Chapter 1

Cancer in the twenty-first century

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Introduction

Cancer was recognised as a disease many centuries ago, being mentioned by the ancient Egyptians in 1500 BC. Much later, Hippocrates used the Greek words to describe a crab, carcinos and carcinoma, to describe tumours. The Greek word 'karkinoma', meaning a crab, was used because of the likeness of blood vessels extending out of a tumour to a crab's body and legs. It is known from early Egyptian papyrus that attempts were made to burn or cauterise tumours but that this was always to no avail.

Much has changed since ancient times. Cancer is now part of everyday vocabulary around the world, and although cancer remains the leading cause of death, much has changed with respect to its diagnosis and treatment. Today, it is recognised that about one-third of all cancers are preventable, and improvements in detection and treatment have meant that many people survive the cancer and treatment. Survival rates around the World, however, vary greatly (Coleman et al., 2008). Most of the wide global range in cancer survival is attributable to differences in access to diagnostic and treatment services.

What is cancer and what causes it?

Cancer is not a single disease but rather a group of diseases characterised by uncontrolled cellular growth. There are over 200 different types of cancer arising from different cells of the body. In normal circumstances of cell and tissue division, differentiation and cell death are carefully regulated processes. Cancer can arise when a single cell has lost control of the normal balance of cell proliferation and cell death and appropriate cell differentiation.

Usual cell division involves the exact replication of the DNA helix. For this to take place accurately, a number of mechanisms are in place, and these are influenced by chemicals from within the cell itself, from different cells or by hormones produced by distant tissues and transported in the bloodstream. These influence cell division by binding to receptors on the cell surface and transmitting signals to the cell to stop or start the process of division.

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Table 1.1 Different cancer-causing genes

Type of genes	Action
Oncogenes	Initiate cell division, when faulty increases the rate of transformation from a normal cell to a cancer cell.
Tumour-suppressor genes	Prevent excessive growth of a cell either by control of cell proliferation or by control of DNA repair rate.
DNA repair genes	Work in different ways to repair damaged DNA, for example, to correct mismatched bases, copying errors, errors that distort structure of DNA.
Apoptosis genes	Cells are programmed to reproduce a certain number of times and then they die. There are genes within the cell that control the process. There is much interest in these genes as they may help the understanding of how cells start to self-destruct.

Binding with cell receptors involves the process of phosphorylation or dephosphorylation, which is necessary to transmit the appropriate signal within the cell.

Hundreds of proteins, or genes, are involved in the processes within the cell that involve the exact replication of the DNA helix. Transcription factors are the proteins involved in the regulation of gene expression and carry the signals from the cell surface to the nucleus of the cell and therefore the DNA.

Genes involved in cell division can be divided into four main types, and it is thought that tumours have a fault or mutation in one or more copies of these genes (see Table 1.1).

Knowledge of the underlying genetic causes of cancer has increased rapidly particularly within the past 30 years and has resulted in improvements in the prevention, detection and treatment of cancer. Significant progress has been made in the identification of genes responsible for both sporadic and familial cancers such as BRCA1, BRCA2 (breast, ovarian, colon and prostate cancer) and APC (familial adenomatous polyposis for colon cancer). It is also now accepted that as well as genetic mutations, epigenetic changes and the interactions of genes with lifestyle factors, such as smoking, diet, body weight and exercise, affect the development of cancer. This knowledge brings with it the challenge of how to develop measures to prevent cancers forming. In some familial cancers, this may be through screening, chemoprevention, prophylactic surgery and lifestyle changes.

The environmental factors for cancer development also vary greatly around the world. Increasingly, it is recognised that it is this interaction between genetics and the environment that plays a role in the development of cancer.

The known lifestyle, infectious agents or genetic abnormalities that can cause cancer are outlined in Table 1.2. The causes of cancer are multifactorial, and in any individual different factors will either contribute or protect against the development of cancer.

Development and spread of cancer

Cells, whether they are normal or cancerous, grow and interact with adjacent cells and tissues through a complex network of control signalling, which involves communication

Table 1.2 Factors contributing to the development of cancer

Carcinogens	Substances such as asbestos and tobacco smoke are known carcinogens although not all those exposed will necessarily develop cancer.
Age	Three non-mutually exclusive factors may explain the association of ageing and cancer: (1) the lengthy process of carcinogenesis, (2) molecular changes to tissue with age and (3) age-related environmental changes favouring the growth of cancer cells.
Genetic make-up	A proportion of cancers occur in individuals who are genetically predisposed to develop these cancers. This is about 5–10% of common cancers. The most common abnormality is the BRCA1 and BRCA2 genes that increase the risk of breast and ovarian cancer in women and prostate cancer in men.
The immune system	Cancer is more common in people who have a suppressed immune system which may be due to drugs, for example after organ transplantation, disease affecting the immune system such as HIV or AIDS or in rare medical conditions where the immune system is affected. These conditions tend to increase the rate of cancers caused by viruses such as cervical cancers or in the development of lymphomas.
Body weight, diet and physical activity	Increased body weight, diet and lack of physical activity are thought to contribute to approximately one-third of all cancers worldwide. A thorough and comprehensive review of the evidence has been undertaken by the World Cancer Research Fund and enabled dietary recommendations relating to food intake, body weight and physical activity that are aimed to reduce the risk of cancer (World Cancer Research Fund, 2007). Generally, higher rates of cancer are observed in countries where the diet is lower in fruits, vegetables and plant-based foods and higher in animal products such as meat. The consumption of alcohol, salty foods and mouldy foods also contributes to an increased risk of cancer.
Environment	Environmental hazards include exposure to tobacco smoke, radiation, work-related carcinogens such as asbestos and exposure to the sun. It is difficult to quantify the actual contribution of all these elements to cancer risk.
Viruses	Some cancers can be attributed to viral infections, and it is thought that these may represent approximately 15% of all cancers. Cervical cancer, Kaposi's sarcoma and hepatocellular cancer are all caused by viruses. It is thought that the action is by stimulation of cellular proliferation that is not inhibited by normal cellular or immune control mechanisms.
Bacterial infection	Some bacterial infections cause cancer; for example, *Helicobacter pylori* causes approximately 60% of stomach cancers in developed countries. It works by invading the stomach lining and causing chronic gastritis.

Doll and Peto (1981), World Cancer Research Fund (2007) and Cancer Research UK (2010a).

via both compounds within the membrane of the cell and extracellular growth factors and cytokines. These bind to receptors on the membrane of the cell and influence cell proliferation and differentiation. In cancer, these processes may be altered to produce an unregulated growth of abnormal cells.

As cancer cells divide and grow, they occupy space in the surrounding normal tissue. This is known as local invasion and can result in the cancer-infiltrating local tissue, blood

vessels and the lymph system. When the cancer cells become detached from the primary tumour and enter the bloodstream or the lymphatics, they can become lodged in other tissues in the body. This is a complex process as the cells must penetrate blood vessels or lymphatics to spread throughout the body. Eventually, the cancer cells must develop a new blood supply to grow into a secondary or metastatic cancer.

It is likely that some of the cells that spread are killed by the body's immune system but others may lodge in tissues separate from the primary site of the cancer, causing secondary tumours or metastasis. Often this initial spread will not be detectable by current methods of scanning and is deemed as micrometastases. The pattern of spread is particular to different primary diagnoses but may include spread to essential organs such as the lungs, liver, brain and bones. For some diseases, this spread may have already occurred and therefore may be already present at the initial diagnoses, whilst for others they live with the uncertainty of whether the cancer will recur as metastases. For some types of cancer, this intervening period between treatment of the initial primary cancer and detection of metastases may be a number of years, indicating that the cells may remain dormant or very slow growing during this period.

The aim of the treatment of cancer is not only to eradicate the initial site of cancer growth but also to treat or prevent the spread of cancer cells to other tissues and organs in the body (see Chapter 3 on treatment of cancer). This requires both the detection of such disease and appropriate methods of destroying these cancer cells whilst maintaining the integrity and function of the remaining tissues and organs.

What is the global burden of cancer?

Cancer is an important cause of ill health worldwide. In 2008, an estimated 12.4 million people were diagnosed with cancer. The most common cancers, primarily breast, lung, stomach, bowel or prostate cancer, accounted for 50% of diagnoses. The large populations in Asia mean that they account for a large number of the total global cancer burden and actually represent 45% of all those diagnosed with the most common cancers listed. The contribution of cancer as the cause of death varies around the world (see Figure 1.1). This figure is influenced by the age demographics of the population and access to health care. Generally, survival is positively associated with gross domestic product and the amount of investment in health care. For example, for colorectal cancer, 5-year survival for patients ranges from around 60% in North America, Japan, Australia and France down to 40% in Algeria, Brazil, Czech Republic, Estonia, Poland, Slovenia and Wales (Coleman et al., 2008). Rates also vary within a country with those having access to health insurance showing higher rates of survival.

There are 6.7 million reported deaths from cancer annually; again half of these deaths are in Asia, making up 12% of deaths worldwide. This is more than HIV/AIDS, malaria and tuberculosis combined. It is estimated that there are 24.6 million people alive who have been diagnosed with cancer in the last 5 years; half of these people live in Europe or North America. Survival figures for different types of cancer vary greatly (see Figure 1.2). Advances in treatment have seen survival rates for many cancers increase, and in the United Kingdom over 50% of cancer patients will be alive 5 years after diagnosis.

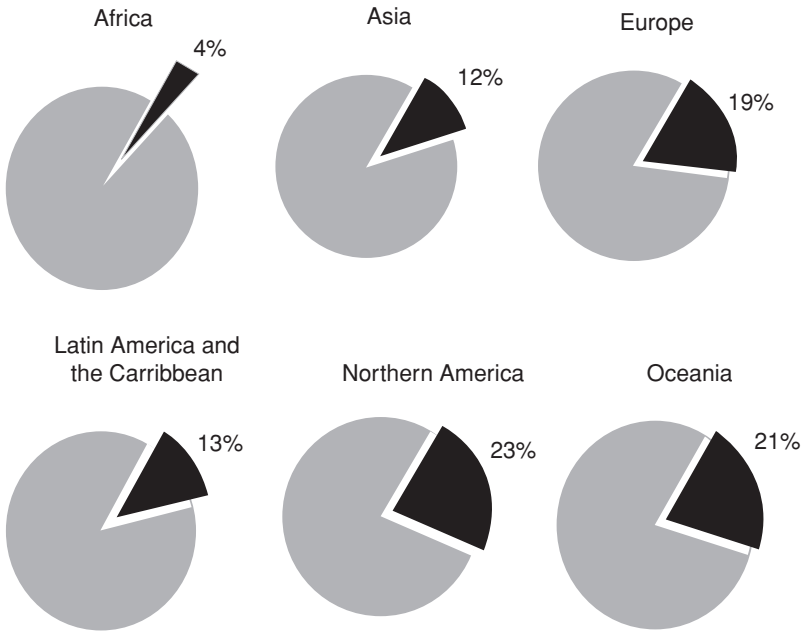

Figure 1.1 Percentage of all deaths due to cancer in the different regions of the world. (Reproduced with kind permission of Cancer Research UK, 2010b.)

Whom does cancer affect?

Cancer can affect anyone of any age. Childhood cancer (below the age of 15) affects about 1500 children a year in the United Kingdom, with a risk factor of 1 in 500. The cancers seen commonly in adults in developed countries are rarely seen in children, and the common childhood cancers are equally rare in adults.

It is important to note that the population of the world is ageing; this is significant because cancer is predominantly a disease of the elderly. Principally, as a result of the post-war baby boom, 10% of the world's population is currently 60 years or older, varying from 20% in the developed world to 8% in the less developed areas. By 2050, the overall percentage will rise to 22%, 33% in the developed world and 19% elsewhere. Consequently, there will be an increase in the number of cancer diagnoses. The many and varied complications of old age are well documented. Hypertension, heart conditions, arthritis and gastrointestinal problems are the most common comorbid illnesses in the elderly population who have cancer, and by the age of 75 a typical patient will have four comorbidities, which also require assessment and apposite treatment (Hurria, 2008). By the age of 85, frailty increases with a decline in vision and hearing, which can make people more prone to injury and functional dependence (Balducci & Extermann, 2000). This will undoubtedly contribute to the assigning of performance status, which will in turn affect the treatment options available.

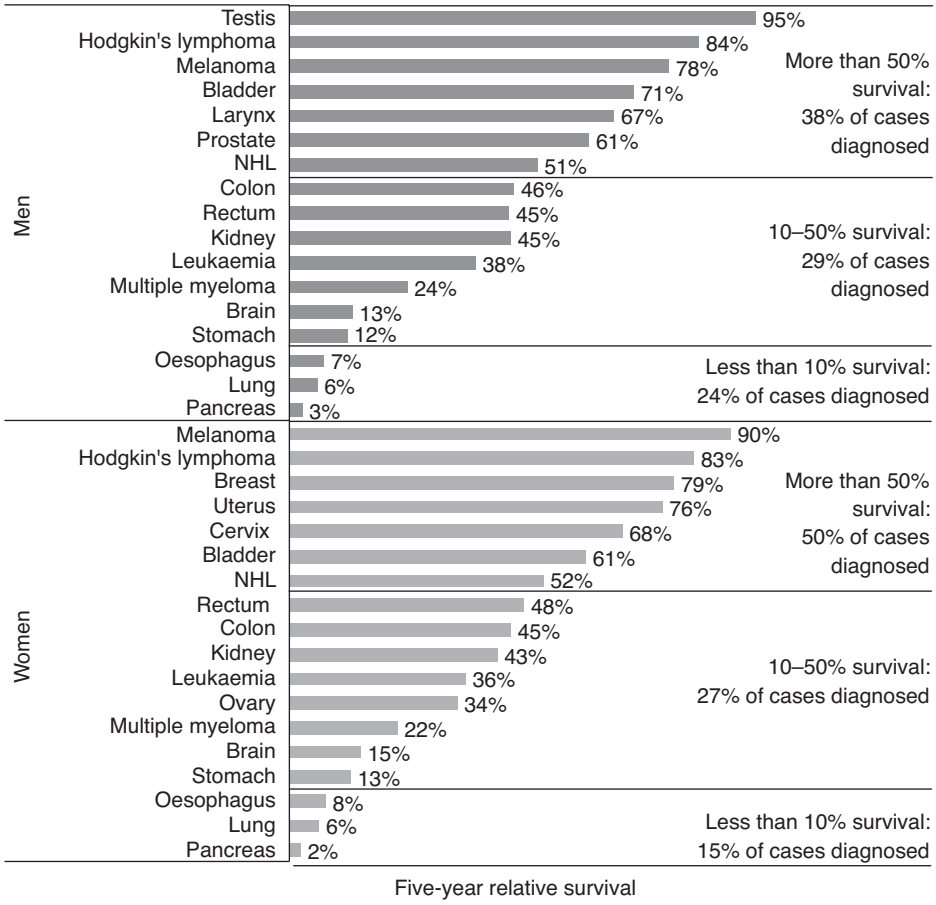

Figure 1.2 Relative 5-year survival estimates based on survival probabilities observed during 2000–2001, by sex and site, England and Wales. (Reproduced with kind permission of Cancer Research UK, 2002.)

Historical perspective on cancer treatment

The history of cancer diagnosis and treatment options is long and varied but allows us to understand the complex global situation of today.

Several thousand years BC, the Chinese and the Egyptians both made descriptions of tumours and the therapies used to treat them, ranging from surgery to five forms of therapeutic care including diet. In 460 BC, Hippocrates, the father of medicine, was born and texts on the treatment of tumours have been subsequently attributed to him. By AD 129, the world saw the birth of Galen, the first person to suggest that breast cancer arose from melancholia.

However, it was not until 1829 that Joseph Recalmier, a French gynaecologist, first used the term 'metastasis' to describe the spread of cancer and 1867 before this mechanism was investigated by Wilhelm Gottfried Waldeyer-Hartz, a German anatomist. In 1830,

the first book containing illustrations of cancer cells as seen under a microscope was published by English surgeon Everard Home, and by 1851 the first hospital in Britain devoted to cancer was opened by William Marsden. In 1895, antibody treatment for cancer was first described by Hericourt and Richet, with several patients receiving an individual antiserum. Despite treatment not resulting in cure, they showed significant improvements in their symptoms. This line of investigation was abandoned in 1929, reappearing in 1975, when Kohler and Milstein's work on monoclonal antibodies was published. This work continues to evolve in the twenty-first century.

Another significant milestone in the diagnosis of cancer was also made in 1895 when Wilhelm Konrad Rontgen discovered X-rays able to visualise bones and soft tissues; within a year of this discovery, there were reports of damage to human tissue caused by the X-rays. By 1898, Marie and Pierre Curie had isolated the radioactive elements of polonium and radium, and by 1904 it was confirmed that radium rays destroyed diseased cells. The use of radiation treatment for cancer remains one of the most significant treatment developments.

In 1902, the Imperial Cancer Research Fund was founded in the United Kingdom, followed in 1907 by the American Association for Cancer Research and in 1909 by the Institute Curie in Paris. International cancer statistics were first published in 1915, and in 1919 James Ewing established oncology as a medical speciality in the United States. These treatment-focused initiatives were complemented in 1911 by the founding of the UK National Society for Cancer Relief by Douglas Macmillan following his father's death from cancer. This experience highlighted to him the importance of the holistic needs of people affected by cancer. During this time individuals working with specific tumours also made significant discoveries, for example the association of aniline used in the dye industry and cancer of the bladder was demonstrated by Lueunberger in 1912 and the eponymous James Ewing described an endothelial tumour of the shaft of long bones in 1920.

The specific classification of tumours began in 1920 when an US pathologist classified tumours into four groups on the basis of differentiation of cells, and in 1944 the TNM (tumour, node, metastasis) classification was proposed. The 1930s saw the combining of radiotherapy and surgery as an effective treatment modality in certain tumours and the passing of the Cancer Act by the British government to aid the early diagnosis and treatment of the disease. At the same time, reports appeared in the literature about how nutritional status may influence the outcome of patients being treated in hospitals. Studley (1936) reported that patients undergoing surgery had a poorer outcome if they had lost weight prior to surgery. However, there is little in the literature about whether nutrition was addressed as part of the treatment or care of the cancer patient (Studley, 1936).

Around this time, advances in treatment were being made with the discovery of the therapeutic effects of radiation. The next notable landmark in systemic anticancer treatment was the announcement in 1946 of the successful use of nitrogen mustard in the treatment of some lymphomas and leukaemia resulting from observations on the blood counts of troops gassed in World War I.

The post-war era brought the founding of the United Nations and the World Health Organization. By 1950, Doll and Hill had demonstrated an indisputable link between cigarette smoking and lung cancer, and in 1959 work was first published on the role of

hereditary factors in breast cancer. Laboratory work also looking at the growth of breast cancer indicated that diet may have a role to play influencing the growth of mammary cancer cells in mice (Silverstone & Tannenbaum, 1950).

During the 1960s and 1970s, major advances were made in the use of chemotherapy in addition to surgery in the treatment of cancer, resulting in an increase in the number of drugs developed. During this time, the developments in intravenous therapy enabled the administration of many more drugs, blood products and electrolyte solutions, thereby allowing the more effective management of critically ill patients (Dougherty & Lamb, 2008). These years also saw the therapeutic advancement of bone marrow transplantation, and by 1971 a cure for childhood leukaemia had been found using a combination of radiotherapy and chemotherapy. With the aim of making the conquest of cancer, a national crusade, the National Cancer Act, was passed in the United States in 1971, with an initial budget of US$500 million. In 1973, another milestone in diagnostics had been reached with the simultaneous trans-Atlantic discovery of computerised axial tomography (CT scanning).

However, advances in the treatment of cancer were not universal, and in 1975 a report from the WHO noted that deaths from breast cancer had not decreased since 1900. This acted as a strong advocate for the use of combination therapies, demonstrating that surgery alone was not sufficient to successfully treat cancer.

By 1975, the cancer-suppressor *P53* gene had been isolated, and the 1980s brought the publication of landmark papers to support the effects of lifestyle on cancer causation. In 'The Causes of Cancer' (1981), Sir Richard Doll suggested that 70% of cancers were connected to diet, and in 1992 the evidence was presented establishing the relationship between ageing and development of cancer (Doll & Peto, 1981). Throughout these developments, there continued to be advances in the support of patients during their treatment. The 1980s proclaimed the development of fine-bore feeding tubes and almost simultaneously percutaneous endoscopic gastrostomy to allow delivery of the vital adequate nutrition needed by people during cancer treatment.

The 1980s also saw the role of oncogenes and tumour-suppressor genes in cancer isolated and the 1990s the identification of two breast cancer genes, *BRCA1* and *BRCA2*; by 1999 the human papilloma virus was shown to be present in 99.7% of all cases of cervical cancer.

The twentieth century has witnessed the development of targeted cancer therapies in both radiotherapy and chemotherapy as a result of the discovery of the role of oncogenes. There has also been an increased use of systemic therapy to combat metastatic disease, resulting in a reduction in the amount of radical surgery carried out and an increase in the use of techniques such as laparoscopic and robotic surgery. The century has also seen the further development of biological and hormone treatments and their use as a preventive measure in, for example, prostate cancer.

The future of systemic cancer treatments is increasingly tailored towards the individual utilising the significant progress made in three main areas of research: (1) the inhibition of the angiogenesis factor, to destroy the vital blood supply to a tumour; (2) the interruption of single transduction, the signalling mechanism to the nucleus of a cell; and (3) the introduction of genes into cancer cells for treatment purposes (see Chapter 3).

Increasingly, cancer is now identified as a preventable disease, and whilst much emphasis has been placed on finding a cure, the focus for the twenty-first century is on strategies

that prevent, cure and care with respect to cancer (World Health Organization, 2007). Effective approaches to prevention have been demonstrated around the world, including in less developed countries such as Brazil where tobacco control measures have had an impact on the rates of lung cancer. Other countries are tackling other lifestyle issues such as diet, obesity, physical exercise and alcohol consumption, which will impact on not only cancer but also other chronic diseases.

The global burden of cancer also focuses on access to screening, early detection of cancer, and access to treatment. Some countries are receiving advice on acquiring health devices and technologies that will enable them to offer screening and treatment more effectively to their population (World Health Organization, 2007). There is a particular burden on low- and middle-income countries where the cost of treating cancer, particularly the use of expensive chemotherapy, may prevent access to appropriate treatment. This may also be the case for drugs that palliate symptoms, particularly the use of morphine for pain control.

Cancer survivorship – living with and beyond cancer

A cancer survivor is anyone who has received a cancer diagnosis during his or her life. In the UK, for example there are approximately 2 million cancer survivors; 13% or 1 in 8 of the population over the age of 65 are cancer survivors (Maddams et al., 2009). It is also estimated that 15 years post-diagnosis 40% of people still receive some form of cancer-related care (Corner, 2008). These figures will vary worldwide, where other factors constitute a threat to life.

The concept of surviving cancer is complex; the experience will be unique to the individual but have universal aspects, change over time and be life changing. There will be positive and negative aspects to the experience, and the person will live with an element of uncertainty thereafter. The consequences of receiving a cancer diagnosis and living with and beyond it can be physical, psychological, social or spiritual (Doyle, 2008).

Cancer is now classified as a chronic life-threatening illness and in the developed world where more people are living longer but not necessarily healthier lives. A new attitude to disease management is needed to reflect this, particularly as previously described, cancer is a complex disease. A cancer diagnosis often leads to what Bury describes as 'biographical disruption' where a person is forced to reassess their life (Bury, 1982). Recently, writing autobiographical accounts of the cancer experience has become increasingly prevalent as has the use of daily blogs and tweets, giving the public immediate access to the daily activities and thoughts of people affected by cancer (Picardie, 1998; Armstrong, 2001). These accounts allow for cancer and its meanings to feature in the public psyche, more than ever before, creating a culture where cancer touches everyone's lives. Little et al. comment on the state of limbo people find themselves in between health and wellness, depicting a state of liminality (Little et al., 2000). It is important to note that a cancer diagnosis carries a particular message to the world, and although this is beginning to change, that message remains one of inevitable fatality (Tritter & Calnan, 2002).

Up until now, it has been relatively easy for people to abdicate responsibility for health concerns to health care professionals by the very nature of health service structure and

ethos – *the doctor knows best*. The changing social, financial and political climate that dominates the advent of the twenty-first century means that individuals will need to start to accept personal responsibility for aspects of their health. Wherever possible, the use of chronic disease management on an individual, population and system level and supported self-management techniques needs to be employed to promote empowerment and independence (Forbes & While, 2009). The basic principles of self-management are basic problem-solving skills, decision-making, the finding and utilisation of resources, developing partnerships with health care providers and taking action (Lorig & Holman, 2003). Health literacy levels will vary worldwide, and until people affected by a disease such as cancer understand its causes and consequences, little progress will be made towards creating the empowered survivor (Nutbeam, 2008). The cancer survivor has many needs, but there must also be a cultural shift in society towards the care and support for people affected by cancer with a greater focus on recovery, health and well-being. The United Kingdom is working on a National Cancer Survivorship Initiative, which looks at improving the care pathway for survivors (Department of Health, 2010).

A diagnosis of cancer is known to affect more than just the individual concerned; this heightening of awareness of health issues can and should be capitalised on for the benefit of public health. The 'teachable moment' as described by Demark-Wahnefried presents an ideal way of introducing important public health initiatives such as smoking cessation, the importance of exercise and healthy eating advice such as reducing fat intake, limiting intake of red meat and consuming at least five portions of fruits and vegetables daily (Demark-Wahnefried et al., 2005). However, the uptake of these lifestyle messages is variable; for example studies suggest that only 25–42% of survivors consume at least five portions of fruits and vegetables daily, indicating that such behavioural interventions are not embraced by all. Health promotion guidance is provided by only 20% of oncologists, and further work needs to evaluate how this advice applies to particular diagnostic groups or whether it is suitable for all (see Chapter 9 on late effects of cancer treatment).

Increasingly, it is recognised that patients may require support services and rehabilitation in relation to their cancer, at any point along their care pathway. Often these needs, which may include nutrition, are overlooked, and patients are left without the appropriate assessment and intervention. In the United Kingdom, a national project has been undertaken to produce rehabilitation guidelines which have linked the evidence base to therapy interventions in different cancer diagnoses (NHS Cancer Programme for England, 2007). Nutrition and dietetics features in all the rehabilitation pathways and provides an excellent basis for highlighting patients' need and planning service delivery to those undergoing treatment, post-treatment and for those surviving after a cancer diagnosis.

Nutrition and cancer

Nutrition has been demonstrated to have a key role and influence in many aspects of the development of cancer not only through the direct role of food components and nutrients but also through its influence on body composition, hormones and growth factors. The influence of diet in the causation of cancer is discussed in detail elsewhere in the excellent review by the World Cancer Research Fund (World Cancer Research Fund, 2007).

Once cancer has developed in an individual then a variety of nutritional problems may develop. The interaction of metabolic and nutritional changes may influence body composition, performance status, psychological state and ability to withstand cancer treatment. Treatment in the malnourished patient may pose challenges as it is associated with increased morbidity and mortality. These changes can have a profound impact on the quality of life of the cancer patient and their carers.

Nutrition is therefore crucial in the support of cancer patients undergoing intensive treatment, in the lifestyle changes that cancer survivors may make and in the management of some of the side effects of cancer treatment. For those patients who cannot hope for a cure, food and nutrition may continue to be an important part of ensuring their quality of life, and for all patients, food may remain central to the social aspects of being with family and friends.

This book aims to examine the role of food and nutrition for the cancer patient and the complex interaction of nutrition, the metabolic changes that occur in cancer, nutritional requirements and the provision of appropriate nutritional support for the cancer patient. The provision of dietary advice and nutritional support for the cancer patient must be timely and consider the potential benefits and burden to the patient. It should be in a way that supports the patient to the best effect, taking into account their cancer, treatment, lifestyle and prognosis and be with maximal benefit and minimal risk. Evidence-based practice is the cornerstone of planning nutritional interventions, but in the absence of evidence, good practice guidance and patient's experience contribute to our knowledge of the best methods of support.

As the chance of survival after a diagnosis of cancer increases then it is likely that the nutritional problems that present will also increase and change. The search for the optimal diet for cancer survivors must continue and needs to consider any dietary changes that may influence the chance of recurrence or the development of new primary tumours. It must also consider the potential effect on other chronic diseases such as heart disease and stroke. Increasingly, there will be the presentation of chronic side effects of treatment that influence dietary intake, for example chronic gastrointestinal symptoms or dysphagia caused by radiotherapy. These symptoms have profound physical and psychological consequences for the patient and should be recognised early and managed appropriately. Good nutrition is essential for all and should be considered at all stages of the development and management of cancer.

References

Armstrong, L. (2001) *It's Not About the Bike: My Journey Back to Life*. London: Yellow Jersey Press.

Balducci, L. and Extermann, M. (2000) Management of cancer in the older person: a practical approach. *Oncologist* **5**(3), 224–237.

Bury, M. (1982) Chronic illness as a biographical disruption. *Sociology of Health and Illness* **4**(2), 167–182.

Cancer Research UK (2002) Relative five-year survival estimates based on survival probabilities observed during 2000–2001, by sex and site, England and Wales. Available at: http://info.cancerresearchuk.org/cancerstats/survival/latestrates/index.htm (accessed 21 January 2010).

Cancer Research UK. (2010a) Causes of cancer. Available at: http://info.cancerresearchuk.org/cancerstats/causes/index.htm (accessed 15 January 2010).

Cancer Research UK. (2010b) Percentage of all deaths due to cancer in the different regions of the world. Available at: http://info.cancerresearchuk.org/cancerstats/world/mortality/index.htm (accessed 25 January 2010).

Coleman, M.P., Quaresma, M., Berrino, F., et al. (2008) Cancer survival in five continents: a worldwide population-based study (CONCORD). *The Lancet Oncology* **9**(8), 730–756.

Corner, J. (2008) Addressing the needs of cancer survivors: issues and challenges. *Pharmoeconomics Outcomes Research* **8**(5), 443–451.

Demark-Wahnefried, W., Aziz, N.M., Rowland, J.H., et al. (2005) Riding the crest of the teachable moment: promoting long-term health after the diagnosis of cancer. *Journal of Clinical Oncology* **23**(24), 5814–5830.

Department of Health, Macmillan Cancer Support and Improvement, N. (2010) The National Cancer Survivorship Initiative vision. Available at: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_111230 (accessed 27 January 2010).

Doll, R. and Peto, R. (1981) The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. *Journal of the National Cancer Institute* **66**(6), 1191–1308.

Dougherty, L. and Lamb, J. (2008) *Intravenous Therapy in Nursing Practice*. Oxford: Blackwell Publishing Ltd.

Doyle, N. (2008) Cancer survivorship: evolutionary concept analysis. *Journal of Advanced Nursing* **62**(4), 499–509.

Forbes, A. and While, A. (2009) The nursing contribution to chronic disease management: a discussion paper. *International Journal of Nursing Studies* **46**(1), 119–130.

Hurria, A. (2008) Assessment of the older adult with cancer. *The Journal of Supportive Oncology* **6**(2), 80–81.

Little, M., Sayers, E.J., Paul, K., et al. (2000) On surviving cancer. *Journal of the Royal Society of Medicine* **93**(10), 501–503.

Lorig, K.R. and Holman, H. (2003) Self-management education: history, definition, outcomes, and mechanisms. *Annals of Behavioral Medicine* **26**(1), 1–7.

Maddams, J., Brewster, D., Gavin, A., et al. (2009) Cancer prevalence in the United Kingdom: estimates for 2008. *British Journal of Cancer* **101**(3), 541–547.

NHS Cancer Programme for England (2007) Raising the bar for rehabilitation service provision in cancer and palliative care. Available at: http://www.cancer.nhs.uk/rehabilitation/index.htm (accessed 21 January 2010).

Nutbeam, D. (2008) The evolving concept of health literacy. *Social Science and Medicine* **67**(12), 2072–2078.

Picardie, R. (1998) *Before I Say Goodbye*. London: Penguin.

Silverstone, H. and Tannenbaum, A. (1950) The effect of the proportion of dietary fat on the rate of formation of mammary carcinoma in mice. *Cancer Research* **10**, 448–453.

Studley, H.O. (1936) Percentage of weight loss. A basic indicator of surgical risk in patients with chronic peptic ulcer. *Journal of the American Medical Association* **106**(6), 458–460.

Tritter, J.Q. and Calnan, M. (2002) Cancer as a chronic illness? Reconsidering categorisation and exploring experience. *European Journal of Cancer* **11**, 161–165.

World Cancer Research Fund (2007) *Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective*. Washington DC.

World Health Organization. (2007) The World Health Organization's fight against cancer. Strategies that prevent, cure and care. Available at: http://www.who.int/cancer/publicat/WHOCancerBrochure2007.FINALweb.pdf (accessed 22 January 2010).