation has also disclosed long-term damage caused by alcohol to the nervous system, the liver, and other organs. These effects often result from years of exposure, generally to levels lower than either those that cause gross intoxication or that are consumed by those with alcohol dependence.

The consumption of alcoholic beverages convincingly increases the risk of cancers of the oral cavity, pharynx, larynx, oesophagus, liver, and breast (and probably colorectum). The increase in risk appears to be primarily due to alcohol *per se* rather than specific alcoholic beverages. Whereas most of the excess risks occur with high alcohol consumption, a small (about 10%) increase in risk of breast cancer has been observed with approximately one drink per day. Recent studies suggest that the excess risk of breast and colon cancer associated with alcohol consumption may be concentrated in persons with low folate intake (Key et al., in preparation).

The carcinogenic effect of alcohol in relation to oral, pharyngeal, laryngeal and oesophageal cancer is exacerbated by tobacco use (IARC, 1988). Primary liver cancer is strongly associated with cirrhosis of the liver, whether induced by toxic or infectious agents. In developed countries, cirrhosis is related principally to alcohol consumption.

The risk relationship between alcohol and cancer is nearly a linear dose-response relationship between volume of drinking and risk. The pattern of drinking does not seem to have an important role. There is little evidence to suggest that consumption of small amounts of alcohol increases the risk of cancer. Moreover, there is evidence that moderate alcohol consumption (no more than two drinks in a single day) is protective for cardiovascular disease.

These patterns are substantially different from the risks of tobacco smoking, where any degree of exposure, active or passive, is hazardous.

Prevention

Controlling alcohol consumption

In any approach to the control of alcohol consumption, it is useful to note several similarities with the problem of tobacco. Both substances are:

- toxic agents that can damage several parts of the body, and also cause cancer;
- favoured by economic advance in developing countries, or among disadvantaged people in developed countries;
- widely supported by social forces such as peer pressure;
- likely to produce or capable of producing physiological dependence;
- backed by strong commercial interests;
- “price elastic”, that is, consumption goes down as their cost to the individual goes up.

Control of alcohol must take into account the wide range of social forces that affect alcohol use. In many Muslim countries, the sale and consumption of alcohol are prohibited whereas in many other countries, wine at meal-times is the social norm and certain groups are especially heavy consumers of stronger alcoholic beverages. Efforts to control alcohol will usually reflect concern about a range of diseases, as well as the domestic, social, and industrial problems that arise from alcohol use. Hence, specific action against alcohol will rarely be justified solely as part of a national cancer control programme. Those involved in cancer control must collaborate with other health interests in seeking to reduce excessive alcohol use and to provide public education about the effects of alcohol on health.

Reducing individual consumption is potentially a powerful strategy against alcohol abuse. However, action directed solely to individuals (in the form of brief interview sessions or alcohol dependence treatment) is unlikely to be fully effective. Practical obstacles to the use of alcohol are required. The most effective action a government can take to reduce individual alcohol consumption is to raise prices through taxation. Other measures that have been tried with varying degrees of success include limiting the places and times at which alcohol is available, raising the age at which alcohol may be purchased, and creating a government monopoly on alcohol sales.

Health promotion activities to reduce alcohol consumption consist of taxation, general public education, and encouraging highly vulnerable groups, such as young people, to avoid or significantly reduce consumption of alcoholic beverages by providing early interventions for those drinking at hazardous levels. Programmes targeting particularly hazardous situations,

such as drinking alcohol and driving, may also be effective. It is important to identify individuals who show signs of alcohol dependence and to provide help. This help can come from health professionals or from self-help groups.

Physical activity and avoidance of obesity

Obesity is epidemic in many developed countries, and is increasingly becoming a concern in many developing countries. Obesity is defined by WHO as a body mass index (BMI) of $\geq 30 \text{ kg/m}^2$, while people with BMI in the range $\geq 25 - < 30 \text{ kg/m}^2$ are classified as overweight. The prevalence of obesity in the United States of America has increased to about 22% of adults, with another 32% of adults being classified as overweight. In Europe, about half the adult population is overweight, and the prevalence of obesity in the urban areas of many developing countries is similar.

Obesity increases the risk of postmenopausal breast cancer, and cancers of the endometrium, colorectum, kidney, and oesophagus. It is also associated with cardiovascular disease and adult-onset diabetes. The fundamental causes of obesity and overweight are societal, resulting from an environment that promotes sedentary lifestyles and over-consumption of high-calorific food. There is also convincing evidence to show that physical activity has a beneficial influence on the risk of colorectal cancer and probably has a beneficial effect on breast cancer risk, independent of its effect on obesity. Taken together, excess body weight and physical inactivity account for approximately one-quarter to one-third of breast cancer, and cancers of the colon, endometrium, kidney (renal cell) and oesophagus (adenocarcinoma).

Moderate activities, such as walking for one hour a day is required to maintain normal body weight, especially in sedentary people. In addition, more vigorous activities such as brisk walking several times a week may give additional benefit concerning cancer prevention. However, obesity cannot be prevented or managed, nor physical activity promoted, solely at the level of the individual. Governments, the food industry, the media, communities and individuals all need to work together to modify the environment so that it is less conducive to weight gain (IARC, 2001). In developing countries without a current obesity problem, the objective should be to enact strategies to prevent their situation from worsening.

As countries industrialize, and the size of their agrarian sector is reduced, a higher proportion of the population has lowered energy expenditure. Sedentary jobs replace more active occupations. As populations become more urbanized, mechanical transportation replaces walking or bicycling, and another source of energy expenditure is reduced. Some modern urban

designs make pedestrian activity unsafe, and a substantial distance between residential areas and workplaces or markets makes using a motor vehicle virtually inevitable. Prevention of the epidemic of obesity and inactivity characteristic of many developed countries is an important part of cancer prevention strategies, in addition to having beneficial effects on cardiovascular disease and diabetes risks.

OCCUPATION AND ENVIRONMENT

It appears that occupational factors are responsible for about 5–10% of all cancers and that environmental factors are responsible for 1–2% of all cancers in industrialized countries. While it is essential to minimize occupational and environmental exposure to carcinogens, the level of public concern may well be disproportionate to the dangers.

Knowledge about occupation and cancer

Historically, exposure of chimney sweeps to soot and of other workers to certain types of mineral oil were found to cause cancer of the scrotum; metal mining gave rise to lung cancer, and chemicals used in dye works to bladder cancer (Tomatis et al., 1990). Systematic investigations have disclosed many more such links throughout the industrialized world. Moreover, the expansion of many industries has accelerated the introduction of new physical and chemical processes that entail exposure to carcinogenic agents.

Identification of occupational factors in cancer etiology is hindered by the fact that as many as 20–30 years may elapse between exposure and disease. However, the concentration of exposure among relatively few workers has made it possible to pinpoint several occupational situations responsible for a variety of cancers. Some examples of the occupations involved are given in Table 4.2.

In industrialized countries, approximately 9% of all malignancies among men result from exposure to carcinogens in the workplace (Miller, 1984); the figure is lower for women. In different regions there may be substantial differences in the amount of cancer attributable to occupation, dependent on the prevailing industries in the area (Vineis et al., 1988). Risk is generally apparent from the age of about 50 years, but maximum risk may not be seen until the post-retirement years, because of the long latent period for induction of many occupationally-induced cancers.

Occupational cancers are now emerging in countries where the process of industrialization is taking place. For example, high levels of lung cancer have been observed among workers engaged in the manufacture of rubber

tyres in some developing countries. Health protection measures in these countries should thus include monitoring the use of potentially carcinogenic materials and processes in industry, providing public education, and enacting appropriate legislation.

Control of occupational cancer

The control of occupational cancer calls for the identification and assessment of existing or potential hazards. Developing countries have an excellent opportunity to learn from the experience of the industrialized countries, and to take steps to avoid the emergence or importation of cancer hazards in

Table 4.2 Selected occupations involving exposure to chemicals, groups of chemicals, industrial processes, or complex mixtures for which there is sufficient evidence to demonstrate carcinogenicity to humans

Industry	Occupation	Site	Causative agent
Agriculture	Vineyard work involving arsenical insecticides	Lung, skin	Arsenic
Extractive (mining)	Uranium mining	Lung	Radon daughters
Asbestos	Mining, manufacture of asbestos-containing products, insulators, etc. Construction work, Ship breaking	Lung, pleural and peritoneal mesothelioma	Asbestos
Petroleum	Shale oil production workers	Skin, scrotum	Polynuclear aromatic hydrocarbons
Metals	Chromium plating	Lung	Chromium
Shipbuilding, motor workers	Shipyard and dockyard workers, motor industry manufacture	Lung, pleural and peritoneal mesothelioma	Asbestos
Chemicals	Vinyl chloride production, dye manufacture and use	Liver angiosarcoma bladder	Vinyl chloride monomer, benzidine, 2-naphthylamine, 4-aminodiphenyl
Gas	Gas workers	Lung, bladder, scrotum	Coal carbonization products, 2-naphthylamine
Rubber	Rubber manufacture	Lymphatic and hematopoietic system (leukaemia)	Benzene
Leather	Boot and shoe manufacture and repair	Nose, bone marrow (leukaemia)	Leather dust, benzene
Furniture	Furniture manufacture and cabinet-making	Nose (adenocarcinoma)	Wood dust
Textiles	Mule spinners	Skin	Mineral oils (containing various additives and impurities)

Source: Tomatis L. et al., eds. *Cancer: causes, occurrences and control*. Lyon, International agency for Research on Cancer, 1990 (IARC, Scientific Publication, No. 100)

industry. Wherever occupational cancer hazards are found to exist, exposure standards must be set that will minimize the risk to workers. This typically requires the appropriate government, scientific, industrial, and labour organizations to review and discuss relevant data and then to agree on controls. Once a quantitative standard is set, industrial processes must be modified to ensure that the agreed maximum exposure level is not exceeded. This may involve the mechanical redesign of a process, substitution of materials, or other significant adaptations. The World Health Organization series *Environmental Health Criteria*, numbering more than 160 monographs, provides guidance on minimizing environmental cancer hazards, including occupational hazards.

Certain industrial processes that demand costly safeguards against exposure to carcinogens are now being exported to countries that are ill equipped to provide those safeguards or to deal with the problems that may arise. International surveillance and control of such situations seem indicated. A valuable source of reference is the list of banned or restricted chemicals and drugs published by the United Nations (New York) and regularly updated: The consolidated list of products whose consumption and/or sale have been banned, withdrawn, severely restricted, or not approved by governments.

Successful control of occupational hazards has been achieved in a number of areas. An excellent example is the modification of manufacturing processes in the dyestuff industry, which substantially reduced the incidence of bladder cancer among workers in the West. Other measures that are valuable in reducing the dangers of unavoidable exposure include the wetting down of potentially carcinogenic particulate matter, to prevent its inhalation; improved ventilation in mines; and use of protective equipment and clothing in many industrial settings.

Cancer control programmes should encourage action at government level to prohibit:

- the importation of hazardous work practices that involve exposure to known carcinogens;
- the dumping of hazardous waste in such a manner that drinking-water or air will become contaminated with carcinogens.

INFECTIONS AND CANCER

Viruses as causative agents

Cancer of the liver is one of the principal human forms of the disease attributable to a virus; chronic infection with hepatitis B or C virus (HBV or

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HCV) (IARC, 1995). Incidence is particularly high in sub-Saharan Africa and eastern Asia where viral hepatitis (HBV) is transmitted at the time of birth or during early childhood. In Japan, Egypt and for some cases of liver cancer in the United States and Europe, the cause appears to be chronic infection with HCV resulting from past use of unsterilized equipment or contaminated blood products.

The sexually transmitted human papilloma viruses are now recognized as the principal cause of cancer of the uterine cervix, especially subtypes 16 and 18 (IARC, 1995). Infection with these viruses is prevalent in young women, but the factors that cause these infections to persist and in some cases result in the development of invasive cancer are still unknown. Some studies have connected papillomaviruses with cancer of the skin and oral cavity.

A causal relationship has also been observed between Epstein–Barr virus (EBV) and Burkitt lymphoma affecting children in central Africa and in Papua New Guinea, and between EBV and nasopharyngeal carcinoma, especially among populations of southern Chinese origin (IARC, 1997).

AIDS

One of the manifestations of the epidemic of acquired immunodeficiency syndrome (AIDS) is Kaposi sarcoma, a form of cancer that occurs in about 10% of AIDS patients in Europe, North America and Africa, now recognized as being caused by human herpes virus type 8 (IARC, 1997). Another AIDS-related neoplasm is non-Hodgkin lymphoma.

There are three modes of transmission of the human immunodeficiency virus (HIV), the cause of AIDS: sexual; parenteral (through direct inoculation of blood or blood products, for example, in blood transfusions, or by sharing of contaminated needles by intravenous drug users); and perinatal (from an infected woman to her foetus or infant, before, during, or shortly after birth). The principal objective in AIDS control is reduction in HIV transmission through promotion of condom use, provision of sterile needles, access to treatment for drug dependence and prevention of mother-to-child transmission using antiretroviral drugs and/or breastmilk substitutes. The first of these measures is in line with programmes designed to prevent cancer of the uterine cervix, so health educators working in the national cancer control programmes should collaborate with AIDS educators to ensure that messages are compatible and mutually supportive.

Parasitic infections

Schistosomiasis is one of the most widespread human parasitic infections, responsible for a substantial amount of bladder cancer in Egypt, Iraq, and

west and south-eastern Africa (IARC, 1994a). The causative organism, *Schistosoma*, passes part of its life cycle in snails that inhabit shallow waters, and is then released into the water, infecting humans by penetrating the skin. Passing of urine or faeces into the water by infected people then continues the life cycle.

A different parasite, the liver fluke, has been shown to give rise to cancer of the bile ducts (cholangiocarcinoma) in south-east Asia and the Korean peninsula (IARC, 1994a).

Bacterial infections

Infection of the stomach lining by a bacterium, *Helicobacter pylori*, known to be a cause of peptic ulcer disease and gastritis, is also a cause of stomach cancer (IARC, 1994a), probably by virtue of its induction of chronic gastritis, recognized to predispose people to stomach cancer. Infection with this bacterium can be eradicated by antibiotic therapy, and it is possible that some of the reduction in stomach cancer in most countries during the 20th century was a result of such therapy. The interaction between infection with *H. pylori* and dietary factors is, however, as yet unresolved, and as indicated above in the discussion of diet, strong associations between diet and stomach cancer are also known and thought to be causal.

Controlling biological agents of cancer causation

Control of cancers induced by biological agents depends upon combating the infection concerned. Essential measures include education to minimize the transmission of infection, for instance teaching people to avoid infected water, unsafe sexual behaviour, injection drug use and sharing of equipment, and urination/defecation in water that will be used by others. Environmental measures, such as eliminating intermediate hosts of the parasites, may be valuable in reducing human exposure. Antiparasitic drugs can successfully treat infestation (and reduce the risk of subsequent cancer), but their use is not a substitute for environmental and personal measures, if the risk of re-infestation remains common.

Effective vaccines would be the most potent weapons against the viruses estimated to cause up to 15% of all cancers. Vaccination is currently available only against the hepatitis B virus. HBV vaccination of infants in areas of high prevalence is being promoted by WHO's Expanded Programme on Immunization as a means of preventing chronic hepatitis. The effect of such vaccination on the incidence of liver cancer should become apparent in about 30 years' time, and there are already some indications that it may be having an effect in reducing liver cancer in young people in Taiwan, China.

Vaccination of injection drug users is another effective measure of preventing the spread of HBV.

Vaccines against the human papilloma viruses that cause cervical cancer are being developed and entering early clinical studies. There is some hope that such vaccines could be effective in those already infected with the virus in preventing the development of cancer (therapeutic vaccines). This could be an additive effect to the usual effect of vaccines against infection, in preventing the establishment of an infection in the first place.

SUNLIGHT

Exposure to excessive ultraviolet radiation from the sun causes all forms of skin cancer (IARC, 1992). Successful education programmes to persuade people to avoid unnecessary exposure to sunlight could dramatically reduce the incidence of both basal cell and squamous cell carcinoma of the skin and probably also of cutaneous melanoma. The main host determinants of susceptibility to melanoma are fair hair and skin. Individuals at high risk are characterized by excessive freckling and benign naevi, with a tendency to burn on exposure to the sun.

The following have been identified as key preventive measures:

- increasing the number of people who are aware of their own risk factors for skin cancer;
- persuading people at high risk to avoid excessive exposure to sun-derived and artificial sources of ultraviolet radiation, and to adopt appropriate protection measures for themselves and their children;
- effecting changes in public attitudes to a tanned appearance.

Promotion of awareness of the hazards of sun exposure by ministries of health and nongovernmental organizations is therefore important in preventing skin cancer. WHO's Intersun Project on ultraviolet (UV) radiation facilitates public and occupational programmes to reduce UV radiation-related health risks, and also develops practical resources in support of those programmes.

The emphasis should be on school programmes aimed at children and young people, because most of lifetime sun exposure occurs during childhood and adolescence. Countries should participate in international agreements to curtail the use of chemicals that damage the earth's ozone layer. In countries where the risk of skin cancer is high, there should be routine monitoring of ultraviolet radiation levels, and the public should be informed whenever levels are particularly high. Avoidance of exposure to the sun between the hours of 11:00 and 15:00 is a sensible precaution.

Use of sunscreens has been controversial. Some studies have suggested that increasing the duration of sun exposure that can be experienced before the skin starts to burn may increase the risk of melanoma and basal cell carcinomas. The use of sunscreens for such purposes should therefore be avoided, and preference should be given to sun avoidance behaviours (IARC, 2000).

SEXUAL AND REPRODUCTIVE FACTORS

The incidence of certain cancers is influenced by a number of sexual and reproductive factors. The risk of breast cancer, for instance, is greater in nulliparous women and in women who have their first child over the age of 25, and especially over age 30. Starting sexual intercourse at a young age and having multiple sex partners have been shown to increase the risk of cervical cancer because of the increased probability of infection with an oncogenic human papillomavirus. Women who have multiple pregnancies incur additional risk, compared to those who have few or none. Women with untreated sexually transmitted infections are also possibly at greater risk of cervical cancer. The use of estrogens to treat menopausal and postmenopausal symptoms produced a significant increase in the incidence of endometrial hyperplasia and cancer, and there is evidence that prolonged use of estrogens by postmenopausal women increases their risk of developing breast cancer (IARC, 1999). This risk seems to disappear after cessation of use for 5 years or more, and is probably outweighed by the beneficial effects on ischaemic heart disease and osteoporosis.

Oral contraceptives are now recognized to increase the risk of breast cancer, at least in young women after prolonged use (IARC, 1999). However, they also reduce the risk of endometrial and ovarian cancer, and the cost-benefit of these combined effects, especially when their other benefits are taken into consideration, justifies their continued use. The use of diethylstilbestrol to treat threatened abortion increased the risk of vaginal cancer among the daughters of women so treated (Lanier et al., 1973). It is not known if an increased risk of breast cancer is evident among women who were themselves treated with diethylstilbestrol.

A national cancer control programme should provide education and information on sexual and reproductive factors relating to cancer.

Appropriate topics include:

- the elements of sexual and reproductive behaviour that are risk factors for various forms of cancer (and for sexually transmitted diseases);
- the importance of “safe sex” and the value of barrier methods of contraception;

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- family planning to help reduce the risk of cancer of the cervix;
- the risks involved in prolonged use of non-contraceptive estrogens.

Instruction in sexual and reproductive behaviour should start at school. It is important that educational programmes on sexual lifestyles for young people are coherent. Such programmes should emphasize the benefits of protected intercourse in reducing cancer of the cervix, as well as AIDS and other sexually transmitted diseases.

A FRAMEWORK FOR HEALTH PROMOTION

Many factors are involved in cancer control. Therefore, to be more effective, broad based health promotion is required. Health promotion uses an integrated approach, emphasizing partnership, intersectoral collaboration and community participation. The Ottawa Charter for Health Promotion (WHO, 1986c) sets out a strategy with five essential actions (see Box 4.1). Health promotion actions contribute towards:

- developing healthy public policies, legislation, and economic and fiscal controls which enhance health and development, for example on environmental pollution, tobacco control and food safety;
- creating environments that are protective and supportive of health, using mediation and negotiation, for example in relation to asbestos and other carcinogenic substances;

Box 4.1 The Ottawa Charter for Health Promotion

The Ottawa Charter for Health Promotion identifies the following essential actions:

- *building healthy public policy;*
- *creating supportive environments;*
- *strengthening community action;*
- *developing personal skills;*
- *reorienting health services.*

Combinations of the five action areas are the most effective. These actions strengthen capacity and support both individuals and society at large in addressing the social, economic and environmental conditions and specific risk factors that determine health, many of which also impact on cancer control (WHO 1986c).

- strengthening community action through social mobilization, for example gaining acceptance of cancer screening;
- increasing individual knowledge and skills using health education and communication, for example creating awareness of the risk factors in relation to cancer and the importance of cancer screening;
- reorienting health services more towards prevention and consumer needs.

Education, public health policy, and environmental support play key roles in health promotion approaches to cancer control.

Education

As an approach to health promotion, education helps people to make healthy decisions and participate in healthy activities by:

- increasing knowledge and motivation;
- changing attitudes;
- increasing the skills needed to maintain good health.

Health promotion initiatives include a number of educational strategies. One of the most widely used is health communication, the process of promoting health by disseminating information through media channels (for example posters, television, newspapers) or interpersonal contacts.

A number of educational initiatives have the potential to reduce the incidence of cancer and mortality from the disease. Examples include:

- training health professionals to provide counselling on smoking cessation and risks from exposure to environmental tobacco smoke;
- offering classes on healthy food preparation and shopping skills;
- disseminating information on the hazardous effects of excess alcohol consumption, especially in conjunction with tobacco smoking;
- maintaining or initiating efforts to ensure the right of employees to know about hazardous substances in their workplaces;
- adopting public education initiatives to increase awareness of environmental health risks and measures that can be taken to address these risks;
- promoting awareness of the risks of common cancers, and their curability if detected early.

Public health policy

Healthy public policies promote the health of individuals and communities by:

- making it easier to adopt healthy practices;
- making it more difficult to adopt unhealthy practices;

- creating healthy social and physical environments.

There are two main approaches to fostering healthy public policies: health advocacy and community organization. *Health advocacy* is the process of lobbying decision makers to take action on health-related issues. *Community organization*, often referred to as community development, is the process of mobilizing communities to take action on their shared health concerns. All efforts to facilitate community action should incorporate the process of empowerment, the ability of individuals and communities to control the factors affecting their health.

Some policies that could enhance cancer control include:

- ensuring tobacco is taxed at an appropriate level, and that tobacco taxes are increased at least enough to keep pace with increases in the cost of living;
- introducing legislation banning smoking in the workplace and in schools;
- introducing mandatory warning labels on tobacco and alcohol products;
- enforcing bans on sales of tobacco or alcohol to minors;
- ensuring that alcohol is taxed and alcohol use is banned in the workplace;
- developing a food labelling system that enables consumers to determine the content and nutritional value of food products;
- ensuring that healthy school meals are available to children who need them;
- introducing legislation to reduce the exposure of workers to carcinogens in the workplace;
- ensuring that hepatitis B vaccination is included in expanded programmes of immunization of children in countries with high HBV transmission rates, as well as in immunization programmes for high risk groups such as injection drug users and sex workers.

Environmental support

Environmental support consists of tangible resources, practices and policies that make it easier for people to maintain their health. Some examples of environmental support that helps to reduce the incidence of cancer are:

- smoke-free public places and workplaces;
- ensuring that there is shade in school playgrounds, especially for populations with fair skins;
- encouraging town and residential planning to ensure that people can exercise when they are able;
- provision of adequate levels of income to purchase nutritious food;
- availability of healthy food choices in schools and workplaces;
- workplaces free from hazardous levels of occupational carcinogens;
- pollution-free soil, air and drinking water.

Education, public health policy and environmental support are complementary approaches to health promotion. Each approach can strengthen the impact of the others. All three approaches are necessary to achieve the three purposes of health promotion: health enhancement, risk avoidance and risk reduction.

Health enhancement

Health enhancement reaches the entire population. Health enhancement activities are designed mainly to increase levels of good health, vitality and resilience in all people. Although health enhancement activities may also prevent disease or reduce health risks, their main focus is to enhance health rather than to reduce or prevent illness. For example, a population-based campaign encouraging people to become more physically active is a health enhancement activity that could help to bring about a reduction in the incidence of several forms of cancer, as well as other noncommunicable diseases.

Risk avoidance

Risk avoidance reaches individuals who have not yet developed the health problems associated with a particular health risk. The goal of risk avoidance activities is to ensure that those at low risk of a particular health problem remain at low risk. An effective health education programme aimed at discouraging young people from experimenting with tobacco consumption is one example of how risk avoidance can be applied to prevent cancer and other noncommunicable diseases. A public education campaign pointing out the advantages of locally grown fruits and vegetables and the hazards associated with consumption of high-fat meat products is another.

Risk reduction

Risk reduction reaches those at moderate or high risk of health problems. The goal of risk reduction activities is to modify the environmental conditions, behaviours or predisposing characteristics that are creating the risk for those vulnerable to a particular health problem. Examples of risk reduction activities aimed at preventing cancer include policies to integrate programmes into the primary health care system that will encourage and support smokers who wish to treat their dependence, and to provide early and brief interventions for reducing hazardous or harmful drinking. Other examples include policies to eliminate hazardous emissions of an occupational carcinogen at a work site.

Health promotion activities need to be coordinated, so it may be necessary to appoint a health promotion expert as part of the multidisciplinary team managing the national cancer control programme. This may be particularly necessary when the cancer control activity could be regarded as contrary to the local culture. A particular example is the difficulty many rural women have with the preventive nature of a cervical cancer screening programme, especially those women no longer in contact with maternal and child health services because of their age. Yet, in every community, those older women are at highest risk of cancer of the cervix, and the programme should be especially directed to them.

PRIORITY PREVENTION ACTIONS FOR VARIOUS RESOURCE LEVELS

All countries should give priority to implementing integrated health promotion and prevention strategies for noncommunicable diseases that are consistent with the present and projected epidemiological situation. As a minimum, these interventions should include tobacco prevention and control, reduction of alcohol use, promotion of a healthy diet and physical activity, and education about sexual and reproductive factors.

Furthermore, all countries should establish policies aimed at minimizing occupationally-related cancers, and legislate to control known environmental carcinogenic agents. Strategies should include legislation and regulation, environmental measures, and education at community, school and individual levels.

Avoidance of unnecessary exposure to sunlight should be recommended, particularly in high-risk populations.

Low-resource countries should focus on areas where there are not only great needs, but also the potential for success. They should ensure that priority prevention strategies are targeted to those groups that are influential and can spearhead the whole process, such as policy-makers, health workers, and teachers. In areas with a high prevalence of cancers induced by biological agents, special measures should be developed to combat the infections concerned, for example, schistosomiasis and hepatitis B. In areas endemic for liver cancer, HBV vaccination should be integrated with other vaccination programmes.

Countries with medium levels of resources should consider developing clinical services for brief, effective counselling on tobacco cessation, and other cancer risk factors as well as strengthening education on sexual and reproductive factors. These activities should take place in primary health care settings, schools and workplaces. Medium-resource countries should

also consider developing model community programmes for an integrated approach to the prevention of noncommunicable diseases.

Prevention

Countries with high levels of resources should implement comprehensive, evidence-based health promotion and prevention programmes, and ensure nationwide implementation of these programmes in collaboration with other sectors. Routine monitoring of ultraviolet radiation levels should be established if the risk of skin cancer is high.

