

**Radiotherapy in Palliative
Cancer Care: Development
and Implementation**



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**RADIOTHERAPY IN
PALLIATIVE CANCER CARE:
DEVELOPMENT AND IMPLEMENTATION**

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FOREWORD

According to the World Health Organization (WHO), the global burden of cancer is burgeoning. Rates of cancer doubled during the last 30 years of the 20th century. Population growth and the ageing of the world's population have had, and will continue to have, immediate effects on the cancer burden. In the future, more than half of all cancer cases will be diagnosed in low income countries, and about 80% of these patients will have incurable disease at the time of diagnosis. Based on these statistics, palliative care will remain one of the most important worldwide interventions in oncology.

The WHO's 1990 report on cancer pain and palliative care called for integration of efforts to maintain patient quality of life through all stages of cancer treatment. Building on this foundation, the current report was written following an IAEA consultants meeting in October 2007. The aims of the meeting were to recognize and document the diversity and complexity of cancer types, rates, diagnoses and treatment worldwide, and to provide guidelines to ensure optimum delivery of comprehensive palliative cancer care. This report specifically recognizes the role and potential of radiotherapy as a cost effective, palliative tool in cancer care, while also emphasizing the need for training in comprehensive palliative care among the radiation oncology community. The report summarizes current approaches to palliative radiotherapy, and outlines the steps needed to enhance access to palliative radiotherapy and improve the quality of palliative care as a whole through a more integrated and multidisciplinary approach.

The IAEA thanks the experts involved in the preparation of this review for their contributions. The IAEA officer responsible for this publication was E. Salminen of the Division of Human Health.

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EXECUTIVE SUMMARY

Palliative cancer care plays an increasingly important role in global health care for two main reasons [1]: although the cure-rates of cancer are improving in high income countries, cancer continues to be one of the world's leading causes of death, and [2] despite a rise in cancer deaths, survival rates are also steadily increasing. This leads to a population of patients who may be short term or long term survivors but still need to cope with the symptoms and clinical problems caused by cancer and its treatment.

Palliative care is defined as the physical, social, psychological and spiritual care of patients with life limiting illnesses that is delivered by a multidisciplinary team. Palliative care is an approach to improving the quality of life of patients and their families facing problems associated with life threatening disease through the prevention and relief of suffering by means of the early identification and impeccable assessment and treatment of pain and other problems physical, psychological and spiritual. Supporting care is defined as treating the adverse effects of cancer treatment such as nausea, vomiting, infections, cytopenia, mucositis, malignant effusions, paraneoplastic syndromes, oncological emergencies and nutritional support. It aims to optimize the comfort, function and social support of patients and their families at all stages of disease.

Radiotherapy is one of the most effective means of providing palliation of cancer symptoms. The symptoms most commonly relieved with palliative radiotherapy are pain, bleeding and organ obstruction caused by tumours. Recognizing the importance of radiotherapy in palliative care, this topic is routinely included in the curriculum for the training and education of radiation oncologists. Trainees should be familiar with the principles of both palliative and supportive care together with the principles of radiation biology, the indication of the use of radiotherapy as a curative and palliative modality, the control of cancer related symptoms and the adverse effects of treatment.

Criteria for simulation are not formalized in palliative radiotherapy. In keeping with the goals of effective palliation, simulation and palliative radiotherapy techniques should be simplified to maximize the patient's comfort. Simulation and portal imaging are beneficial when treating spinal cord compression or vertebral metastases to ensure the proper coverage of the vertebral bodies. Simulation and imaging are important when palliative radiotherapy fields must account for prior radiotherapy portals, particularly over the spinal cord or other critical structures.

While simulation is usually a standard of care in high income and most middle income countries, it is not always mandatory for palliative radiotherapy, especially for the treatment of long bones such as femur and humerus. The site and volume of tumour involvement are the most important considerations in the development of a palliative radiotherapy treatment plan because of the radiation tolerance of adjacent normal tissues. Unlike the comprehensive radiation treatment portals used in curative therapy, palliative radiotherapy usually only aims to encompass the tumour volume relevant to symptoms. Treatment planning must minimize possible toxicities and account for prior courses of radiation. Toxicity is reduced by limiting the irradiated volume and through the application of dosimetric principles that minimize integral dose.

In contrast to the low daily radiotherapy doses given in standard curative fractionation (1.8–2.0 Gy per fraction) to total doses of 50–70 Gy in 5–7 weeks, hypofractionation is recommended for most palliative clinical situations. Hypofractionation consists of larger than standard doses per fraction and shorter overall treatment times. Hypofractionated radiotherapy schedules can range from 2.5 Gy per fraction administered over 3 weeks for a total dose of 35 Gy to a single 8.0 Gy dose of radiation for solitary painful bone metastases. A single 8.0 Gy fraction is routinely given in most European countries and Canada for uncomplicated painful bone metastases given the equivalent outcomes in a wide range of clinical trials. A single large radiotherapy dose is as effective in relieving pain as other more protracted schedules. Retreatment with the same dose is possible if necessary.

What follows is a summary of relevant recommendations:

- (a) Palliative radiotherapy should be integrated into a broader palliative care system. Radiotherapy should be considered in patients receiving symptomatic treatment for advanced/metastatic cancer. Symptoms related to cancer and its treatment should be controlled through the continuum of the disease course. Analgesics, including opioids should be available to optimize pain relief during and after palliative radiotherapy.
- (b) All radiation oncologists should be trained in palliative cancer care. Specific training in palliative cancer care will improve the quality of treatments and strengthen the therapeutic approach. Symptoms of cancer and its

treatment should be systematically documented and monitored. Specific training in palliative radiotherapy is highly recommended as part of radiation oncology training programmes. Continuing medical education in palliative cancer care, including palliative radiotherapy, is essential for all disciplines involved in the care of cancer patients.

- (c) Palliative radiotherapy resources should be optimized. The most cost effective planning processes and fractionation schedules should be applied. Health policy makers should ensure access to palliative radiotherapy to cancer patients with advanced symptomatic disease with treatable symptoms. Palliative cancer care should be delivered with minimal treatment burden and financial costs to the patient.
- (d) Research on palliative radiotherapy is a high priority, especially in low- and middle income countries, since available data mostly comes from developed countries. Different patient populations may require different approaches that can be identified through clinical trials and careful monitoring and evaluation of treatment outcomes. Palliative radiotherapy research should be implemented with representative patient populations. Specific programmes should be developed to fund research on palliative cancer care. Palliative cancer care research should be planned and implemented through a multidisciplinary approach.

SUMMARY

It is estimated that in 2008 there were over 12 million new cancer diagnoses and 7 million cancer deaths worldwide [1]. The World Health Organisation (WHO) predicts that cancer rates will increase from 10 million to 24 million in the next 50 years [1]. More than half of cancer cases will be diagnosed in low income nations, where 80% or more of patients will have incurable disease at diagnosis.

In situations where most patients are diagnosed with incurable disease or where curative treatment is logistically unavailable, as is the case in many low income countries, the allocation of limited health care resources should reflect a greater emphasis on palliative care. Ironically, access to palliative care is greater in health care systems with well developed infrastructures and facilities for prevention, early detection, and curative treatment of cancer. To provide comprehensive cancer care, a multidisciplinary approach is needed. This maximizes the available treatments and interventions, whilst ensuring a cost effective and ethically sound approach to the treatment of patients at each stage of the disease.

Barriers to palliative care may result from its low prioritization in health care policy and education. The WHO expert committee on cancer pain and palliative care report of 1990 called for the integration of efforts directed at maintaining patient quality of life through all stages of cancer treatment [3]. As a result supportive interventions aimed at improving quality of life are needed for patients undergoing both curative and palliative cancer treatment.

The International Atomic Energy Agency is currently collaborating with the Open Society Institute to develop palliative care programmes in Eastern Europe, Africa and India, as well as supporting programmes in other regions of the world, through the International Palliative Care Initiative. OSI partners with the IAEA's Programme of Action for Cancer Therapy, the World Health Organization, the International Agency for Research on Cancer, the International Union against Cancer and the International Network for Cancer Treatment and Research (INCTR), to design, implement and integrate comprehensive and cost effective national cancer programmes across all areas of cancer control and treatment, including palliative care.

It is important to note that palliative care is not only care of the dying, since even with advanced and disseminated cancer, patients are now living longer. The goal of palliative care is to relieve symptoms effectively and efficiently and to maintain the maximum quality of life for the duration of the patient's life. The interventions recommended depend on the patient's clinical status, severity of disease, and the location of the symptomatic site. Radiotherapy has an important role to play as a cost effective and simple method to relieve symptoms caused by bone or brain metastases, tumour bleeding, or visceral/lymphovascular obstruction due to cancer.

This report was written following an IAEA consultants meeting in October 2007 and further electronic communications. The aims of the discussions were to: recognize and document the diversity and complexity of cancer types, rates, diagnoses and treatments worldwide; and to provide guidelines to ensure optimum delivery of comprehensive palliative cancer care. This report makes five recommendations:

- (1) The management and control of cancer symptoms is needed in all health care systems. There is a shortage of palliative care specialists in all health systems, relative to the number of cancer patients needing palliative care.
- (2) Because palliative care specialists can reach only a small proportion of the patients in need, palliative care principles and techniques should form a core element of the medical education for all health care providers, and especially for those who regularly treat cancer patients.
- (3) There is a specific need for training in comprehensive palliative care amongst the radiation oncology community. Radiation oncologists should be knowledgeable in the principles of analgesic therapy and palliative interventions in order to comprehensively manage patients' palliative care needs.
- (4) Palliative care guidelines should recognize the role of radiotherapy in palliative cancer treatment, especially where other forms of palliative care treatment may be unavailable.
- (5) There is a need for research to develop a palliative care service that adapts to the available medical facilities, culture, patient performance status, and cancer burden of the geographical area in which it is being provided.

1. INTRODUCTION

1.1. BACKGROUND

Palliative cancer care plays an increasingly important role in worldwide health care for two main reasons. In the first place, although the cure rate for cancer is improving in high income countries, cancer is the world's leading cause of death. Secondly, despite a rise in cancer deaths, cancer survival rates are steadily increasing. Whereas thirty years ago, a patient with liver metastases from colorectal cancer could have expected to live for less than half a year, today such patients typically live for over two years thanks to therapeutic advances. Likewise, patients diagnosed with advanced stage cancer now also have a prolonged prognosis. Thus palliative care represents not only the care of the dying, but also involves the extended care of patients with advanced cancer and metastatic disease.

Whilst surgery, chemotherapy and radiotherapy can all be used with curative or palliative intentions, this report discusses only the role of radiotherapy as a palliative treatment. When delivered using evidence based techniques, radiotherapy can improve the survival rate and/or quality of life of patients with limited and advanced cancer.

Since palliative care specialists can reach only a small proportion of the patients in need, this report advocates the incorporation of palliative care principles and techniques as a standard of medical care for all health care providers, and especially for those professionals treating cancer patients. There is a need to raise awareness of the extent of suffering among cancer patients, and the therapies currently available to relieve the symptoms of cancer. The role of radiotherapy in palliative cancer treatment should be recognized, especially where other forms of palliative treatment may be unavailable. Patient quality of life should remain a priority for both curative and palliative cancer treatments, and indeed health care professionals must incorporate quality assurance measures at all levels of care. To maximize quality of life during the course of cancer, the use of radiotherapy for symptom prevention and symptom management is needed. Figure 1 [4] shows the current thinking regarding the integration of palliative care during the course of cancer.

It is important to note, however, that worldwide, patients require different types of palliative care. A study with two groups of terminally ill cancer patients from the UK and Kenya contrasts the differing needs of patients from a high income country with those in a low income country [5]. In the UK, the main issue expressed by patients was the emotional pain associated with dying, while amongst cancer patients in Kenya, physical pain and financial worries dominated. Kenyan patients believed that their non-physical needs were met through family support, while many of the UK patients believed that these non-physical needs were unmet. These findings reflect a cultural difference in family dynamics between the two nations. It is important to highlight, therefore, that palliative care services should be adapted to the specific local and regional areas in which they operate, and that research should include an awareness of the impact of cultural differences upon service delivery.

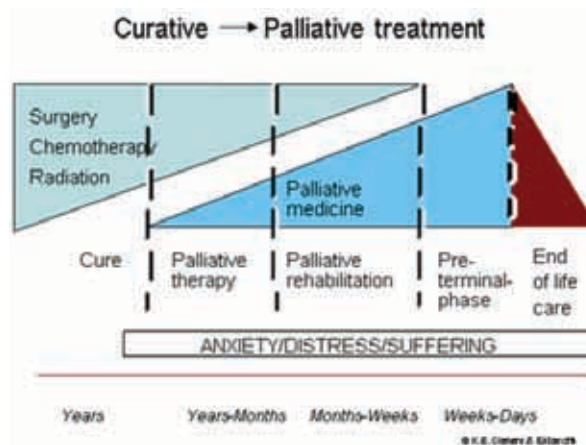


FIG. 1. Integration of palliative care during cancer disease [4].

In this report, palliative care and radiotherapy will be defined, together with a detailed summary of the current thinking on what features a good palliative care programme should contain. The current status of cancer care and palliative therapy across the world will then be detailed, highlighting in particular the shortfalls in current practice, training and resource allocation. The final sections of the report will outline the most effective ways to overcome the current shortfalls and will give guidelines for the planning, implementation and maintenance, from governmental down to grass roots level, of more effective palliative care programmes, with particular reference to radiotherapy.

1.2. CURRENT STATUS OF PALLIATIVE CARE AND PALLIATIVE RADIOTHERAPY

1.2.1. Development of palliative care

Palliative care is defined as the physical, social, psychological, and spiritual support of patients with life limiting illness that is delivered by a multidisciplinary team [6]. Although in most high income nations palliative care has become an established credentialed medical subspecialty on a par with medical oncology, the worldwide need for palliative care remains much greater than the available provision.

Research shows that approximately 30% of patients with newly diagnosed cancer, 30% to 50% of patients undergoing treatment, and 70% to 90% of patients with advanced disease experience pain [7]. While many tumours do not cause pain at diagnosis, tumours that cause obstruction of the respiratory, gastrointestinal or urinary tracts often have pain as their first symptom. Recognizing that cancer patients may experience pain at diagnosis, during treatment, and after treatment when cancer recurs, means that pain is considered one of the most negative factors affecting the quality of life of people with cancer [8]. Pain interferes with normal daily activities, prevents relaxation and sleep, and increases stress and fatigue [9]. The suffering caused by unrelieved pain also creates stress, depression and fatigue among caregivers, friends, and family. Regardless of the stage of disease, however, pain associated with cancer can almost always be relieved by proper treatment and pain relief, and this should be considered a human right. [8].

The WHO, recognizing the need, together with the existing barriers, to improving cancer pain management, set up a working group in Milan, Italy, in 1982 to draft guidelines on cancer pain relief. Building on the foundation of these guidelines, in 1986 the WHO published the manual 'Cancer Pain Relief' and developed a Global Programme for Cancer Pain Relief [10]. Barriers to improving cancer pain management have included lack of professional training in palliative care. However, the WHO's three step analgesic ladder for improving pain management has now been incorporated into clinical practice through professional education initiatives. In addition, the WHO has worked effectively to remove legal sanctions against opioid importation and use in palliative situations for pain management.

In 2002, the WHO updated its definition of palliative care and supportive care, respectively:

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 identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual [11].

Supportive care is defined as treating the adverse effects of cancer treatment, including nausea and vomiting, infections, and cytopenia, mucositis, malignant effusions, oncologic emergencies, paraneoplastic syndromes, and nutritional support. It aims to optimize the comfort, function and social support of the patients and their families at all stages of illness.

The terms supportive care, continuing care and palliative care all describe care that treats the whole patient and the symptoms experienced during the course of cancer with the goal of relieving suffering and maintaining the highest possible quality of life [8]. Although many associate palliative care solely with end of life care, it is increasingly used to refer to symptom control throughout the course of cancer.

Indeed, the WHO's 2002 definition of palliative care states that such care should [8]:

- (a) Provide relief from pain and other distressing symptoms;
- (b) Affirm life and regard dying as a part of the life cycle;
- (c) Intend neither to hasten nor postpone death;
- (d) Offer a support system to help patients live as actively as possible until death;
- (e) Offer a support system to help the family cope during the patient's illness, and in bereavement after the patient dies; this support should also address the specific needs of children;
- (f) Use a team approach to address the needs of patients and their families, including bereavement counselling if indicated;
- (g) Enhance the patient's quality of life, and positively influence the course of the patient's illness.

These principles are echoed by the American College of Surgeons Statement of Principles of Palliative Care [12] which state that the physician should:

- (1) Respect the dignity and autonomy of patients, patients' surrogates and caregivers;
- (2) Honour the right of the competent patient or surrogate to choose among treatments, including those that may or may not prolong life;
- (3) Communicate effectively and empathetically with patients, their families and caregivers;
- (4) Identify the primary goals of care from the patient's perspective and address how the surgeon's care can achieve the patient's objectives;
- (5) Strive to alleviate pain and other burdensome physical and non-physical symptoms;
- (6) Recognize, assess, discuss and offer access to services for psychological, social and spiritual issues;
- (7) Provide access to therapeutic support that encompasses the whole spectrum of care, from life prolonging treatments through to admission to hospice, when the physician can realistically be expected to improve the quality of life as perceived by the patient;
- (8) Recognize the physician's responsibility to discourage treatments that are unlikely to achieve the patient's goals, and encourage patients and families to consider hospice care when the prognosis for survival is likely to be less than six months;
- (9) Arrange for continuity of care by the patient's primary or specialist physician, thus alleviating the sense of abandonment patients may feel when 'curative' therapies are no longer useful;
- (10) Maintain a collegial and supportive attitude toward others entrusted with the care of the patient.

Palliation represents a large component of cancer treatment and includes the use of therapeutic measures such as radiotherapy, chemotherapy, surgery and supportive care measures like opioids and other analgesics. Treatment for palliation is intended to control the symptoms of disease. Controlling symptoms of disease relieves suffering from pain and prevents loss of functional integrity, for example paralysis from spinal cord compression. This is especially important when cancer cannot be eradicated.

Unlike other aspects of cancer therapy, tumour control and survival are not the absolute endpoints of therapeutic success in palliative care.

The need for the development of health care infrastructures and organizations that deal specifically with palliative cancer care has been addressed on many levels. Among the United Nations organizations, the WHO has the primary health care mandate for developing palliative care. Through its PACT programme, the IAEA is partnering with key international organizations to work with low and middle income Member States to develop and implement comprehensive national cancer programmes. The IAEA continues to support capacity development for radiotherapy services through technical cooperation projects and human health activities.

The INCTR, a not-for-profit, non-governmental organization founded in 1998 by the Union for International Cancer Control (UICC) at the Institute Pasteur in Brussels addresses cancer as a relatively neglected area in global health. The National Cancer Institute of the United States of America has agreed to assist the INCTR to achieve its goals by providing financial, technical and intellectual support. The INCTR, in turn, assists developing countries through a structured programme that includes palliative care [13, 14].

A palliative care network can be built with a team of professionals dedicated to interdisciplinary collaboration in developing and delivering symptom management. This requires capital investment, advocacy within

governmental agencies, inclusion into a comprehensive national cancer care programme, and continuous professional education and training. Investment in capacity building through training of professionals including physicians, nurses, pharmacists, and other health care workers is essential.

The National Quality Forum (NQF) created a 'Framework for Hospice and Palliative Care', guidelines from voluntary, evidence based clinical practice in order to guide the growth and expansion of palliative care in the USA [15]. The definition of palliative care was derived from the Centres for Medicare and Medicaid Services (CMS). The CMS definition states that palliative care means patient and family centred care that optimizes quality of life by anticipating, preventing and treating suffering. Palliative care involves addressing the physical, intellectual, emotional, social and spiritual needs of the patient throughout the continuum of illness and to facilitate the patient's autonomy, access to information and choice.

The recognized models of palliative care delivery include [15]:

- (i) Consultation service team;
- (ii) Dedicated inpatient unit;
- (iii) Combined consultative service team and inpatient unit (hospital and nursing home);
- (iv) Combined hospice programme and palliative care programme;
- (v) Hospital or private practice based outpatient clinic;
- (vi) Hospice based palliative care at home;
- (vii) Hospice based consultation in outpatient settings.

The NQF Framework includes eight domains of preferred practice [15]:

(1) Structure and process of care

- (a) Provide palliative and hospice care by an interdisciplinary team of skilled palliative care professionals, including physicians, nurses, social workers, pharmacists, spiritual care counsellors and others who collaborate with primary health care professionals;
- (b) Provide access to palliative and hospice care that is responsive to the patient and family twenty-four hours a day, seven days a week;
- (c) Provide continuing education to all health care professionals in the areas of palliative care and hospice care;
- (d) Provide adequate training and clinical support to ensure that professional staff are confident in their ability to provide palliative care for patients;
- (e) Ensure that hospice care and specialized palliative care professionals are appropriately trained, credentialed and/or certified in their area of expertise;
- (f) Formulate, utilize and regularly review a timely care plan based on a comprehensive interdisciplinary assessment of the values, preferences, goals, and needs of the patient and family, and ensure that all professionals involved in the patient's care are aware of these wishes;
- (g) Ensure that on transfer between health care settings, there is timely and thorough communication of the patient's goals, preferences, values, and clinical information so that continuity of care and seamless follow-up are assured;
- (h) Health care professionals should present hospice as an option to all patients and families when death is expected within a year; and reintroduce the option for hospice if the patient initially declines;
- (i) Enable patients to make informed decisions about their care by educating them on the process of their disease, prognosis, and the benefits and burdens of potential interventions;
- (j) Provide education and support to families and other caregivers based on the patient's individualized care plan.

(2) Physical aspects of care

- (a) Measure and document pain, dyspnoea, constipation, and other symptoms using available standardized scales;
- (b) Assess and manage symptoms and side effects in a timely, safe, and effective manner to a level acceptable to the patient and family.

- (3) Psychological and psychiatric aspects of care**
- (a) Measure, document, and effectively manage anxiety, depression, delirium, behavioural disturbances, and other common psychological symptoms using available standardized scales, and in a manner acceptable to the patient and family;
 - (b) Assess and manage psychological reactions of patients and families in order to address emotional and functional impairment and loss (including stress, anticipatory grief, and coping) in a regular ongoing fashion;
 - (c) Develop and offer a grief and bereavement care plan.
- (4) Social aspects of care**
- (a) Conduct regular patient and family care conferences with physicians and other members of the interdisciplinary team to provide information, discuss goals of care, disease prognosis, advanced care planning, and to offer support;
 - (b) Develop and implement a comprehensive plan which addresses the social, practical, and legal needs of the patient and caregivers, including but not limited to relationships, communication, existing social and cultural networks, decision making, work and school settings, finances, caregiver availability/stress, and access to medicines and equipment.
- (5) Spiritual, religious and existential aspects of care**
- (a) Develop and document a plan based on assessment of religious, spiritual, and existential concerns using a structured instrument, and integrate the information obtained from the assessment into the palliative care plan;
 - (b) Provide information about the availability of spiritual care either through organizational spiritual counselling or through the patient's own religious contacts;
 - (c) Ensure that specialized palliative and hospice spiritual care professionals build partnerships with community clergy and provide education and counselling related to end of life care.
- (6) Cultural aspects of care**
- (a) Incorporate cultural assessment as a component of comprehensive palliative and hospice care assessment, including, but not limited to, decision making, preferences regarding disclosure of information, truth telling, dietary preferences, language, family communication, desire for support measures such as palliative therapies and alternative medicines, perspectives on death, suffering, grieving, and funeral/burial rituals;
 - (b) Provide professional interpretation services and culturally sensitive materials in the patient's and family's preferred language.
- (7) Care of the imminently dying patient**
- (a) Recognize and document the transition to the active dying phase and communicate to the patient, family, and staff the expectation of imminent death;
 - (b) Ensure that the family is educated on a timely basis regarding signs and symptoms of imminent death in a developmentally, age, and culturally appropriate manner;
 - (c) As part of on-going care, routinely ascertain and document the patient's and family's wishes about the care setting for the site of death and fulfil these preferences whenever possible;
 - (d) Provide adequate dosage of analgesics and sedatives to achieve comfort during the active dying phase, and address concerns and fears about using narcotics that hasten death;
 - (e) Treat the body with respect after death according to the cultural and religious practices of the family and in accordance with local law;
 - (f) Facilitate effective grieving by keeping the family as the focus of care and supporting their bereavement process.
- (8) Ethical and legal aspects of care**
- (a) Document the designated decision maker in accordance with local law for every patient in primary, acute, and long term care, and in palliative and hospice care;
 - (b) Document the patient's or designated decision maker's preferences for goals of care, treatment options, and setting of care at first assessment and at frequent intervals as conditions change;
 - (c) Convert the patient treatment goals into medical orders, and ensure that the information is transferable and applicable across care settings, including long term care, emergency medical services, and hospitals;

- (d) Make advance directives and surrogacy designations available in all health care settings, while protecting patient privacy;
- (e) Develop health care and community collaborations to promote advance care planning and completion of advance directives for all individuals;
- (f) Establish or have access to ethics committees or ethics consultation across care settings to address ethical conflicts at the end of life.

1.2.2. The value of radiotherapy as a palliative cancer therapy

Radiotherapy is one of the most effective means of providing palliation of cancer symptoms. The symptoms most commonly relieved with palliative radiotherapy are pain, bleeding, and obstruction caused by the tumour [16]. The symptomatic site is more important to the radiation treatment plan than whether the symptom is caused by locally advanced or metastatic tumour. Common sites palliated by radiation, either alone or in combination with other treatments, include tumour involvement of the lung, pelvis, skin and subcutaneous tissues, brain and bone.

The three most common types of cancer, lung, breast and colorectal carcinoma, have high rates of metastatic spread to bone and visceral structures. Bone metastases are the most common cause of cancer related pain, and over 70% of patients with bone metastases are symptomatic. One of the most important goals in the treatment of bone metastases is to relieve suffering and maintain independent function. Palliative radiation is especially important in weight bearing bones responsible for ambulation and activities of daily living. Several meta-analyses showed that the overall response rate is 60% and the complete response rate is 33%. A recent RTOG randomised trial showed an overall response rate of 66% [17, 18].

Recognizing the importance of radiotherapy in palliative care, its increased availability is included among the recommendations for a Global Core Curriculum in Medical Oncology. This task force recognized the increasing internationalization of health care, exchange of specialists, and rapid flow of information over borders [19]. Within the section of 'Basic Principles in the Management and Treatment of Malignant Disease', the need for training in supportive and palliative care, and radiotherapy is stressed. The recommendations indicate that trainees should know both the principles of supportive and palliative therapies, together with knowledge of the best way to administer them. In addition, trainees should be familiar with the principles of radiobiology, the indications for the use of radiotherapy as a curative and/or palliative treatment, the control of cancer related symptoms, and the adverse effects of the treatment.

1.2.3. Availability of palliative radiotherapy

Radiotherapy requires a fixed infrastructure, sustainable radiotherapy units and trained personnel to meet the needs of cancer patients. Regardless of income level, all countries face issues that make access to radiotherapy potentially problematic. These issues can include the location of the treatment facilities, and difficulties associated with the transportation of the patient to and from this site, together with financial barriers to treatment [20, 21]. These barriers are evident even among high income countries and countries with nationalized health care systems. They can often be alleviated by offering subsidized travel and accommodation during radiotherapy treatment. Efficient radiotherapy schedules, especially single fraction radiotherapy, should also be applied, when appropriate, in order to provide rapid relief of symptoms, increase access to care, and to save costs.

Radiotherapy training programmes worldwide need to incorporate specific training in palliative care. Given that palliative treatment represents the largest segment of clinical radiotherapy practice, this palliative care training must include control of pain and other symptoms using medications and other therapeutics. Certification examinations for radiotherapy should include questions specific to palliative radiotherapy techniques, as well as the palliative treatment of cancer related symptoms with therapeutics other than radiotherapy.

Radiotherapy is needed for treatment in up to 60% of all cancer patients diagnosed in high income countries. The intent of treatment is palliative for between 40 to 70% of radiation treatment courses [21]. In low and middle income countries, palliative radiotherapy is particularly needed as most patients are diagnosed when symptoms are severe and the cancer has advanced beyond cure.

The availability of radiotherapy services is closely linked to the level of medical care and the economic status of a given country [22]. Consequently, the shortage of radiotherapy equipment and staff is more severe in low and middle income countries [23]. Worldwide, there is a need for more radiotherapy facilities, the upgrading of existing

radiotherapy facilities and the training of radiotherapy staff. The IAEA is following the development of these services through the Directory of Radiotherapy Services Database. Further information that sets out what is needed in order to establish a radiotherapy centre can be found in Ref. [21] and other guiding documents produced by the IAEA for safe and good quality radiotherapy practice and training.

Development of academic programmes and accreditation in palliative radiotherapy will help to increase coordination between palliative care services and palliative radiotherapy. The cooperation between radiotherapy education and training programmes of high income and low and middle income countries needs to be strengthened. Distance learning tools can be developed for training in palliative radiotherapy. Benchmarking visits and fellowships in centres of excellence will enhance the transfer of practical skills and knowledge.

Any therapy administered with palliative intent should provide maximum benefit and minimize harm and adverse effects, since the ultimate aim is to relieve or prevent symptoms and to maximize the quality of the patient's life. Therefore, the total dose of irradiation should normally be low and the fraction size large to obtain rapid symptom relief. This differs from the approach used in curative radiotherapy where total dose is high and small fractions are used. Full information, patient consent, and accurate records need to be available for all forms of radiotherapy delivery since re-irradiation may become necessary due to multifocal and progressive disease.

1.2.4. The need for integration of palliative radiotherapy with palliative care in the comprehensive care of cancer

Palliative care services have been developed in 115 of the world's 234 countries [6]. Great variability exists, however, in the integration of palliative care within the wide range of health care systems worldwide. Indeed palliative care has been integrated within existing health care systems, and has achieved recognition within health care policy in only 15% of countries. This does not come close to meeting the global need for palliative care when it is estimated that palliative care could benefit 60% of the 56 million people who die annually from cancer. In his 2007 review of the history of palliative cancer care, Clark calls for a multidisciplinary approach that incorporates a wide variety of palliative therapies, from radiotherapy, to surgery, chemotherapy, anaesthesiology and psychiatric and psychological interventions. [6].

Patients will only be referred for radiotherapy when health professionals understand the value of radiotherapy in curative and palliative cancer management. Currently, however, only ten per cent of physicians receive radiotherapy education during their formal medical training [24].

The strategy to improve radiotherapy services, therefore, needs to be multipronged. It must include training in palliative care and palliative radiotherapy for radiotherapy staff, along with planning for the development of radiotherapy services and investment in equipment.

2. A DEMOGRAPHIC ANALYSIS OF WORLD REGIONS, CANCER TRENDS AND THE AVAILABILITY OF RADIOTHERAPY AND PALLIATIVE CARE SERVICES FOR CANCER PATIENTS

2.1. AFRICA

Africa consists of 54 countries and has a surface area of 30 million square kilometres. At the end of 2005 the population was 912 million, representing 14% of the world's total [25]. It is the poorest continent in the world. According to the International Monetary Fund (IMF), more than 13 African countries have a gross national product under US \$10 billion [26]. It is the only continent that has become poorer in the last 25 years. Many African countries have only started to develop cancer care programmes in recent years [27, 28].

2.1.1. Health care systems; cancer and access to cancer care, radiotherapy and palliative care

Infection and malnutrition are the major health priorities in Africa and few countries have cancer control as a priority. In Africa, cancer is not a disease of the elderly as it is in Europe and North America, but it affects younger populations, mainly due to cancer resulting from HIV, hepatitis and other infections [29]. This increases the socioeconomic burden for families and society as a whole. Currently, South Africa is the only country in Africa with a national cancer control programme. The WHO is involved in preventive work focusing on childhood vaccination programmes against hepatitis B and tobacco control [11]. Tobacco consumption is a major issue in Africa. Indeed, the consumption of tobacco is increasing more rapidly in Africa than anywhere else in the world. This will, of course, increase the incidence of lung cancer and other smoking related cancers.

The WHO estimates that, at present, there are 0.5 million deaths per year from cancer in Africa and that cancer rates are expected to grow by 400% over the next 50 years [30]. The forecasts indicate that the number of cancer cases in Africa will increase to approximately 1 million cases per year by 2020 [31]. In Africa, registration of cancer cases is an issue needing improvement, as most countries have no cancer registry. The WHO and IARC are helping to set up cancer registries in Africa and this is also encouraged in IAEA radiotherapy projects. Cancer registries are needed for accurate statistics to document the incidence of cancer, access to treatment, and the efforts that are taken to improve palliative care in Africa through the help of international organizations [32, 33].

In North Africa breast cancer is the most commonly occurring cancer among women, while in Central and Southern Africa cancer of the cervix is the dominant cancer. In males there is more diversity between regions, with the most common cancers being oesophageal cancer. In males there is more diversity between regions, with the most common cancers being oesophageal cancer (Kenya and United Republic of Tanzania), liver cancer (Ghana), prostate cancer (South Africa, Madagascar and Nigeria), lung cancer (Morocco, Algeria and Libya), bladder cancer (Egypt), Non-Hodgkin's Lymphoma (Sudan), Kaposi's sarcoma (Ethiopia, Uganda, Zimbabwe and Namibia) and colorectal cancer (Mauritius) [11, 29, 30, 34].

As mentioned in the introduction, the palliative care needs of patients in Africa differ from those in the developed world. Basic needs such as food may be more important in the African context than symptom relief. In Africa palliative care is often seen as a necessity for HIV/AIDS patients, and most of the palliative care funding from charities goes to projects associated with HIV/AIDS or tropical diseases.

The WHO has initiated a community based approach to palliative care for HIV/AIDS and cancer patients in five countries, based on a needs assessment carried out in 2002 [34]. The study was conducted in sub-Saharan African countries, (Uganda, Botswana, United Republic of Tanzania, Ethiopia and Zimbabwe) to establish what palliative care programmes are needed. A review of palliative care infrastructure in 47 African countries showed that 21 had no identified hospice or palliative care activity; capacity building is under way to promote hospice and palliative care delivery in 11 countries, the localized provision of hospice and palliative care is in place, often heavily supported by external donors in 11 countries; and only four countries had hospice and palliative care services approaching some measure of integration with mainstream service providers and gaining wider policy recognition. [35]. Over half of these facilities were found in South Africa. WHO found that the greatest needs of terminally ill patients were pain relief, accessible and affordable drugs, and financial support. Family members cared for most patients, although they often lacked the skills to perform their task adequately. The report also found that there was a stigma associated with cancer that was often an obstacle to receiving appropriate care [29, 34, 36]. Lack of awareness of cancer, inadequate training, and limited diagnostic facilities mean that cancer generally presents at an advanced stage in African patients [29]. Poor infrastructures, poverty, ignorance, and cultural factors play a big role in failure to access palliative radiotherapy and palliative care. An important development for palliative care in Africa has been the formation of the African Palliative Care Association (APCA). This group is a driving force behind new developments [34].

The countries identified in the WHO report where palliative care is most developed include South Africa, Kenya, Uganda and Zimbabwe. In the United Republic of Tanzania, Congo, Sierra Leone, Swaziland, Gambia, Morocco, Nigeria, Egypt, Zambia, Namibia and Botswana there are local palliative care programmes. Programmes are usually run by non-governmental agencies. Palliative care training exists mainly in Uganda, South Africa, Kenya, Zimbabwe, and Namibia. The United Republic of Tanzania has limited palliative care training at Ocean Road Cancer Institute and plans are under way to expand it to the rest of the country [34, 36]. Currently the INCTR is working in the United Republic of Tanzania to establish a palliative care programme based on a model in Nepal. Uganda was the first African country to prioritize palliative care in its National Health Plan and it has adopted the

WHO palliation principles. It has compulsory undergraduate medical and nursing education on palliative care based at hospice Uganda that provides palliative services around Kampala and has regional branches throughout the country.

There are three specific reasons why access to palliative care is so limited in Africa. In the first place, access to morphine remains a major problem. There is a close relationship between the lack of palliative care programmes and low morphine use in countries [36]. Several global and national associations such as the APCA, Hospice Palliative Care Association of South Africa (HPCASA), and the International Association for Hospice and Palliative Care (IAHPC) have been working together to influence policy makers on this issue [37, 38].

Secondly, there is a severe shortage of equipment and staff for radiotherapy treatment centres in Africa. A survey of radiotherapy services in 1998 found that nine of the 56 countries had no radiotherapy facilities at all, and many countries had machines that were outdated or which had insufficient capacity. Twenty-two countries had megavoltage equipment; with 155 machines in 69 centres in 40 cities [39, 40]. This represents only 18% of the equipment required to provide a service equivalent to that in developed countries. Twenty one per cent of the population of Africa had no access to radiotherapy at all.

The countries with the largest discrepancies between supply and demand for radiotherapy are Niger, Ethiopia, Congo, and the United Republic of Tanzania. Only one country, Mauritius, has fewer than a million people served by a megavoltage machine. Egypt, Gabon, Libya, Namibia, South Africa, and Tunisia have one teletherapy machine for 1 to 2 million population. Algeria, Cameroon, Morocco, and Zimbabwe have one megavoltage facility for 2 to 10 million population [39, 40]. The remaining countries with equipment have more than 10 million population per megavoltage machine, ranging from 10.4 million in Ghana to 70 million in Ethiopia.

The third reason why access to palliative care in Africa is limited is that available radiotherapy equipment is often not used in the most cost effective way. Despite the lack of equipment and staff in most African countries, there is a tendency not to use evidence based short radiotherapy treatment schedules. In an IAEA patterns of practice study [41], only 61% of centres had a policy of using a single fraction for bone metastases, and 70% of centres used ten fractions for the palliation of brain metastases. Clearly, if evidence based short radiotherapy treatment schedules were used, more patients would benefit from treatment.

In order to combat these problems, the APCA African Palliative Outcome Scale was developed. It seeks to enshrine in health policy a commitment to deliver quality palliative care through education and training from the undergraduate level into continuing education [42, 43]. It is important to note that unlike cancer patients in the UK, whose main concern tends to be the emotional pain associated with dying, worries over physical pain and financial difficulties often dominate amongst cancer patients in Kenya [5]. The need for research to provide a palliative care service appropriate to the needs of African people has been widely endorsed by several stakeholders involved in palliative care activities in Africa. African services largely rely on community volunteers and families to both identify patients who require palliative care and to provide that care. There is a culture of caring for African patients at home, but specialist skills in palliative care are missing.

Figure 2 [44] shows the varied adoption of palliative care policies and programmes across Africa. To meet the WHO standard, a good palliative care policy should include a holistic approach that seeks to control the patient's distressing symptoms, through good knowledge of pain management and access to oral morphine.

2.1.2. Training in radiotherapy and palliative care

Lack of training for radiation oncologists, physicists and radiation therapists is a major problem in Africa, since, as has been noted before, only a few countries have established radiotherapy training programmes.

African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) is an alliance of 33 African countries [45]. Its mission is to develop the infrastructure to use nuclear applications to meet the challenges of sustained communal socioeconomic development in Africa. In conjunction with the IAEA, this alliance is working to improve access to radiotherapy in Africa by encouraging countries to develop radiotherapy services, upgrade equipment, and train health care personnel. Three centres in the region have been nominated as designated centres to develop radiation oncology by providing expertise and support for training and education. The IAEA also supports regional and national training courses and fellowships for professionals working in radiotherapy.



FIG 2. Access to palliative care in Africa (APCA Palliative Care Survey 2007) [44].

2.2. ASIA

Asia comprises roughly one-third of the world's land area and about three-fifths of its population. According to the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the continent includes the two most populous nations in the world, China and India, which together account for some two-fifths of the world's population [46]. Asia's present population of 3.5 billion will have reached over 4.7 billion by 2025. Its population is rising faster than that of Europe or the Americas, and a growing proportion of it is over 65 years of age. In the last 25 years, for example, the population of China has grown by 31% while the proportion of those over 65 years of age has grown by 81%. This compares with a 6% overall population growth, and a 7% growth in the population over the age of 65 years in the UK during the same period [47]. Throughout Asia, the population in the age group of 65 years and older will increase by 314% from 207 million in 2000 to 857 million in 2050.

2.2.1. Health care systems; cancer and access to cancer care, radiotherapy and palliative care

Health care systems in most Asian countries are typically financed by out of pocket payments by individuals. A recent study on health equity in 13 countries in the Asia-Pacific region, the Equity in Asia-Pacific Health Systems (EQUITAP) project, indicated that Sri Lanka and Thailand had the lowest share of out of pocket expenditures for health care within this group [48]. The majority of Asians do not have health insurance, hence the cost of treatment for any one family member is borne by the entire family. Where there is no financial risk pooling mechanism, poor people have to meet the costs of health care from out of pocket payments, driving many households into poverty [49, 50].

Cancer already kills more people worldwide than AIDS, tuberculosis and malaria combined and a high percentage of these deaths occur in the Asia-Pacific region. In 2008, for example, of the world's 7.5 million cancer deaths, more than half (4 million) were in Asia, and of these 2 million occurred in China. [31].

Many epidemiologists and health policy workers have been warning about Asia's approaching cancer epidemic resulting from an aging population, high rates of tobacco use, and increasing rates of obesity. The number of new cancer cases in Asia is set to increase from 6.1 million in 2008 to 8.3 million by 2020 [31]. However, most of the patients in Asia are too poor to afford expensive treatments.

Several challenges are present when dealing with the cancer burden in Asian countries. The incidence of lung cancer which is responsible for the greatest number of cancer related deaths is expected to rise, exceeding death from gastric cancer, currently estimated at 1.2 million deaths from 2005 to 2015 [51]. Tobacco is estimated to kill over 175 million people worldwide between the years 2005 and 2030, with a large majority of these deaths being in Asia. One fourth of deaths among middle aged men in India are caused by smoking and it is predicted that as many as 100 million Chinese current male smokers will die from tobacco use [52]. The prevalence of *H. pylori* infection, which significantly increases the risk of gastric cancer, in Asian countries with low socioeconomic status is extremely high reaching 92% in Bangladesh, 79% in India and 58% in China [53]. The endemic of hepatitis B in Southeast Asia also considerably increases the risk of hepatic cancer.

Like many African countries, most Asian countries belong to low and middle income nation groups. Low and middle income nations have little access to anti-cancer drugs, when high income nations purchase most of the global supply. Large discrepancies are also observed between the estimated need for radiotherapy and its supply in most Asian countries.

Many barriers prevent access to radiotherapy services in Asia. Safe and efficient use of radiotherapy needs trained oncologists, physicists, and technicians. Services are usually provided only in metropolitan centres, and many patients need assistance for travel and accommodation during their treatment. Though some of the Asian countries, including India, have established national cancer control programmes based on WHO guidelines [11], the status of radiation therapy in low and middle income Asian countries, especially in the poorest of countries, is not well developed.

Since 1997, the IAEA has supported a regional project for the improvement of radiation oncology under the Regional Cooperative Agreement for Research, Development and Training (RCA) in cooperation with representatives of South-East Asia and Pacific Member States. Sixteen member states (Australia, Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia, Mongolia, Myanmar, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam) participated in the project. The number of megavoltage machines varied greatly between Member States, ranging from 0.09 to 7.39 machines per million populations. This represents a differential factor of 82. If all countries in the region were included in the analysis, the lower limit of the range would be zero, since some of the Asian countries do not have even a single radiotherapy facility. Only two of the most developed countries, Japan and Singapore, exceed two machines per million of population [54, 55]. Radiotherapy and palliative care facilities are fairly well established in the more developed economies of East Asia such as Japan, Republic of Korea, Hong Kong (China), Singapore, and Taiwan [22, 56].

The IAEA has adopted the suggestion by the Inter-Society Council for Radiation Oncology of the USA that one radiation oncologist can treat 200–250 patients per year [21]. The number of technicians available to operate a megavoltage machine ranges from 1.25 to 6.70 (factor of 5.4). The number of radiation oncologists per million population in Asia, however, correlates strongly with its economic status [55]. Radiation oncologists in many low and middle income countries in Asia also cover duties of diagnostic radiologists, medical oncologists, or medical physicists. Indeed, the number of available radiation oncologists for 1000 cancer cases varies greatly from 0.14 to 3.96 per 1000 cancer cases (factor of 28).

It should be noted, however that cultural barriers to resource development can be equally as important as the financial, educational or logistical barriers outlined above. A case in point are many countries in the Middle East, where there has been little development in palliative care, despite extensive resources and booming urban development over the past 50 years [57].

Approximately 50% of new cancer patients in high income nations are treated with radiation therapy. Using that statistic, there should be more than two radiation oncologists per 1000 cancer incidences. Only four Asian countries currently meet these criteria [55]. As in other low and middle income nations, most Asian cancer patients present with advanced cancer. Although these patients require shorter courses of radiotherapy, the number of cancer patients needing radiation therapy still remains much larger than can be managed with the limited capacity and

resources. Additionally, many radiotherapy units in low and middle income Asian countries do not have proper quality assurance and maintenance systems.

Even a statistically adequate number of radiotherapy units, however, do not necessarily ensure delivery of treatment to the whole population since accessibility may not be guaranteed. This factor is especially significant in countries where the population is scattered over large areas or many islands. The cost of treatment also affects the accessibility to radiotherapy, as low income patients cannot afford the cost of curative or palliative radiotherapy. Studies from high income countries have shown that palliative radiotherapy costs only about one-eighth of the cost of curative therapies, and was more cost effective than analgesia alone or palliative chemotherapy [58]. These costs might not be directly comparable, but the qualitative result is likely to be the same in low and middle income Asian countries [59].

2.2.2. Training in radiotherapy and palliative care

Training programmes for radiation oncologists and technologists differ between, and even within, Asian countries [60, 61]. Many Asian countries have a variety of training programmes in palliative care for doctors and nurses, but none of them are specific to radiation oncologists or palliative radiotherapy. Palliative medicine is an accredited medical specialty with a specific postgraduate training programme in several Asian countries. Palliative care is also included in the undergraduate medical and nursing curriculum in many medical and nursing institutions in these countries [57].

A palliative care strategy must include training in palliative care and palliative radiotherapy for all health care professionals, along with planning for development of radiotherapy services and investment in equipment.

2.3. EUROPE

The Council of Europe, the oldest political organization in Europe, has 47 member states, and the European Union links 27 independent nations as of 2010. Without a doubt, Europe encompasses great diversity, with a wide range of languages, history, cultures, economies, and education and health care systems. For the purposes of this publication, however, regions of Europe can be delineated into two regions, Eastern Europe and Western Europe.

The population of Europe, estimated to be 729 million in 2005 by the UN and representing one-ninth of the total world population, has grown in the past century, but there has been faster growth in other areas of the world, particularly in Africa and Asia [25]. According to a UN population projection (medium variant), Europe's population will have fallen 5% by 2050, to 691 million. Europe is also facing an important demographic change, as the UN forecasts that between 25–26% of the population in European countries will be over the age of 60 years by 2020 [25].

2.3.1. Health care systems; cancer and access to cancer care, radiotherapy and palliative care

2.3.1.1. Eastern Europe

The health care system in Eastern Europe still retains vestiges of the old centralized system of medical care that was characterised by a dense network of practitioners with particular overstaffing in hospitals. The two main consequences of these policies have been that health care provision is largely inadequate, and despite increases in the health care budget, adequate financing of the health care system is extremely difficult. [62].

The following discrepancies within the health care system highlight the imbalance of health care provision in much of Eastern Europe [63]:

- (a) The number of hospital beds per capita remains high, and this is especially evident in public hospitals. The only exceptions to this rule are Latvia, Slovenia, and Estonia, where there is an insufficient number of hospital beds for the countries' needs;
- (b) Whilst specialist medicine is over represented, there is an insufficient number of primary care doctors. In the Czech Republic, for example, there are only 5000 general practitioners compared to 38 000 specialist doctors;

- (c) More emphasis needs to be placed on disease prevention, as the high death rates from cardiovascular disease indicate;
- (d) Health professionals are generally not well paid and are often inadequately trained; their low socioeconomic status has been blamed for the development of a corrupt two tier system of health care.

The historical legacy of the Eastern European health care system presents particular problems when financial reforms are introduced [63]. Indeed, despite a rise in budgets, financing of health care still remains inadequate. After a severe adjustment at the beginning of the period of political transition, health budgets have risen sharply in the majority of Eastern European countries. For example, the Czech Republic and Slovenia approach Western European levels of funding, in proportion to their level of wealth and health indicators. Private spending on health also developed very early in Poland and Hungary. The picture is not the same everywhere, however, and public spending on health remains low in the poorest countries of Bulgaria, Romania, Latvia, and Lithuania where the overall health situation remains particularly rundown.

Even where money has been invested in the health care system, however, reforms have generally failed to increase accountability and incentives to limit costs and waste. Although a system of decentralization of hospital management has begun in Poland, Hungary, Estonia and the Czech Republic, it has not resulted in greater efficiency, and has, in fact often simply passed on the financial burden to the local authorities [63].

In recent years spending on medicines has increased enormously to more than 10% per annum in the Czech Republic. In Poland, the proportion of spending on medicines within the total health expenditure increased from 23% in 1994 to 29.5% in 1999. This compares with figures of 13% and 17% in the UK and Germany in a similar period [63].

The need for reform of the East European health service is therefore urgent, especially when the region's unfavourable demographic trends are taken into account. This needs to be combined with radical reinvestment to update the health care infrastructure in Eastern Europe as a whole [63].

Reform has begun in Slovakia, with the introduction of a patient contribution and a new scale for refunding the costs of medical treatment. However, increasing patient contribution for health care costs may make the cost of curative cancer treatment prohibitively expensive for low income populations within Slovakia. Despite these risks, however, such reforms will also be imperative in Poland, the Czech Republic, and Hungary where public finances continue to deteriorate [63].

TABLE. 1. NUMBER OF HOSPITAL BEDS AND DOCTORS PER 100 000 INHABITANTS (2001) AND NUMBER OF ANNUAL VISITS TO THE DOCTOR (2000) [63]

	Beds	Doctors	Visits
Belarus	699	334	5.4
Czech Republic	1096	378	14.5
Estonia	670	313	6.3
Hungary	806	293	14.7
Latvia	518	296	4.9
Lithuania	869	380	6.6
Poland	718	224	5.4
Romania	749	189	6.4
Slovakia	767	334	16.4
Slovenia	533	227	7.4
EU-15	660	390	5.8

2.3.1.2. Western Europe

Western European countries, involved in a process of political and economic integration, share guaranteed access to health care services for all citizens as a basic value [64, 65]. Despite differences, the health care systems of these countries can be classified in two basic ways, national health services and social security systems.

National health services are based on egalitarian principles and are financed through general taxation, and the health care services are, in general, publicly owned and managed. Social security systems, on the other hand, are financed mostly through obligatory payroll premiums and provide unequal levels of coverage, and the health care services are, in general, private. In countries with social security systems, the share of private health expenditure within the total health expenditure budget tends to be higher [66, 67].

Global competition and the mobility of capital are increasing challenges to welfare states and, therefore, to the health care systems of Western Europe. A common goal of these countries is to increase the efficiency of their health care systems. One health care system may be considered more efficient than another if, for the same level of health care expenditure (costs), it produces either better health outcomes or the same health outcomes with fewer resources [68, 69].

Cancer is second to cardiovascular disease as the main cause of death in the European Union, but the incidence of cancer is rising in Europe [70, 31]. In the next two decades, the ageing of the population is expected to lead to an annual increase of 1–1.5% of cancer cases. In 2006 in the 38 European countries, as defined by the UN, an estimated 3.2 million cancer cases were diagnosed and there were 1.7 million deaths from cancer. The most common form of cancer was breast cancer [429 900 cases), followed by colorectal cancer (412 900 cases) and lung cancer (386 300 cases). Lung cancer causes most cancer deaths worldwide. In men, prostate cancer is the most common cancer followed by lung cancer and colorectal cancer. In females, breast cancer, followed by colorectal cancer and uterine cancer, are the most common cancers [70]. Western Europe has the highest incidence of breast cancer worldwide, with the Netherlands having the highest rate in Europe. In contrast, there is a lower incidence of breast cancer in the countries of Eastern Europe, with Macedonia having the lowest incidence [71]. The incidence

TABLE 2. TOTAL PUBLIC HEALTH SPENDING AS % OF GDP (2001) AND PER INHABITANT IN USD PPA (2000) [63]

	Total spending	Public spending	Inhab.
Belarus	4.2	4.0	—
Czech Republic	7.3	6.7	1106
Estonia	5.5	4.3	594**
Hungary	6.8	5.1	911
Latvia	4.8	3.4	338**
Lithuania	5.7	4.0	426**
Poland	6.2	4.4	558**
Romania	4.5	4.5*	272**
Slovakia	5.7	5.1	682
Slovenia	8.5	7.1	1389**
EU-15	8.5	6.3	2230,6
France	9.5	7.2	—
Germany	9.4	5.2	—

Source: OMS, OCDE *1999; ** 2000.

and mortality of cervical cancer are much lower in Western Europe than Eastern Europe. This is due to the lack of adequate screening, more advanced staging at diagnosis and the lower effectiveness of cancer treatment in Eastern Europe [72].

2.3.1.3. Cancer control in Europe

Most countries in Western Europe have established cancer registries. Austria, Denmark, Finland, Iceland, Ireland, Malta, Norway, Slovenia, Sweden and the UK, have registries that cover 100% of the population [73]. However, several countries in Europe have incomplete cancer registries, and many of the Eastern European countries have no established registries at all. EURO CARE is a European cancer registry project that looks at the survival and care of patients with cancer. The importance of the collection of cancer data is that it allows governments to plan health care policy that responds to the specific cancer burden of the country. The EURO CARE 4 studies have shown that, while overall survival rates for cancer are gradually improving in Europe, Eastern Europe still lags behind the west [73].

While the health ministers of the EU States unanimously approved the European Council's recommendation on cancer screening in 2003 [74], the implementation of cancer screening programmes varies in its extent among the EU member states.

According to the report by the European Commission published in 2008, for breast cancer screening, population based programmes were running or being established in 22 Member States, and 11 Member States (Belgium, Cyprus, Estonia, Finland, France, Hungary, Luxembourg, Netherlands, Spain, Sweden, and the United Kingdom) had completed nationwide rollout of population based programmes based on mammography by 2007 [75].

For cervical cancer screening, population based programmes of cytology based screening were running or being established in fifteen Member States, and seven Member States (Denmark, Finland, Hungary, Netherlands, Slovenia, Sweden and the United Kingdom) had completed nationwide rollout by 2007 [75].

For colorectal cancer screening, twelve of the Member States have adopted the population based approach to programme implementation for screening recommended by the Council of the European Union, and population based programmes were being rolled out nationwide by five Member States (Finland, France, Italy, Poland and the United Kingdom) in 2007 [75].

Screening for prostate cancer by the use of prostate specific antigen (PSA) testing is not recommended because of the lack of proven benefit in improving disease specific survival; however, PSA testing is widespread in the higher income countries of Europe because of public demand. This has led to the huge rise in the diagnosis of prostate cancer seen in Western Europe [76–78].

2.3.1.4. Palliative care in Europe

In Europe two events have been significant in the development of palliative care. The first was the dissemination of a WHO cancer pain relief booklet in 1986 [10]. This, together with its validation study, led to a greater awareness of the problem of cancer pain and heralded an increase in the consumption of opioids. Through attention to pain, an awareness of the multifaceted problems and needs of patients with advanced cancer crept into the daily practice of many health care professionals.

The European Association for Palliative Care (EAPC) was created in 1988, with the aim of increasing awareness and promoting the development and dissemination of palliative care at scientific, clinical, and social levels. The EAPC has produced comparative data for the first time on the status of palliative care in the entire WHO European Region [79–82]. The goal of this project was to assess the current status of palliative care in Europe and to advance policy making. An atlas of palliative care in Europe, produced from the work of this group, showed that palliative care in Western Europe is far better than in Eastern Europe [79, 83].

For Western Europe, the UK is best in terms of its ratio of palliative care services per million population. In Central and Eastern Europe, Poland and Armenia have the best palliative care services. The overall number of palliative care physicians working across Europe is not well documented, but there is one doctor per 100 000 population in those countries that have well developed palliative care services. National palliative care associations exist in 36 of the 52 European countries; the quality of palliative care in a country correlates well with

the presence of a national palliative care association. A wide diversity in service exists between European countries, and a lack of unified standards was observed [83].

EAPC has committed to promote research in palliative care and to set up a research network. This first multicentre study identified the patient populations in Europe using specialist palliative care services [84]. From data on 3013 patients in 22 countries, 27% of patients using specialist palliative care services were ambulatory, and 60% of patients received treatment as an outpatient, undermining the idea that palliative care is only for patients who are at the point of death. The number of patients who participated in the study showed the enthusiasm, capacity and competence for research within the palliative care community in Europe.

As the organization and development of palliative care in Europe is variable, it is only possible to present some snapshots of European palliative care. There are distinct differences among the 34 countries that have at least one palliative care association at the national level [84–86]:

- (a) The UK: there are six different palliative care associations (four for professionals, one common research society, and one umbrella organization);
- (b) France and Italy: each of these countries has one multi-professional association that collaborates closely with a federation of the supporting volunteer associations;
- (c) Germany: there is the German Association for Palliative Medicine (DGP), which includes physicians, nurses and other professions, and two hospice associations;
- (d) Netherlands: the national association is called the Network of Palliative Care Services;
- (e) Belgium and Switzerland: each has palliative care associations catering for the different languages spoken in the country.

There are large variations among EU countries, and even regional variations within countries, in the provision of radiotherapy. In the ESTRO (European Society of Therapeutic Radiation Oncology) QUAntification of Radiation Therapy Infrastructure and Staffing Needs Project (QUARTS), it was demonstrated that even countries which appear to be socioeconomically similar have quite different numbers of linear accelerators per million population with the ratio in the UK being 3.2 per million and that in France being 6.1 per million [87]. In this audit, they used information on cancer incidence rates in the 25 EU countries to estimate the number of megavoltage equipment needed per million population. This was based on treating 450 patients per machine. The estimated need varied between 4.0 per million population in Cyprus, to 8.1 per million population in Hungary. They looked at the ratio between the actual numbers of megavoltage equipment per million and the ideal numbers of megavoltage equipment per country. The largest gap was seen for Slovenia and Poland followed by the Czech Republic and the UK [88].

Under-utilisation of radiotherapy, which is related to a lack of equipment, remains an issue particularly in Eastern European countries. Sweden, France and Belgium were the only countries where therapy units reached or exceeded 90% of estimated needs. When under-utilization of radiotherapy was remedied by increasing equipment levels in Sweden, the number of cancer patients receiving radiotherapy increased from 32% to 47% over a 10 year period [89].

The relationship between equipment and access to radiotherapy has been demonstrated in the UK, where only 39% of cancer patients access radiotherapy [90]. In a UK audit of waiting times for radiotherapy, 60% of patients receiving palliative radiotherapy waited longer than two weeks to receive treatment and it was demonstrated that the percentage of palliative patients waiting more than two weeks for treatment had increased since a previous audit [91]. When radiotherapy resources are limited it seems that cancer patients with a potential for cure are triaged to receive radiation over palliative care patients, and that palliative patients who have a short life expectancy may never receive radiotherapy because of long time delays for treatment.

There is a lack of uniformity regarding guidelines for staffing levels in radiotherapy departments across Europe. The ESTRO QUARTS study looked at guidelines for infrastructure and staffing of radiotherapy departments [87]. They found that guidelines for the optimal number of linear accelerators and personnel were available in about 40% of the countries of the 41 countries surveyed. Most countries had no health policy plan for the number of simulators, treatment planning systems/stations. Guidelines for radiation oncologists varied widely from 1 per 150 patients to 1 per 400 patients among European nations, and this variation was independent of the country's income [92]. The ESTRO QUARTS study found that, the national guidelines for the number of accelerators were, on average, 1 per 183 000 inhabitants in the high, 1 per 284 000 in the medium, and 1 per

500 000 in the low resource countries. The working group suggested that in relation to equipment there should be one accelerator per 450 patients per year and that for every two treatment machines there should be one simulator and/or CT scanner. In relation to personnel, the group suggested to have one radiation oncologist per 200–250 patients and one physicist per 450–500 patients (or one per linear accelerator) [92]. They stressed, however, that these guidelines should be individualized to the population structures, cancer incidence, and treatment strategies of the country in which they are used [92].

Another major European professional society, ESMO (European Society for Medical Oncology) has endorsed the WHO recommendations in palliative care. In 1999 ESMO established a special working group that formed a policy on supportive and palliative care to improve the quality of supportive and palliative care delivered by medical oncologists, and the coordination with other supportive and palliative care clinicians [93, 94]. This policy statement was ratified in June 2002 at the National Representatives meeting in Lugano, Switzerland.

2.3.2. Training in radiotherapy and palliative care

The need to train undergraduate medical students in palliative care has been recognized, and is provided for, in many countries [95]. Since the early 1990s there have been improvements in palliative care in Eastern Europe. The Council of Europe produced a set of guidelines on the organization of palliative care in 2003, which was approved by 45 member countries [96]. These recommendations have been used particularly in Eastern Europe to advocate and lobby for palliative care services. Currently Poland and the Russian Federation have the most advanced programmes in palliative care but there are also signs of substantial achievements in Romania and Hungary.

The OSI's International Palliative Care Initiative (IPCI) has provided funding for palliative care services in Eastern European countries including Azerbaijan, Macedonia, Moldova, Poland, Romania, the Russian Federation, Serbia, Tajikistan and Ukraine. It is currently assessing palliative care needs in Albania and Kazakhstan [97].

Within Western Europe, the UK currently appears to have the most well developed undergraduate training programmes for doctors. Health care professionals are likely to be involved soon after graduation in the care of patients with life threatening illnesses and with those facing death. The media focus on hospice and palliative care has led to a renewed awareness of both the problems faced by cancer patients and the specific educational needs for all health care professionals. Even today, many graduating professionals have an inappropriate fear of prescribing opioids, and are unaware of the core methods of symptom control and of ways of encouraging patients to communicate openly. In postgraduate training the focus switches to the need to provide competent care for an individual patient. A graduate programme needs to focus on the four key domains in learning: knowledge and understanding of skills and competencies; attitudes and professional behaviour; professional development; and personal growth.

As the specialty of palliative care expands, the need to increase the educational opportunities available to graduate health care professionals will also expand. The special nature of palliative medicine with holistic, multi-professional, patient centred care necessitates what some practitioners may find a very new approach. Communication skills, bereavement care, ethical decision making, and spiritual care may be better learned by role playing and reflective practice. Distance learning courses may facilitate the growing need for a geographically diverse group of professionals to learn together, particularly when augmented by residential weekend courses and on-line resources. As well as strengthening existing knowledge, it is important to further encourage the knowledge base of the specialty through research. Appropriately supervised and funded higher research training will advance knowledge and improve patient care through the 21st century.

2.4. LATIN AMERICA

Latin America as a region includes Mexico, which is part of North America, all of Central America, South America, and the Caribbean. In 2005 the population of Latin America was 557 million [25]. About seventy per cent of the population is concentrated in four countries, Brazil (186 million), Mexico (105 million), Colombia (43 million), and Argentina (39 million) [25]. Ninety-seven per cent of the population speaks Spanish or Portuguese with the majority having Spanish as their first language. The IMF defines all Latin American countries as 'other emerging market' and developing countries having a gross national income per capita of less than US \$10 000 [98].

Inequality and poverty continue to be the region's main challenges; according to the United Nations Economic Commission for Latin America and the Caribbean (UNECLAC or ECLAC) Latin America is the region of the world with the greatest degree of inequality between rich and poor. The large variation in life expectancy between countries in Latin America reflects this: life expectancy is 63 and 59 years, respectively in Guyana and Haiti whereas in the Virgin Islands and Puerto Rico life expectancy is 79 and 76 years, respectively [99].

2.4.1. Health care systems; cancer, access to cancer care, radiotherapy and palliative care

In the 1990s there was a major overhaul of national health care systems in Latin America and many reforms were introduced. The consequences of these reforms were decentralization and privatization of the health service [100].

Currently, in most countries there are three sectors involved in health care delivery. These are the public health care systems, social health plans and private health care systems [101]. Cuba differs from other countries in having a universal health care system that is similar to many industrialized countries. It has been shown that the reform of the health sector in most of the Latin American countries has led to a decline in both the quality of, and access to, health services particularly in the public sector [102]. Decentralization has meant that local authorities treating the poor cannot compete with the private health care facilities for the wealthy. Consequently local hospitals treating the poor are left understaffed or are staffed with poorly trained personnel.

Privatization of the health service has also contributed to an inequality between rich and poor. By opening their health care to private markets, several countries have encouraged investment from foreign insurers without adequate regulatory controls to preserve equity and ensure consumer protection [103]. This explains why Brazil, Chile, and Uruguay, despite being low and middle income countries, are included in the seven countries worldwide that finance more than 20% of their health care via private health insurance.

Cancer is now a leading cause of death in Latin American countries, as deaths from communicable diseases and maternal/prenatal mortality have declined despite the existing inequalities of care. The WHO reported that in 2001 nearly half a million Latin Americans died of cancer, and that in 2002 the estimate of new cancer cases was 828 000 [104]. The incidence (crude rate in 2008) varies from 99 per 100 000 population in Nicaragua to 436 per 100 000 population in Uruguay [31]. This higher incidence in Uruguay reflects an older population, a better economy and a more robust system of registration of cancer cases.

Most patients with cancer in Latin America are diagnosed with advanced disease. This is due to the lack of screening and diagnostic facilities. It is estimated that by 2020, if the present trend continues, almost half a million people in Latin America will need palliative care services [105, 106].

In Latin America the most commonly occurring cancer in males is prostate cancer (73 112 cases per year), followed by lung cancer (38 587 cases per year), and stomach cancer (39 481 cases per year). In females, breast cancer dominates (38 921 cases per year), followed closely by cervical cancer (38 567 cases per year), and stomach cancer (20 859 cases per year) [104]. In Central America the incidence of cervical cancer exceeds that of breast cancer.

Cancer control programmes have been implemented recently in Uruguay, Cuba, Costa Rica and Nicaragua [105, 106]. Cervical cancer screening programmes have existed in many Latin American countries, (Chile, Colombia, Costa Rica, Cuba, Mexico, and Puerto Rico), since the 1970s. Apart from Puerto Rico and Chile, there has been no decline in deaths from cervical cancer since the programmes have not been fully developed. Sporadic breast cancer screening programmes have recently been initiated through Breast Health Global Initiative (BHGI).

The WHO and its regional office for the Americas, the Pan American Health Organization (PAHO), made cervical cancer a priority in 1996 because of the high incidence of cervical cancer in Latin America, and because, unlike other regions, the screening programmes to reduce mortality from the disease had failed [107]. Qualitative studies have been undertaken to identify factors that discouraged women from participating in screening programmes and to implement more effective programmes. Research has also been undertaken into whether to, and how to, introduce human papilloma virus (HPV) vaccines [108].

The WHO sponsored an anti-tobacco project that has been successful in reducing smoking levels in Brazil but, in general, tobacco control has not been tackled in Latin America. Ironically, the tobacco industry funds the health system in some Latin American countries [109].

Access to palliative care is extremely limited in many Latin American countries. It is estimated that only 5–10% of Latin American patients receive their required palliative care [110]. The WHO Collaborating Centre, in

the Department of Symptom Research at MD Anderson Cancer Center in Texas, conducted the first cross-national survey of Latin American cancer care providers to evaluate the status of palliative care [101]. Data was collected from 777 health care professionals involved in cancer care in Argentina, Brazil, Cuba, Mexico, and Peru. There was considerable variation in respondents' views on the quality and affordability of, and access to, advanced cancer care across these nations. Access to palliative care was closely related to the quality of cancer care. Other predictors of quality included affordability of care, country of care, income gap quintile (a measure of equity), and institutional availability of opioids. Barriers to development were a low prioritization of palliative care in health care policy and in health care education.

Cuba, the only country with a universal health care system in Latin America, scored highest in terms of providing a quality service in palliative care [101]. Despite this, the palliative care outcome scale (POS) showed that 70% of patients were burdened by time wasted on appointments, and 42% of patients had unresolved pain. Only 41% of the 91 surveyed cancer patients in Cuba were aware of their cancer diagnosis, yet 9% believed that they were dying. Those who were aware of their cancer diagnosis, however, had significantly better scores with respect to symptoms [111].

The lack of opioids is an ongoing issue for advanced cancer patients since very few countries meet the International Narcotics Control Board (INCB) and WHO criteria [112]. The WHO uses consumption statistics by countries as a broad indicator of adequacy of access to morphine. In 1999 the INCB reported that consumption of morphine in the USA was 29 mg per capita, whereas in Latin America per capita rates ranged from 0.14 mg in Mexico to 1.78 mg in Brazil [113]. From these figures it is apparent that opioid consumption is low throughout Latin America. The reasons for this include a lack of recognition of the importance of opioids in managing cancer related pain, lack of education of pharmacists and physicians about the administration and side effects of opioids, and excessive legal barriers which impede access.

The PAHO has recently promoted palliative care as a component of their Cancer Control Initiative. They are involved in a number of ongoing projects to expand the availability and effectiveness of palliative care services [105, 106]. Their goals include:

- (a) Identifying and eliminating those barriers in the legislation that impede access to adequate use of analgesic opioids;
- (b) Educating health care workers to be capable of disseminating and multiplying information on the basics of palliative care and pain relief;
- (c) Establishing palliative care services at the primary health care setting with the intention of performing pain assessment, symptom evaluation and offering the appropriate course of action;
- (d) Designating the resources needed to ensure the long term survival of the service and the permanent availability of opioids [113].

PAHO's palliative care programme includes field demonstration projects to evaluate cost effective options for decentralized palliative care programmes. These projects will be carried out in countries where opioids are available to treat advanced cancer, and with a decentralized health care system. Only three countries in the region have integrated palliative care into public health care laws and regulations. These countries are Cuba, Costa Rica, and Chile. The factors that account for the effectiveness of their programmes include [110]:

- (1) Health policy support;
- (2) Programme development that follows established plans based on needs assessments;
- (3) Interaction with a primary health system that refers patients and collaborates on their care.

In many Latin American health care systems, palliative care is not recognized as a medical specialty. In these systems, many palliative care health professionals must eventually move to other specialties as their positions are unrecognized and often they do not receive salaries. The lack of palliative care personnel means that patients with advanced cancer are often put through inappropriate treatment protocols when relief of symptoms is the only realistic treatment option [111]. The regional palliative care organization in Latin America, 'Asociación Latinoamericana de Cuidados Paliativos' (ALCP), is a network that offers support and transfer of information and knowledge to those working to provide palliative care in Latin America.

Access to radiotherapy is very variable between countries in Latin America. There are several countries, including Guyana, Belize, Suriname, and Haiti, that have no radiotherapy centre. The IAEA carried out a comprehensive survey of radiation therapy resources in Latin America [114]. They looked at the number of radiotherapy centres, the equipment available, personnel, training, and the source of funding of the existing centres. There were a total of 470 centres in 18 countries, and 75% of centres were in the most populated countries. There were 710 teletherapy machines that included 396 Cobalt and 314 linear accelerators. They graded centres on a scale of 0–3 according to equipment and staffing levels:

- (i) Level 0 was centres with stand-alone teletherapy units;
- (ii) Level 1 was centres with teletherapy, brachytherapy, a treatment planning system, immobilization, a radiation oncologist and at least one part time physicist;
- (iii) Level 2 had simulator imaging, the ability to make individualized shielding blocks and a full time physicist;
- (iv) Level 3 had the above, plus either intensity-modulated radiation therapy (IMRT), stereotactic radiotherapy or intra-operative radiotherapy.

Of the 470 centres surveyed by the IAEA, 18% were of level 0 standard, 51% were level 1, 25% were level 2, and 3% were level 3. Level 0 centres were over-represented in Argentina, Bolivia, Ecuador, El Salvador, Mexico, and Paraguay. Simulators were present in 19% of the centres, and treatment planning systems were present in 45% of centres. The range of megavoltage machines per million population ranged from 0.21 in Nicaragua to 4.12 in Argentina, Uruguay, Paraguay. Panama had the highest ratios while Chile, Brazil, Mexico, Peru and Colombia were the least well equipped countries [114].

The data regarding personnel and training documented that there were 933 radiation oncologists, the majority of whom were trained in the region, as two thirds of Latin American countries have an infrastructure for training. There were 357 medical physicists, most of whom had a degree in medical physics; 7 of 14 Latin American countries have formal training programmes in physics. There were 2300 radiation therapists (RT) and it was difficult to determine their qualifications [114].

The IAEA survey identified a diverse range of facilities. The private sector funded 207 centres [44%]. However, many of these private centres were level 0–1. The health sector accounted for 181 centres [39%], and the social security sector contributed only 17 centres [3.6%]. Non-governmental charitable organizations, the universities, municipalities, or the military operated the remaining 13% of the centres [114].

The IAEA survey concluded that the need for palliative care and palliative radiotherapy is very high in Latin America because of late cancer diagnosis. There are currently many bodies addressing this issue, but as it stands, many patients with advanced cancer have no access to palliative radiotherapy or palliative care. This leads to much unnecessary suffering for these patients and their families [114].

2.4.2. Training in radiotherapy and palliative care

Training in palliative care has not been established as a significant focus of undergraduate or postgraduate medical education in Latin America. An on-line survey showed that the vast majority of health care professionals deliver palliative care but fewer than 15% received any specific undergraduate training [112]. Postgraduate training programmes of health care professionals in Latin America are mostly interdisciplinary and vary from long distance learning to formal certificates and diplomas. Training programmes and requirements need to be harmonized.

2.5. NORTH AMERICA

North America includes the countries of Canada, Mexico, and the USA. Culturally and economically, North America comprises Canada and the USA, while Mexico more closely matches Central and South America. Canada is the largest nation in North America having a total land mass of 9.9 million square kilometres, and, with an estimated population of 33.82 million in 2009 has one of the lowest population densities in the world. However, 90% of Canadians live within 160 kilometres of the USA. Having a land mass almost as large as Canada, an area totalling 9.8 million square kilometres, the USA has a population ten times that of Canada, totalling 308.76 million. Covering almost 2 million square kilometres, Mexico is the fifth largest country in the Americas by total land area,

and the 14th largest independent nation in the world. With an estimated population of 109 million, it is the 11th most populous country, and the most populated Spanish speaking country, in the world [115, 116].

In 2006 total health expenditures as a share of gross domestic product was 10% in Canada, 16% in the USA, and 6.4% in Mexico [62].

2.5.1. Health care systems; cancer, access to cancer care, radiotherapy and palliative care

2.5.1.1. Canada

Canada's health care system is a socialized health insurance plan that provides coverage to all Canadian citizens. The health insurance plan is publicly funded by the central Canadian government and by provincial taxes. Following guidelines set by the central Canadian government, the plan is administered on a provincial or territorial basis. Under the Canadian health care system, individual citizens are provided preventative care and medical treatments from primary care physicians, and they have access to specialists and hospitals, dental surgery and additional medical services [117–119]. With a few exceptions, all citizens qualify for health coverage regardless of medical history, personal income, or standard of living.

At a federal level, funds are allocated to provinces and territories via the Canadian Health and Social Transfer (CHST). Transfer payments are made as a combination of tax transfers and cash contributions. In 2000, the Canadian government injected an additional CA \$23 billion of investment into the health care system to upgrade the health care infrastructure and expand access to care [119]. The amount of funding provided by the Federal Canadian Government to the provinces and territories topped CA \$35 billion in 2002–2003, representing 6% of total health care expenditures and 0.6% of the Canadian GDP. However, in the provinces, territories and municipalities, health care represents 64% of the total expenditures, and 6.7% of the GDP. In combination, Canada spends over 7% of its GDP on health care [120].

The public Canadian health system provides only 70% of health care in Canada. In 2002, Canadians spent an additional 30%, representing 3% of the national GDP, on health care in the private sector [117, 120]. Private health insurance plans are usually offered as part of employee benefit packages in many Canadian companies. Many Canadians also purchase private insurance to obtain broader health care coverage, and/or more efficient services outside of the public Canadian health system.

In 2009, Canada had an estimated 171 000 new cases of cancer, and 75 300 deaths from cancer. Lung cancer remains the leading cause, and colorectal cancer the second leading cause of cancer death for both men and women [121]. Both the overall incidence of, and mortality rates from, cancer are higher in Atlantic Canada and Quebec, and are lowest in British Columbia. The increased number of new cases of cancer is largely the result of a rapidly aging population. Nearly half of new cancer cases and 60% of cancer deaths occur among those who are at least 70 years of age. However, a third of new cancer cases and 17% of cancer deaths occur among young and middle aged adults in their most productive stage of life. Based on current incidence rates, cancer will be diagnosed in 40% of Canadian females and 45% of Canadian males, and approximately one in every four Canadians will die from cancer [121].

Two lessons have been learned from the past three decades of the Canadian national cancer control strategy. Firstly, Canada needs to plan for the anticipated increased numbers of cancer cases. The Canadian health care system experienced strain from an increase in cancer incidence after the initiation of cancer screening strategies. The Canadian health care system should include surge capacity to treat cancer, and an enhanced palliative care programme staffed by health care professionals, including oncologists and primary care physicians. Secondly, improved primary cancer prevention is needed in order to reduce the number of avoidable cases of cancer. There are currently about 30 000 primary care doctors in Canada, about one primary care doctor for every 1000 Canadians, and they account for just over half of all physicians. A financial investment of CA \$260 million between 2006 and 2010 was recommended by a 30 member council to improve cancer surveillance and care in Canada [122].

2.5.1.2. United States of America

Health care now consumes 16% of the GDP of the USA. Medicare forecasts are frightening, with large segments of society reaching retirement age and fewer workers remaining to pay for the costs of Medicare [123]. More than 25% of the entire Medicare budget is spent in the last six months of patients' lives [124–126]. The

National Institutes of Health estimate that the overall cost for cancer in 2008 was over US \$228 billion. Of this less than half of the cost, US \$93 billion, was spent for direct medical costs; US \$19 billion was spent on indirect costs due to loss of productivity; and over US \$116 billion was spent on lost productivity due to premature death [127].

Like other diseases, the cost of cancer treatment has become more expensive due to developments in technology and drugs. Patients sometimes have unrealistic expectations for cure of their cancer. Physicians may encourage misplaced hope, especially as new treatments become available, as part of their desire to act as an advocate for the patient. [128–130].

The burdens of cancer were detailed in a study of 1000 terminally ill patients and their family members in six randomly selected cities across the USA. In the previous 6 months, 76% had been hospitalized, 22% had been in the intensive care unit, and 37% had undergone a surgical procedure [131]. More than a third of patients needed to spend more than 10% of their household income on health care, and 16% of families had to take out a loan, spend their savings, or obtain an additional job to cover medical costs [132].

There is a complex health insurance system in the USA. US government based health insurance is available through Medicare and Medicaid. Medicare is the primary health insurance for the elderly and disabled. Medicaid provides health insurance for the poor. Approximately 60% of Americans have private health insurance through their employer.

People without health insurance coverage represent approximately 15% of the population of the USA [133] and receive health care from State and County Hospitals, funded by local tax dollars. They are primarily the working age population who are ineligible for Medicaid and do not have enough resources to purchase individual health insurance. Others, do not apply for Medicaid or State Children's Health care Program (SCHIP), decline employer based health insurance, or are temporarily uninsured based on a change of employment.

Health insurance reform is currently being reviewed within the US legislative process, though any expansion of government programmes in the US health care insurance system would not occur until 2013 due to financial restraints. Comparative effectiveness evaluations, modelled after the National Institute for Health and Clinical Excellence (NICE) in Europe, will be incorporated into reimbursement for Medicare and Medicaid services in the future. This reduced reimbursement is part of the proposed US \$500 billion of cuts for Medicare services in the current legislation [134].

Financing of Medicare is through a payroll tax. Unlike a true insurance policy where sufficient revenue has been kept in reserve, a significant proportion of these payroll taxes have already been consumed. Therefore, the current contributions of working adults are paying for the health care of retired Americans under Medicare. These contributions, however, are not sufficient to cover the increasing costs of Medicare related to an aging population and the increased costs of health care in general. In 2009, the Medicare Board of Trustees indicated the Medicare Trust Fund is not adequately financed over the next 10 years [135, 136]. The funds are projected to be exhausted in 2017, two years earlier than projected in 2008.

In 2008, 45.2 million people, approximately 15% of the US population, were covered under Medicare; the majority, 37.8 million, are aged 65 and older, while 7.4 million receive Medicare benefits based on disability. Currently, Medicare provides coverage of only 70% to 80% of medical costs. To accommodate this shortfall in medical cost cover, Medicare recipients either obtain supplementary private insurance, or, like 22% of Medicare recipients, participate in Medicare Part C. Medicare Part C, or Medicare Advantage, is a private health insurance that contracts with Medicare to provide health services [135]. Importantly, all pre-existing conditions, like cancer, must be covered as long as the coverage with private insurers is obtained within a given period of time after Medicare enrolment. Therefore, Medicare alone is insufficient to provide comprehensive health care coverage for the elderly in the USA.

The US government, in conjunction with State governments, provided health care to 60 million poor adults and children through the Medicaid and SCHIP in 2005. Almost 75% of all uninsured children, compared to 14% of uninsured adults, are eligible for Medicaid or SCHIP [137]. On average, the Federal government funds 57%, and the State governments pay the remaining 43% of the costs of Medicaid [138]. State governments pay the full premium for Medicaid patients over the age of 65 years, accounting for one-fourth of all Medicare patients [135]. Additionally, State governments pay about 90% of the Medicaid Part D prescription drug costs [139]. In most State budgets, Medicaid is the second largest budget item after education, representing billions of US \$ in tax revenues. In 2007, the USA spent US \$305 billion for Medicaid; of which, the Federal government contributed US \$168 billion and the State governments contributed US \$137 billion [140, 141]. Medicaid provided health insurance coverage for 42.6 million people, representing 14% of the population [133].

Private health insurance primarily serves employer based health care, including some state employers. As noted above, private health insurance also includes supplemental Medicare coverage. In 2008, private health insurance provided coverage for 67% of the total population. The working age population, totalling 176 million Americans or 59% of the total population, had employment based health insurance [133]. Most Americans have private health insurance coverage and it represents the most significant aspect of health care financing in the USA.

The US health care system is the most expensive in the world. The cost of health care ranges from between 8% and 11% of GDP in comparable economies [62]. In 2007, the USA spent US \$7421 per person on health care, totalling US \$2.2 trillion and representing 16% of the US GDP. Growing by an average of 2.4 percentage points faster than GDP since 1970, almost half of all health care spending is used to treat only five per cent of the population. Prescription drugs constitute only 10% of total health care expenditures, but the cost of prescription drugs has increased 89% between 2000 and 2007. New technologies and the spread of existing technologies also account for the increase in health care costs [140].

The National Cancer Act of 1971 mandated the collection, analysis, and dissemination of data useful to the prevention, diagnosis and treatment of cancer. This mandate led to the establishment of the Surveillance, Epidemiology, and End Results (SEER) Program [129]. In 2009, there were an estimated 1 479 350 total new cases of cancer, and 562 340 deaths due to cancer in the USA [7]. The most commonly diagnosed cancers are lung cancer (219 440 cases), breast cancer (194 280 cases), prostate cancer (192 280), and colorectal cancer (152 260 cases).

While the overall incidence of prostate cancer remains high among African American males for a variety of genetic and cultural reasons, screening has successfully reached the African American population. With improved access to care, mortality rates from prostate cancer have declined faster among African Americans than any other ethnic group in the USA. Among females in the USA, the incidence and mortality rates associated with breast cancer have declined among all ethnic groups due to higher rates of screening, reductions in menopausal hormone replacement therapy, and the availability of better therapies. Declines in lung cancer incidence and mortality reflect the success of tobacco control throughout the USA. Difficulties remain for colorectal cancer screening because of the invasiveness of the preparation and procedure, but efforts to increase screening and more effective therapies have improved colorectal survival rates in the USA [7].

Disparities exist in cancer incidence and mortality among racial and ethnic groups in the USA. African Americans have the highest incidence of, and mortality rate from, all forms of cancer. Caucasians in the USA have the second highest incidence and mortality rate from cancer despite the relatively increased availability of health care among the Caucasian population [7]. The exceptions are the predominance of liver and bile duct, and stomach cancers among Asian American/Pacific Islanders, cervical cancer among Hispanic/Latino women, and kidney cancer among Native Americans/Alaskan Natives. These exceptions are based largely on cultural and genetic factors.

An evaluation of over 620 000 hospice patients demonstrated that, between 1992 and 2000, the proportion of cancer patients in hospice decreased from 75% to 58% [142]. The average length of stay between these time periods also declined from 47 days to 16 days, and 63% of patients were under hospice care for less than 30 days.

The major reason for this decline was a 'special fraud alert', issued by the Office of the Inspector General (OIG) in 1998. This fraud alert was issued again in the second and third quarter of 2000 and accused physicians of fraud if patients survived more than six months under hospice care [143]. The conviction of physicians by federal prosecutors after the fraud alert in 1998 resulted in an abrupt drop in the length of stay in hospice. These fraud alerts, combined with the desire of patients and their families in the USA to continue to battle cancer, contributed to the prolonged administration of aggressive cancer treatment instead of transitioning to palliative care in hospice. As of 2002, 41% of hospices in the USA deliver palliative care services outside of the Medicare Hospice Benefit. Nearly a third of the 3200 hospices in the USA are hospital based [144].

Hospice care and advance directives can save about 15% in health care costs during the last 6 months of a patient's life, resulting in savings of more than US \$10 billion in medical costs per year [145, 146]. This was demonstrated both in Massachusetts, where more than 90% of individuals have conventional health insurance, and in California where 30% of patients have managed care.

More importantly, hospice care improves the quality of the patient's life rather than focusing on futile treatment for incurable cancer. There have been studies that unexpectedly showed an increased survival rate among hospice patients who had better control of symptoms such as pain [147, 148]. Additionally, these patients no longer risked the potentially serious side effects of aggressive cancer treatments.

Nearly two-thirds of all cancer patients in the USA will receive radiotherapy during their illness. In 2004, nearly one million patients were treated with radiotherapy; and 60% of these patients, 574 930, had not previously been treated with radiotherapy. External beam radiation was administered to 88% of patients treated; 81 580 were treated with brachytherapy. More than one type of treatment modality was used in 11% of patients. This resulted in a total of 23.4 million radiotherapy treatment visits to 20 010 hospitals and freestanding radiotherapy centres across the USA [149].

Three cancers: breast; prostate; and lung cancer, make up 56% of all the cases treated with radiotherapy. Treatment with curative intent is designated for 75% of the patients treated with radiotherapy. However, treatment with palliative intent is designated for 41% of lung cancer and 50% of brain cancer patients [149].

While the USA has extensive health care resources, the location of radiotherapy units are population based. Throughout the USA, a certificate of need (CON) must be filed with state health commissions to add a new radiotherapy centre, or to add or replace radiotherapy equipment in an existing centre. The CON is based on a projection of the number of procedures required to ensure sustainability of the service. No new radiotherapy units will be approved unless they are in a region with at least 50 000 people, or more than 100 miles from the nearest radiotherapy unit. The new service must be self supporting within 5 years. For a community to receive permission for additional radiotherapy services, the programme must see at least 300 cases and administer 60 000 treatments per year [150, 151].

2.5.2. Training in radiotherapy and palliative care

In 1997, many Canadian radiation oncology residents sought employment outside of Canada or left the specialty altogether because they found it too difficult to find radiotherapy positions within Canada. This resulted in a decline in radiotherapy as a career choice within Canada, and a subsequent shortage of radiation oncologists. This shortage later necessitated increased funding for positions and an expansion of cancer centres. The increased investment resulted, in turn, in another surge of popularity for the specialty [152].

By 2003, radiotherapy training centres had an equal distribution of staff with 22% having less than 5 staff, 29% 5 to 10 staff, 21% 15 to 20, and 28% more than 20 staff members. Most programmes (44%) had 5–10 residents or 11–20 residents (25%), while 14% had more than 20 residents and 17% less than 5 residents. CT simulation was available in all of the training centres surveyed, while only 60% had IMRT and 44% had PET scanners. Prostate brachytherapy was performed in 92% of training centres, 73% had high dose rate gynaecologic brachytherapy, and 57% performed other forms of brachytherapy [152].

A survey of 58 radiotherapy residents from Ontario in the first postgraduate year of their residency in 2006 yielded a 75% response rate. The mean age was 32 years, and 88% had completed medical school in Canada. The largest group of residents had been at a training centre affiliated with the University of Toronto. Ward and call duties were considered appropriate by 84%. Only 74% felt they had enough instruction about what was expected of them. More than 60% felt tired or overworked, 21% indicated that the patient workload and number of patient management problems were excessive, and 21% thought the demands of family had adversely affected the quality of their residency experience although only 39% were female. There was no significant difference related to gender in the stress domain [153].

In 2003 a survey was conducted among Canadian radiation oncology residents in response to the increased popularity of the specialty over the preceding five years. The most difficult aspect of the residency was mastering a large body of written material (70%), while 9% thought palliative care was difficult, and 13% expressed difficulty in dealing with patients when treatment failed [152].

In the USA, a severe health care workforce shortage is looming. Half of the oncologists are over the age of 50. Over half of oncology nurses are over the age of 55 years [154]. In 2000, Florida added a new medical school; this was the first new medical school in 25 years. In 2006, 93 of the nation's 126 medical schools increased enrolment, but the lack of space and other resources limited increases in enrolment [155]. It will take until 2015 before 10 to 15 new medical schools can potentially be added. After more than a decade of decline, with the lowest point occurring in 2002, applications to US medical schools are again on the rise because of economic shifts and an increase in women entering the workforce as physicians. Men in the USA have chosen to pursue more lucrative careers in business and engineering. The number of students applying to medical schools represented an 8% increase over 2006. But residency positions also need to be added to accommodate the increased number of medical students. Since the 1990s, the US federal government has controlled residency programmes, including how many residency

slots are funded and in what specialty. Declines in federal reimbursement for resident physicians have added to the economic losses in teaching hospitals.

The concerns about salary levels among US radiation oncology residents are not unfounded. Before they have their first job outside of residency a physician is, on average, between 30 and 35 years of age and has a debt in excess of US \$130 000 for educational costs alone. Seventy-two per cent of medical school graduates have debt of at least US \$100 000 [156]. Although the quality of radiotherapy residency training in the USA is high, financial and lifestyle issues are paramount to many residents, especially those residents who choose to pursue private practice. Career decisions were affected by many factors, including: lifestyle; income; case mix; desire for autonomy; sub-specialization; research interests; teaching; patient care; board structure; practice environment; and mentoring [157].

There is stiff competition for radiation oncology residency positions in the USA based primarily on lifestyle issues and the lure of a highly technical specialty with comparatively high reimbursement. The Association of Residents in Radiation Oncology conducted a survey of US radiotherapy residents in 2003. Although the response rate was only 44%, 229 surveys were returned. The demographics included a median age of 30, 68% were male, and 70% were married [158]. Additional postgraduate degrees were held by 25%; of these, 11% had a PhD, and 83% had a master's degree. The strongest factors that influenced the decision to enter radiotherapy related to interest in oncology (67%), awareness of the specialty in medical school (65%), lifestyle after residency (43%), and earning potential (22%). Residents near the end of training were more likely to select private practice (52%) over an academic career [154]. Factors influencing the career selection included hours of work (83%), job market (72%), financial remuneration (70%), and desire to avoid politics/bureaucracy in the workplace (67%). By their final year of residency, 81% felt they had received adequate training to enter practice, but the survey failed to ask about training in palliative care [158].

The Scope of Radiation Oncology document for the American Society of Therapeutic Radiology and Oncology included the following three recommendations on palliative care [159]. The first recommendation was to expand training to more successfully integrate palliative care, supportive care, symptom management, and pain management. The second recommendation was to ensure that residents are adequately trained in general medicine, and are capable of managing common oncology related inpatient problems. The final recommendation was to provide continuing education courses for practicing radiation oncologists.

In 2008, the American Board of Medical Specialties, through the American Board of Psychiatry and Neurology and the ABR, offered subspecialty certification in palliative care to radiation oncologists for the first time. From 2009, a one year fellowship in palliative care has been required for palliative care subspecialty certification in radiation oncology [160].

3. RATIONALE FOR INTEGRATION OF PALLIATIVE RADIOTHERAPY AND PALLIATIVE MEDICINE

3.1. THE NEED TO UNDERSTAND THE BENEFITS OF RADIOTHERAPY IN PALLIATIVE CARE

Whilst palliative care and radiotherapy in particular are clearly of crucial importance in the management of cancer, as can be seen from the global survey of cancer incidence and treatment, there is a huge discrepancy between the need for, and the provision of, cancer treatments. One clear area of weakness is the overall lack of understanding of the role which radiotherapy can play in symptom management.

Cancer patients are diagnosed and treated by nearly every medical specialty. Among family physicians, 97% had recently seen cancer patients in their offices, with 85% regularly caring for patients with advanced cancer [24].

It is important to recognize that even in high income nations, not all cancer patients are referred to a cancer specialist. A survey has shown that physicians who are more knowledgeable about the common indications for palliative radiotherapy are significantly more likely to refer patients for radiotherapy. The accessibility to radiation

oncology services was also an important factor for family physicians to refer patients to palliative radiotherapy. Only 10% of physicians had received radiotherapy education during their formal medical training [24].

A second study also found that knowledge of the indications for, and the effectiveness of, palliative radiotherapy was limited among primary care physicians and that only 27% of primary care physicians were aware of all of the support services available for cancer patients, including a pain and symptom clinic, psychological support for patients and families, nutritional counselling, and rehabilitation therapy [161].

Recognizing the importance of maintaining continuity of care with the family physician, a study was conducted among 365 patients over a 15 month period as part of the Rapid Response Radiotherapy Program. While 98% of patients had a family physician, only 43% felt that their family physician was involved in their cancer care. Seventy-one per cent of the patients had known their family physician for more than five years, and 88% were satisfied with the overall medical care provided by their family physician. Satisfaction with the family physician, and perception of the family physician's involvement in cancer care, depended on the overall medical care provided, the length of time since the last visit to the family physician, having seen the family physician since the cancer diagnosis, and the emergency care provided by the family physician [161]. Encouraging continuity of care between patients and family physicians was considered essential for an easier transition of care back to the family physician once palliative treatment at a cancer centre was complete, in order to facilitate end of life planning.

In summary, the WHO indicates that a good palliative care programme involves interventions at all levels of care, and has a particular focus on primary health care services [8]. From a logistical perspective, most countries, including high income nations, do not have sufficient numbers of oncologists to treat all of the cancer patients in the country. Despite the high incidence of cancer, most pre-graduate medical school programmes provide limited experience in oncology and the subspecialty of radiotherapy.

Communication between professionals involved in the care of cancer patients needs to be enhanced to improve coordination of treatment and to improve the knowledge of primary care physicians in the role of radiation in palliative care. Further research into more cost effective treatments and the quality of life benefits from palliative radiotherapy is required in order to have more factual data for treatment indications and applications.

3.2. THE NEED FOR PALLIATIVE CARE TRAINING IN RADIOTHERAPY

Radiation oncologists should have core competence in dealing with palliative and supportive care, symptom management, and end of life issues. Comprehensive oncologic patient care cannot be achieved if palliative care is neglected since, in many cases, improved quality of life is the main objective. Recommendations from the Canadian Association of Radiation Oncologists include [162]:

- (a) Radiation oncologists should coordinate and integrate radiotherapy delivery into comprehensive palliative and supportive care management;
- (b) Although included in residency training programmes, continuing education opportunities for radiation oncologists in areas of palliative and supportive care, treatment management and end of life issues are inadequate and should be enhanced;
- (c) Radiation oncologists should contribute to, and lead, research into palliative care and quality of life issues in cancer patients.

As the American Board of Medical Specialities has formally recognized 'Hospice and Palliative Medicine' as a subspecialty with board certification examinations, this curriculum is recommended for radiation oncologists since there are expected to be an increasing number of terminally ill patients in the next few years [163–165]. Palliative care guidelines cite radiotherapy as an important palliative modality, but few guidelines exist specifically for palliative radiotherapy. The American College of Radiology (ACR) Appropriateness Criteria are evidence based resources developed by experts in the field of radiology, with the intention of helping physicians to make the best treatment decisions for their patients. Evidence is based on current literature and actual clinical situations [166, 167]. The ACR Appropriateness Criteria emphasize the need to index radiation dose fractionation to prognosis and site of disease relative to adjacent normal structures.

The most direct guidelines result from the Cancer Care Ontario Program in Evidence-Based Care. A single eight Gy fraction of radiotherapy is recommended for patients with uncomplicated bone metastases where the

treatment objective is pain relief [18]. There is insufficient evidence to make a dose fractionation recommendation for other treatment indications such as a solitary bone metastasis, prevention/treatment of spinal cord compression, prevention/treatment of pathological fractures, and treatment of soft tissue masses associated with bony disease [18].

3.2.1. Techniques in palliative radiotherapy

IAEA-TECDOC-1549, Criteria for Palliation of Bone Metastasis — Clinical Applications, is a guide for researchers and practitioners, summarizing recommendations and practices [18]. Criteria for simulation are not formalized in palliative radiotherapy. In keeping with the goals of palliation, however, simulation and palliative radiotherapy techniques should be simplified to maximize the patient's comfort. Simulation or portal imaging is beneficial when treating spinal cord compression or vertebral metastases to ensure coverage of involved vertebral bodies. Treatment planning performed after simulation accounts for body shape, and ensures adequate dosimetric coverage, including the anterior aspect of the vertebral body. Simulation and/or imaging are important when palliative radiotherapy fields must account for prior radiotherapy portals, particularly over the spinal cord and other critical structures.

While simulation is usually a standard of care in high income and most middle income countries, it is not always mandatory, especially for the treatment of long bones, like the femur and humerus. During emergent initiation of radiotherapy, for all income level nations, port films have long been acceptable [18]. The site and volume of tumour involvement are the most important considerations in the development of a palliative radiation treatment plan because of the radiation tolerance of adjacent normal tissues to treatment. Unlike the comprehensive radiation treatment portals used in curative therapy, palliative radiation generally only encompasses the tumour volume critical to symptoms. Radiation treatment planning must minimize possible toxicities, and account for prior courses of radiation. Toxicities are reduced by limiting the volume irradiated, and through the application of dosimetric principles that reduce integral dose.

3.2.1.1. Fractionation in palliative radiotherapy

In contrast to the low daily radiation doses (1.8 to 2 Gy) given with each treatment during conventional radiation schedules to total radiation doses of 50 Gy to 60 Gy over 5 to 6 weeks, hypofractionation with short overall treatment duration and larger daily radiation fractions is recommended in most palliative radiotherapy applications. Because of normal tissue tolerance to radiation, the total radiation dose that can be administered is low when high doses of radiation are given with each daily fraction. Hypofractionated radiation schedules can range from 2.5 Gy per fraction administered over 3 weeks for a total radiation dose of 35 Gy to a single 8 Gy dose of radiation [18, 167–169].

Survival is determined by the location and number of sites of metastatic disease rather than the number of radiation fractions used for a localized area of disease. Overall survival rates for a single fraction of radiation are equivalent to a course of palliative radiation with multiple fractions.

A single 8 Gy fraction is generally administered in most European countries and Canada for uncomplicated bone metastases given the equivalent outcomes in a wide range of randomized clinical trials. A single large radiation fraction is as effective in relieving pain as other radiation schedules that have more treatments [18, 167–169]. Retreatment with the same dose is possible if time between fractions is not too short, usually not shorter than one week.

There are five reasons why a shorter radiation schedule is advantageous for patients with a poor prognosis. First, it is easier for patients with a poor performance status to complete therapy. Second, response and survival rates are equal for single and multifraction therapy at three months because median survival is less than six months among patients with a poor prognosis and averages around 24 months among patients with metastatic disease [170–172]. This is an important consideration when the number of weeks of survival is evaluated relative to the number of weeks spent receiving palliative treatment. Third, the option of retreatment after a single fraction of radiation may also provide benefit to patients with good prognostic factors as a means to periodically reduce tumour burden and control symptoms in non-critical anatomic sites. Fourth, a single fraction of radiation is more cost effective. The cost of radiation therapy is reduced by 41% with the use of a single fraction of radiation therapy when compared to a ten fraction course of palliative radiation. In addition, the cost of radiation therapy is less expensive

than the continued cost of analgesics [58]. An analysis of the Dutch prospective study also showed cost benefit for a single fraction of radiation when compared to multiple radiation fractions, even when retreatment was included in the single fraction arm [173]. Fifth, a single dose makes most efficient use of resources and allows more patients to be treated.

Metastatic cancer is often treated as a chronic disease and treatment is given to prevent or relieve symptoms of the disease. Re-irradiation for persistent or recurrent pain is often precluded when higher radiation doses are administered, but re-irradiation is possible after a single fraction of radiation [18].

For patients with metastatic disease, time is critical. The time under radiation needs to be considered as the opportunity cost of palliative treatment [159]. If the median survival of a patient with bone metastases is six months (180 days), the patient will spend 0.6% of the remaining survival time under radiation treatment when a single fraction of radiation is given. If 10 radiation fractions are given, 8% of the remaining survival time and if 20 fractions are prescribed 16% of the remaining survival time will be consumed by radiation therapy. Even if retreatment with a second single fraction is required, the patient will only spend about 1% of the survival time under radiation therapy. For lung cancer patients with a three month survival time, 1% of the remaining time is spent with a single fraction of radiation as compared to 16% if 10 fractions are given, or 30% if 20 fractions are prescribed.

Acute radiation toxicities are linked to the dose per fraction, total dose, and the area and volume of tissue irradiated. If mucosal surfaces like the respiratory tract, gastrointestinal tract and bladder can be excluded from the radiation portals, acute radiation side effects can be significantly reduced whether a single or multiple fractions are prescribed. A more protracted course of radiation is still used for patients with good prognostic factors who require treatment over the spine and other critical sites [170, 172, 174]. For most patients who receive palliative radiation for pain, however, a single fraction of radiation provides an efficient and effective therapeutic option.

Single fraction radiotherapy for uncomplicated bone metastases provides benefit in every respect. From the patient's perspective, a single fraction of palliative radiotherapy effectively relieves symptoms without a prolonged course of therapy that can incur discomfort, and consume valuable time during a limited life expectancy. From the caregiver's perspective, a single fraction of radiotherapy eliminates additional efforts of care, and reduces potential pain associated with transportation to and from the radiotherapy centre over approximately two weeks. From the societal perspective, a single fraction of radiotherapy is cost effective and meets the criteria of 'Quality Adjusted life years' (QUALYS) [167, 169]. Health resources can be optimized with single fraction radiotherapy since ten patients benefit from a single fraction of palliative radiotherapy instead of one patient being treated with ten fractions of palliative radiotherapy.

4. OPTIMIZING RESOURCES IN PALLIATIVE RADIOTHERAPY

4.1. THE NEED TO OPTIMIZE RESOURCES

Worldwide, differing patterns of cancer influence the need for radiotherapy resources. Radiotherapy in low and middle income countries is often a more important resource than other therapeutic modalities used in cancer therapy given the large numbers of patients with advanced and metastatic disease. Radiotherapy may be used in more than two-thirds of cancer patients in high income nations for curative intention, and for palliation when systemic therapies fail to control metastatic disease. For all nations, however, lung cancer, a preventable disease, is the greatest cause of cancer related deaths [31, 175]. Even with the most aggressive therapies in high income nations, lung cancer survival rates remain low; with recurrent or metastatic lung cancer survival being measured in months. Often radiotherapy is the only effective therapeutic modality to palliate symptoms.

Palliative radiotherapy is essential in every country. When cancer screening is limited and most patients present with advanced/metastatic tumours, palliative radiotherapy can provide effective and efficient symptom relief, and be a part of ongoing palliative care. Palliative radiotherapy remains an essential part of cancer care in high income nations.

Clearly, with such an overwhelming need for palliative radiotherapy, it is imperative that the available resources are optimised and used to their fullest potential. There are, however, several factors that prevent such resource optimization.

Firstly, palliative radiotherapy and palliative care are often delayed in pursuit of aggressive therapies even when cure is beyond achievement.

Secondly, radiotherapy resources are concentrated unequally throughout the world. While low and middle income nations represent about 85% of the world's population, high income nations, including North America, Western Europe, Australasia, and Japan, have two-thirds of all radiotherapy facilities. This includes 80% of all electron accelerators and over 25% of all cobalt units. Only 3300 teletherapy machines, mainly cobalt-60 units, are installed in low and middle income nations [21].

Thirdly, with cancer cases set to rise dramatically in the future, it is also clear that there is an insufficient number of radiotherapy machines. Assuming that one machine is required for 500 new cancer cases, more than 4400 radiotherapy machines are currently needed. By 2015 this figure will double to a total of 10 000 machines required to provide treatment for the estimated 10 million new cancer cases in middle income and low income countries [21]. The introduction of new radiotherapy equipment, including linear accelerators and computer based treatment planning equipment, also requires calibration and training of staff for the specific units installed. Trained staff are needed, along with the radiotherapy equipment, to provide safe and effective treatment. Ongoing quality assurance measures are also necessary to maintain the equipment.

Fourthly, a lack of local infrastructure and an inadequate health care structure can negatively impact on the effectiveness of palliative care resources. Even limited health care resources, especially in the case of radiotherapy provision in middle to low income countries, require a fixed and expensive infrastructure to allow access to care. Access to palliative radiotherapy is also affected by a lack of infrastructure, logistical problems due to distance from the treatment site, adverse weather conditions, inadequate health insurance cover, the overall expense of radiotherapy treatment and the failure to be referred for palliative radiotherapy in the first place, when more costly, toxic, and often less effective, systemic therapies are preferred.

Fifthly, and perhaps most importantly, patient socioeconomic status (SES) is the greatest determinant governing access to care. Problems relating to access to health care are pervasive in low income and middle income countries with limited overall health care resources and large rural areas. Uninsured patients of high income countries face similar problems. The largest gap exists between new therapeutics derived from cancer research and cancer care delivery based on SES and system barriers [176].

SES is significantly associated with survival for most types of cancer. Survival data that support these findings have been collected in Canada from the Ontario Cancer Registry and in the USA from the surveillance epidemiology and end results (SEER). The association between SES and survival was weaker in Canada than in the USA. Compared to the USA, poorer communities in Canada had survival advantages for lung, head, neck, cervix and uterine cancers [177]. For middle and upper income groups, however, treatment in the USA resulted in better survival for all types of cancers including breast, colorectal, prostate and bladder cancer. It is believed that the lower survival rates were due to limited health care resources in Canada that result in delays to initiate cancer treatment.

Two further Canadian studies have explained the specific factors that lead to the decision to use palliative radiotherapy as a treatment. The Nova Scotia Cancer Registry was used to identify 9978 adults who were dying of cancer between 1994 and 1998. Palliative radiotherapy was administered to 29% of terminally ill patients during the last 2 years of life, with most of these patients treated in the last 9 months of life [178]. Multivariate analysis identified factors associated with two sequential decisions that determined whether palliative radiotherapy was administered during the last nine months of life. These decisions were a) the likelihood of being seen by a radiation oncologist and b) the likelihood of being treated with radiotherapy. The likelihood of being seen by a radiation oncologist and treated by radiotherapy decreased with age, lower community median household income and distance of the patient's residence from a radiotherapy centre. It was also influenced by the year in which the patient was diagnosed, and the type of cancer that was being treated. An additional factor that was related to a lower likelihood of receiving palliative radiotherapy was a prior history of treatment with radiotherapy.

A further study from the Ontario Cancer Registry of 193 253 adults who died of cancer between 1986 and 1995 found that 26% of patients underwent at least one course of palliative radiotherapy [179]. The likelihood of receiving palliative radiotherapy was disease specific, ranging from 4% for pancreatic cancer to 41% for prostate cancer. Factors other than medical need, such as the patient's age and distance from a radiotherapy unit, were also found to influence the use of palliative radiotherapy.

The Canadian Association of Radiation Oncologists Manpower and Standards of Care in Radiation Oncology Committee wrote a position paper on waiting times for radiotherapy. They suggested that, the interval between the date of the initial referral for radiotherapy, the date of radiotherapy consultation, and the subsequent initiation of radiotherapy should not exceed 10 working days [180]. Although the recommendations did improve radiotherapy waiting times, there is still a degree of discrepancy between provinces, and there is considerable variability on treatment decisions based on the oncologists' own preferences, and personal background [181].

Palliative care may place a substantial economic burden on patients, families, health care resources, and even on the overall economy of a country. It is imperative that all health care, including palliative care, should be delivered in the most cost effective manner. In palliative care, efficiency provides rapid relief of symptoms and allows improved resource utilization. This in turn, benefits all, through increased access to health care.

4.2. RESOURCE OPTIMIZATION THROUGH BETTER HOME CARE SUPPORT

The WHO indicates that a good palliative care programme involves interventions at all levels of care, and has a particular focus on primary health care services and home based care that results in a reduction in hospitalization and the use of inappropriate and expensive procedures. It also argues for a greater use of non-opioid and opioid analgesics administered by trained caregivers to manage pain relief and points out that such caregivers can include family members [8].

The majority of patients with cancer needing palliation can benefit from relatively simple and low cost interventions that can be integrated into primary care and home care. Less than 20% of advanced cancer patients will require long hospitalization for specialized care at secondary and tertiary health care facilities [8].

Home care in low and middle income countries is culturally acceptable and more affordable than prolonged hospital care. A popular model for home based palliative care in low income countries is to provide care through community caregivers or volunteers who are supervised by trained nurses. These nurses are linked to inpatient facilities for patients who require more intensive care. In high income countries, home based services are more resource intensive, and are generally affiliated with a specialist unit or hospice which provides round the clock coverage [8]. Most patients would prefer to die at home when home care is available [144].

Although home care is advisable whenever possible during palliative care since patients generally wish to spend their final days with family members, continuity of care is critical to avoid needless suffering and distress. It is important that the transition to primarily palliative care should not bring a sense of abandonment.

The benefits of home care are both social and societal. While optimizing the palliative care experience of the patient, who remains in familiar surroundings, there is also a societal benefit of reduced utilization of limited hospital facilities and resources. Often, mobile clinics and 'home hospitals' (hospital level services) can be transferred to a home, including intravenous nutrition, to effectively and cost effectively provide palliative care near to home.

It is recognized that if patients are to remain at home, adequate social support is also needed for physical tasks, respite time, and financial assistance for the home caregivers. Access to health care professionals is critical as a source of reference or assistance to cope with changes in the patient's clinical condition. Without adequate social support, the great burden felt by family members who care for patients with chronic and life threatening illness can result in the carers increased morbidity and mortality [144]. Financial strain often results when the outside income is lost when home caregivers lose employment. This can, in turn, lead to a loss of health insurance or other benefits such as retirement savings in some countries.

Many patients are hospitalized during the last six months of life for symptom management. Between 1986 and 1998, 5.3% of all acute care beds in Ontario were devoted to the care of cancer patients in hospital. Linking hospitalization records to the 203 713 cancer patients who died within that time period, it was found that acute care hospitals continue to play a significant role in the care of dying cancer patients. While the mean time spent in hospital in the last 6 months of life decreased from 34.3 days in 1986 to 22.7 days in 1998 [182], hospitalization rates increased exponentially during the last month of life.

Social factors were significant determinants of hospitalization during the last 6 months of life; patients younger than 50 years of age, women, and residents of poorer communities spent significantly longer in hospital than others. Hospitalization rates differed very little amongst those with common solid tumours, spending a median of 22 days in hospital during the last 6 months of life. Patients with central nervous system malignancies,

lymphomas and leukaemias, however, spent significantly longer in hospital than other groups. Access to specialized ambulatory cancer care was associated with lower hospitalization in the last 6 months of life. There was also a statistically significant inverse correlation between the rate of use of palliative radiotherapy and hospital bed use [182].

5. THE REQUIREMENTS FOR A SUCCESSFUL PALLIATIVE CANCER CARE AND PALLIATIVE RADIOTHERAPY PROGRAMME

5.1. RESOURCE PLANNING AND PRIORITIES

Governmental decision makers have a responsibility to manage resources in order to cost effectively benefit the public good. QALYs evaluate the cost effectiveness of one or more interventions as the incremental costs divided by the incremental health benefits. Low cost effectiveness ratios are 'favourable' because they indicate that incremental QALYs or health benefits, can be achieved with inexpensive interventions. An intervention is 'cost saving' if it reduces costs while improving health. Poorly performing interventions can both increase costs and worsen health [183].

The WHO recommends a three level policy to be integrated into a national public health programme in order to ensure optimal palliative care services [8]:

- (a) A government policy to ensure the integration of palliative care services into the structure and financing of the national health care system;
- (b) An educational policy to provide support for the training of health care professionals, volunteers, and the public;
- (c) A drug policy to ensure the availability of essential drugs, in particular opioid analgesics, for the management of pain and other symptoms such as psychological distress.

All three of these measures are necessary, along with committed leadership, to achieve an effective national palliative care programme. The quality parameters of a palliative care programme include the following questions:

- (1) Are all the services of the palliative care programme accessible (to ensure coverage and timelines) to the target population?
- (2) Are there drugs accessible for pain relief, in accordance with the WHO's ladder for cancer pain relief?
- (3) Are there drugs accessible for the control of other symptoms?
- (4) Are the services acceptable (ensuring providers' and patients' satisfaction) and appropriate (based on established standards) for the target groups?
- (5) Are the competences (knowledge and skills) of the providers appropriate for the services needed?
- (6) Is there continuity (integration, coordination and ease of navigation) in palliative care activities for cancer and other chronic fatal disease? Is there continuity among the levels of care? Is there continuity between private and public institutions?
- (7) Are the palliative care activities effective (do they improve quality of life)?
- (8) Are palliative care activities efficient (do they provide the best results at the lowest costs)?

The social context is considered critical in developing and sustaining palliative care plans. It is important to understand the ways in which internal factors, such as the roles that political support, leadership, stakeholder involvement and available resources, have on decisions relating to how, or indeed even whether, a palliative care plan is developed and implemented. Many politicians and decision makers often focus on curative cancer care

rather than palliative care due to a lack of understanding of the importance of palliative care, or the potential perception that they are accepting defeat against disease and are using palliative care as a socioeconomic tool rather than to provide care [8].

The enormous financial impact of a policy that concentrates on unrealistic cancer cure rather than palliative is demonstrated well in the USA. While palliative care has expanded over the past three decades in the USA, the national focus has remained on curative therapies. Indeed, in many cases, palliative care was often never even offered. Unrealistic expectations of cure for incurable disease contributed to rising health care costs and the introduction of managed care systems. Despite three decades of managed care, however, US health care expenditure rose 6.7% in 2006 to over US \$2.1 trillion. This equates to a bill of more than US \$7000 for every US man, woman, and child. Bureaucracy involved in billing for this level of health care consumes US \$400 billion of the total budget [184]. Medicare costs increased a record 18.7% with the initiation of a prescription drug plan. Compared to other nations, the USA spends a higher percentage of its GDP on health care than other high income nations. Medical inflation has been attributed to an aging population, new treatments and technologies, lifestyle factors, and excessive litigation and defensive medicine.

External forces can also affect the development of a palliative care plan. These forces include international efforts to promote palliative care, competing health care initiatives and priorities, and the political and economic situation of the country [8].

The influence of internal and external forces was evident in a comparative analysis of cost and health effects of breast cancer interventions for all stages of disease in Africa, North America, and Asia. The incidence rate of breast cancer in 2000 was reported from WHO data, and the incidence rate for Africa and Asia were grouped together in this study [185]. Because of breast cancer screening initiatives, the majority of women in North America presented with early stage and potentially curative (stage I and II) disease, while the majority of women in Africa and Asia presented with advanced and late stage (stage III and IV) breast cancer.

Treatments administered in this model included:

- (i) Stage I/II: lumpectomy with axillary dissection plus external radiotherapy to the breast. Eligible patients also receive endocrine therapy;
- (ii) Stage III: neoadjuvant chemotherapy followed by mastectomy with axillary dissection and supplemental adjuvant chemotherapy. External radiotherapy is administered to the chest wall. Eligible patients receive endocrine therapy;
- (iii) Stage IV: systemic chemotherapy (supplemented with endocrine therapy for eligible patients). This patient group is designated as receiving palliative therapy. It was assumed that cancer progressed at a constant rate. Note: Palliative radiotherapy is not listed.

Treatment costs were calculated in US dollars for the year 2000 [185]. Life years adjusted for disability (DALYS), and cost effectiveness ratios (CERs) were determined for each stage of breast cancer. For stage I breast cancer, averted DALYs per patient equalled 23 (Africa), 19 (Asia), and 12 (North America). With stage IV breast cancer treated by systemic therapy, averted DALYs per patient decreased to less than one day. With the highest treatment cost per patient, North America has the lowest averted DALYs for every stage of breast cancer. The largest benefit is observed in stage I, while benefits drop considerably as the risk for development of metastatic disease increases with stage II and III disease, despite the addition of systemic therapy [185].

The corresponding average CERs, compared with no intervention, were US \$78 (Africa), and US \$1960 (North America) per DALY averted for stage I; these CERs ballooned in stage IV breast cancer to US \$4986 (Africa), US \$3510 (Asia), and US \$70 380 (North America). CERs were not calculated for palliative radiotherapy. The CERs are the lowest for stage I disease, increased logarithmically and plateaued in stage II and stage III, and increased logarithmically again for stage IV. Although the CERs depended on local economies, they were parallel for all regions [185].

Treatment of stage I disease, identified through routine screening, represents the most cost effective intervention in all countries. Although unstated, systemic therapy is not cost effective in stage IV breast cancer, provides no reduction in cancer related disability and incurs toxicity in any region [185]. The majority of women in Africa and Asia currently present with stage III and IV breast cancer and in these cases aggressive therapies have limited or no advantage. This, coupled with the lack of access to health services for 50% of the population in low

income countries, makes the proposed treatments, based on stage of disease, unfeasible. In these cases, palliative radiotherapy can provide a cost effective alternative to no treatment.

These examples emphasize the need to set priorities and continually study outcomes relative to stated priorities. The first priority must be to relieve suffering from cancer and improve the patient's quality of life. It must also be acknowledged that health care resources have, and always will have, constraints. It is the obligation of governments and health care professionals to make the best use of limited resources. The World Health Organization has created a template to set priorities for palliative care strategies [8].

Firstly, identify the patients who need palliative care and assess:

- (a) the burden they represent in terms of mortality and morbidity;
- (b) the proportion of cases in advanced stages;
- (c) the urgency of their needs (pain relief, control of other symptoms, social support);
- (d) the societal impact of the disease (for example, whether the disease affects children, underprivileged communities and caregivers).

Secondly, choose the type of palliative care strategy according to:

- (a) cost effectiveness;
- (b) affordability;
- (c) sustainability;
- (d) political attractiveness.

5.1.1. Funding a national policy

Cancer care plans for palliation often fail to include accessibility to palliative radiotherapy and most palliative care guidelines include only a limited description of the role of palliative radiotherapy. This limited description also provides limited guidance for evaluating the scope and resources necessary to provide a critical aspect of palliative care.

Because radiotherapy is available for curative cancer treatments, it is often assumed that capacity automatically exists for radiotherapy units to also administer palliative care, especially since fewer radiotherapy fractions are generally prescribed for palliative radiotherapy. However, this assumption is too simplistic and leads to an underestimation of the radiation units, their levels of capacity and the numbers of staff required to operate them. The magnitude of these underestimations can be profound, particularly if a large proportion of patients present with locally advanced or metastatic disease. Palliative care plans should include the resources needed to administer palliative radiotherapy based on regional demographics that reflect the presenting stage of disease. Without such evidence of compelling need for palliative radiotherapy, it is often more attractive to fund new technologies and therapeutics that have lower, and less sustainable, rates of response than palliative radiotherapy.

Funding of radiotherapy units is a challenge to government based health care systems in both high income and low and middle income nations. Underestimation of need for radiotherapy is exemplified by the experience in the UK. For more than a decade, radiotherapy was not a priority for funding there, in comparison to nations in Europe and North America, despite expanding indications for radiotherapy and technological advancements. In the UK, shortages also existed in the radiotherapy workforce [186]. As benchmarks, Australia and Switzerland had 5 linear accelerators per million population, and France had 6 linear accelerators per million population compared to the 4 linear accelerators per million in the UK.

Based on population, the Royal College of Radiologists estimated that by the year 2000, there should be 599 consultant clinical oncologists in the UK based on a maximum of 315 new patients per year; in 2000 there were only 380 consultants in radiotherapy [186]. Significant shortages also existed for medical physicists who require 9 years for certification; radiotherapy radiography staffing was only at 78% of recommended levels. Extending working hours or number of working days per week did not alleviate the problem since this did not overcome the workforce shortage, it violated work rules, and it required increased maintenance and calibration for linear accelerators. Extended working weeks also placed contingency plans in jeopardy when hospital staffing was limited. These contingency plans include guidelines for dealing with machine failure, the additional needs of sick patients, such as transportation, and the ability to address acute medical emergencies, like dyspnoea, that may occur

within the radiotherapy department. Shortages in both the workforce and available equipment resulted in 28% of patients waiting longer than the maximum times advised by the Joint Collegiate Council for Oncology, and 21% of potentially curable lung cancer patients becoming incurable while waiting to receive radiotherapy [186].

As the above example shows, radiotherapy needs to be recognized as an integral aspect of cancer care. Especially in advanced/metastatic disease, radiotherapy is an efficient and cost effective modality. Resource allocation at governmental levels needs to account for the use of radiotherapy in multimodality cancer therapies with curative intent and the need for palliative radiotherapy in cancer patients for whom cure is not feasible. Lack of radiotherapy resources can result in delays in the initiation of curative cancer treatment, which can adversely affect outcomes or fail to provide urgent symptom relief needed by a patient dying of cancer.

5.2. PLANNING NATIONAL TRAINING PROGRAMMES

National training programme planners develop health care policy by influencing the specialty training of health care workers. The scope of responsibility is broad, ranging from disease prevention and public health to the investment in effective interventions that address acute medical problems, the treatment of chronic disease, and end of life care. Training programme policies must run in parallel with governmental health care policies to provide the necessary expertise in training facilities, and to train enough health care professionals to meet the demand created by health care policies. Inpatient and outpatient palliative care clinics at secondary and tertiary care levels should serve as training and referral centres for the management of complex cases [8].

Educational efforts need to be coordinated at every level of professional training to prepare for palliative care initiatives. Training considered necessary by the WHO in preparation for the initiation of a palliative care unit includes [8]:

- (a) First, to provide basic training (20–40 hours) for the health care providers working at the primary and community levels;
- (b) Second, to provide intermediate level training (60–80 hours) for the physicians and nurses working at the secondary and tertiary levels who are dealing with cancer patients;
- (c) Third, to provide proficiency (specialized) training (3–6 months) to the specialized teams or palliative care units at the secondary and tertiary levels;
- (d) Fourth, to provide undergraduate training in medical and nursing schools.

National training programmes should have comprehensive educational programmes that provide training to every level of health care professional. Two factors are important to the success of a palliative care programme. First, all health care professionals within training programmes should be familiar with palliative care principles in order to train future health care providers. Second, a ‘train the trainer’ approach, where training of key health care professionals provides downstream training of other health care professionals, should be widely implemented and is included in current IAEA programmes.

Initiation of a palliative care plan involves leadership and management expertise. For a plan to be feasible and sustainable, steps need to be taken gradually. To plan for the necessary human and financial resources to be in place to implement a palliative care plan, the WHO recommends the following assessment [8]:

- (1) What resources are currently dedicated to palliative care? How can current resources be reallocated or shared to achieve plan outcomes?
- (2) Besides resources currently being expended, what else is needed to achieve the objectives of the plan?
- (3) What potential sources of funding or other resources are available to meet these needs?
- (4) How can partners work together to raise funds from the government or private sector?

Every health care professional needs to be involved in palliative care. Physicians play a crucial role, and they generally lead interdisciplinary teams that include nurses, pharmacists, social workers, and psychologists. Nurses typically have the greatest contact with the patient, and knowledge of palliative care principles is crucial to communicate changes in clinical status and symptoms to the physician. Pharmacists ensure availability of

analgesics and other essential medications used for palliative care. The pharmacist also lends expertise in medication doses, drug interactions, drug formulations, routes of administration, and alternative approaches [8].

Cost intensive inpatient care may not be feasible in all health care settings, especially those in low and middle income countries. As an alternative, a specialized palliative care team, within an established hospital system, is an effective and sustainable way of providing inpatient palliative care services. A palliative care team is generally composed of a physician trained in palliative medicine, at least one clinical nurse, and a part time social worker with the support of adequate administrative staff. Regardless of national income level, hospitals should strive for the following standards of training:

- (i) At the tertiary level, all physicians and nurses dealing with cancer patients should get basic training in managing pain and other symptoms, and in providing psychosocial support. In complex cases, they should refer patients to a specialized team composed of a physician specialized in palliative care, a nurse, a part time social worker (or psychologist) and a pharmacist;
- (ii) At the secondary level, all physicians and nurses dealing with cancer patients should get basic training in managing pain and other symptoms, and in providing psychosocial support. In complex cases, they should refer patients to a specialized team composed of a physician and/or nurse specialized in palliative care, a part-time social worker and a pharmacist. This team should also act as a district reference and training group;
- (iii) At the primary level, all nurses dealing with cancer patients should get basic training in managing pain and other symptoms, and in providing psychosocial support. In complex cases, they should refer patients to a specialized team at the secondary or tertiary level. The specialist nurses in the primary level teams should be trained to train and supervise community leaders, family caregivers and traditional healers.

This approach, using the palliative care service as a consultative service, has the added benefit of training other physicians and nurses within the hospital system, through case by case interactions.

Palliative care is a basic service that should be available in every health care setting, in countries of all income levels. Like other tertiary level medical care, it is not feasible for tertiary level palliative care to be available at every health care setting. As with other specialty services, primary level health care settings should be able to diagnose and take care of more limited palliative care problems, using tertiary care services as a resource for information and potential referral. Inclusion of palliative care services into local hospitals follows an established model of health care delivery. Competence in the principles of palliative care parallels required competence in the management of other acute and chronic health conditions.

6. IMPLEMENTATION OF A QUALITY PALLIATIVE RADIOTHERAPY PROGRAMME

6.1. NEEDS ASSESSMENT

As this report has highlighted, the global need for palliative care is enormous. In fact, the WHO has stated: “The provision of palliative care for all individuals in need is an urgent, humanitarian responsibility” [144]. Faced with this huge need, there is a danger that its very enormity can make finding solutions seem almost impossible. However, the development of palliative care plans, like other initiatives, must begin with a series of small steps, in this case needs assessments that can be used as the foundation of an effective, targeted palliative care programme.

Three needs assessments are outlined below, together with specific points that need to be integrated into the planning, implementation and evaluation of each assessment.

6.1.1. Identification of the regions and populations in greatest need [8].

- (a) This needs assessment addresses issues such as efficient access to care by targeting services at the greatest concentration of need. Provision of excellent palliative care in specialized palliative care institutions within a resource constrained country with a high proportion of patients presenting with advanced stages of cancer is not economically efficient.
- (b) Sustainability and wide access to low cost, basic services can be integrated with primary health care services and home based care.
- (c) All logistical innovations should be considered in order to deliver services effectively and efficiently to populations in outlying areas. This brings significant challenges to regions with vast wilderness such as Canada, nations in Africa or archipelagos in other areas of the world.
- (d) Once the areas of greatest need have been highlighted, and services targeted to these areas, data relating to this success can be used to replicate new projects in other areas of need.

6.1.2. Needs assessment to determine the requirements of patients, family members and caregivers

- (a) This data can be used to target significant and rapid improvement to areas of urgent need. This can provide objective measures of programme success.
- (b) Gaps in palliative care services can be identified.

6.1.3. Needs assessment of available resources

- (a) Needs assessments and palliative care plans should have realistic and achievable goals from which the palliative care programme can be systematically expanded.
- (b) Palliative care plans that fail to account for the feasibility of a project may well fail due to lack of resources. Resources in this instance can include available finance, number of trained personnel, the local culture, the population base to be served, the local geography and logistical factors.
- (c) Palliative care plans should include all of the resources necessary for both the initiation and sustainability of the plan.

6.2. ENSURING AVAILABILITY OF WHO ESSENTIAL DRUGS

Administration of palliative medications to relieve the suffering of cancer is an ethical imperative. Such drugs are administered to relieve suffering when logistical or financial constraints make palliative radiotherapy impossible, whilst waiting for a response to radiotherapy treatment, or for cancer related symptoms that cannot be managed by other available therapies.

Governments and international bodies often regulate essential medications for palliative care. Efforts must be made to enable nations to access medications used in palliative care, such as opioid analgesics. When analgesics are available within a nation's health care system, access to WHO essential Drugs depends on their availability within pharmacies at the local level. Barriers to prescription of WHO essential drugs by physicians should be removed.

6.3. DEVELOPMENT OF SOCIAL SUPPORT SYSTEMS

Social support systems are the pivotal factor in the quality of palliative care since the patient must often depend on others for overall care. In addition to assisting with the activities of daily living, these social support systems provide transportation to health care facilities, purchase and administration of medications, and provide emotional support to the patient. Families, who serve in the role of the social support system, often do so at great personal and financial sacrifice. These caregivers often have little respite from the physical and emotional strain of caring for a loved one, since they are often unable to pay for the costs of either hospitalization or the services of a home health care professional.

Hospice care with home based support provides an anchor for information, recommendations for evolving care, reassurance, and caregiver respite. Pharmacies linked to hospice care are often the only location where medications used in palliative care can be obtained. Hospice care is cost efficient and provides significant improvements in quality of life for patients with advanced or terminal disease. Restrictions, such as limitation of hospice benefits to the last six months of life, do not facilitate palliative care.

The social support system should address the physical, financial and emotional needs of the patient and caregiver. Given the short life expectancy of the patient processes to apply for, and receive, social support assistance should allow expedited approval. The burden of cancer is overwhelming enough without the added concerns of social support.

6.4. FOLLOW-UP OF PALLIATIVE PATIENTS

Follow-up of patients should be encouraged, especially in academic medical centres, in order to assess outcomes of palliative radiotherapy. It is also essential for titration of analgesics and other supportive care medications. However, it is recognized that for all patients, the burden of the disease, or transportational, logistical or financial problems can make it difficult to return to the treatment centres for follow-up. Palliative care networks, structured from the local level to tertiary care centres, should serve as communication links between the patients cared for at home and by the palliative care specialist.

6.5. INCORPORATION OF RESEARCH

Research in palliative care is important to develop therapeutic advances with newer medications that provide added convenience in administration, and fewer side effects. Palliative care research, including studies involving palliative radiotherapy, involves issues relevant to health care research such as access to health care and health care economics. Palliative care research helps determine the utility of therapies in advanced disease. Data from health care research provides critical information for the formation of health care policy. Providing for critical assessment of relevant health care outcomes, such as quality of life, palliative care research has been, and will continue to be, a good measure of the success of health care interventions. Participating in a research programme can also be motivating for the staff.

6.6. STAFF SUPPORT

Tutoring and mentoring is important to keep staff motivated and positive in the working environment. The approach of comprehensive care is demanding for staff and feelings of loss and frustration may occur. To prevent this, regular work guidance and support sessions, either individually or in groups are recommended. Regular thematic meetings and discussion of problem cases also ensure good practice and improve quality of care.

6.7. MAINTAINING THE PALLIATIVE CARE PROGRAMME

Globally, different institutes strive to improve and implement programmes to avoid overlapping and competing activities. When a project is initiated, a multidisciplinary task force is needed to plan the activities and resources required. Representatives of decision makers in health care service and of professionals dealing with these patients on different levels should be invited to work together to set the milestones for tasks and activities.

In order to be able to provide comprehensive care to cancer patients, an interdisciplinary, multidisciplinary approach is needed to utilize the available targeted treatments and to ensure a cost effective and ethically sound approach in the treatment of patients during each stage of the disease. Quality management and quality systems need to be incorporated into all levels of care to ensure this. Auditing of programmes to evaluate the needs for improvement and gaps in service should be regularly scheduled.

The Clinical Practice Guidelines stated that a successful quality palliative care programme should [144]:

- (a) Foster the integration of the principles, philosophy, and practices of palliative care across care settings;
- (b) Stimulate and guide the development and evaluation of new and existing services within and across care settings;
- (c) Ensure that palliative care services deliver care of consistent and measurably high quality;
- (d) Promote formal recognition of specialty status for certification initiatives in palliative care;
- (e) Support the expansion of efforts by hospices and other palliative care programmes to coordinate care services across the continuum.

Continuing medical education, including that for palliative care principles and palliative radiotherapy, is consistent with best medical practice. While much of palliative care research is descriptive and 90% of symptoms can be controlled with current therapeutic strategies, continuing medical education allows for the reporting of experience and new therapeutic developments.

Consistent with the WHO guidelines, programme outcome indicators include structure, process and outcome data (Tables 3 and 4) [8].

The recommendations indicate that palliative and end of life care involve relief of cancer related symptoms such as pain, dyspnoea, anorexia, and nausea. Communication is emphasized as a critical skill. Rehabilitation, including occupational, speech, and swallowing therapy, is recognized as important to regain or overcome functional impairments from cancer or its treatment. Radiotherapy is an essential component of cancer care and access to radiotherapy is considered necessary for the management of the cancer patient [94].

6.7.1. Quality assurance of radiotherapy

Quality assurance (QA) is a priority in radiotherapy, since the treatment outcome of patients improves with appropriate and safe and effective irradiation [21]. QA is essential to ensure safe use of radiotherapy with regard to dose and treatment volume specifications. As a part of physics QA, the national and international bodies have been running mailed thermo luminescent dosimeter (TLD) services for the radiotherapy centres as a routine physics QA support. The IAEA/WHO mailed TLD programme is available globally for checking the beam dosimetry of radiotherapy equipment [187]. The whole process of radiotherapy has multiple, interrelated and integrated procedures from treatment prescription to delivery. It is of particular importance to provide a systematic, comprehensive, and timely quality control to promote high quality treatment for the clinical trials and also for routine clinical practice. The integration of proper and sufficient QA in radiotherapy is an ongoing process, which needs a team of professionals and experts.

TABLE 3. EXAMPLES OF PROGRAMME OUTCOME INDICATORS — STRUCTURE [8]

Structure	
Policies and regulations include palliative care as a key component of national cancer control	
Funding and service delivery models established to support the provision of palliative cancer care in all settings where patients receive care	Official documents, laws, regulations, guidelines and manuals published, updated and available
Opioid prescribing laws and regulations for pain relief	
List of essential medications for palliative care	
Network of health care givers across the different levels of care	Accreditation of palliative care service delivery at all levels of care
Network of community leaders and caregivers trained and motivated to provide good quality palliative care services, including home based care	Accreditation of community based care initiatives
Creation of communities that own and support palliative care services	Mapping of communities
Educational courses that provide:	Undergraduate and postgraduate courses available, including in-service training for health-caregivers across all levels of care
— core knowledge and skills to practising health care professionals across all levels of care	
— expert knowledge and skills to a few selected health care professionals to lead palliative care services at the secondary and tertiary levels	
— undergraduate palliative care education for health care professionals (physicians, nurses, pharmacists, social workers)	

TABLE 4. EXAMPLES OF PROGRAMME OUTCOME INDICATORS — PROCESS AND OUTCOMES [8]

Process	
Number of advanced cancer patients receiving palliative care according to established standards	
Number and type of trained health care professionals at the different levels of care qualified to provide palliative care according to established standards	
Proportion of advanced cancer patients who get early palliative care according to established standards	>80%
Proportion of advanced cancer patients who get palliative care according to established standards	>80%
Proportion of advanced cancer patients receiving home based care provided by trained caregivers	>80%
Proportion of advanced cancer patients receiving home based care who need to be referred for specialized palliative care services at the secondary and tertiary levels	<20%
Proportion of family caregivers who get psychosocial support through the course of the disease, and through bereavement care, according to established standards	>80%
Outcome	
Proportion of advanced cancer patients who get timely relief from pain and other physical, psychosocial and spiritual problems	>80%
Proportion of caregivers of advanced cancer patients who get timely relief from psychosocial and spiritual problems	>80%

The extent of QA review should depend mainly on the complexity of the radiotherapy technique used for delivery. When simple and conventional techniques are used, like in most of the palliative cases, the QA review can include a chart review and a check of the simulation and portal films or images. The indicators for a good QA performance for palliative radiation therapists includes applying evidence based palliative care principles in a timely way, as well as using proper dose fractionation and appropriate irradiation techniques with calibrated equipment.

7. CONCLUSIONS AND RECOMMENDATIONS

- (1) Palliative radiotherapy and palliative cancer care should be integrated:
 - (a) Radiotherapy should be considered for patients receiving treatment for the symptoms of advanced/metastatic cancer;
 - (b) Symptoms of cancer and its treatment should be controlled throughout the continuum of the course of the disease;
 - (c) Analgesics, including opioids, should be available to optimize pain relief during and after palliative radiation.
- (2) Since palliative radiotherapy represents an essential part of symptom control, all radiation oncologists should receive training in palliative cancer care. Specific training in palliative cancer care will improve the quality of treatment and strengthen the therapeutic approach. Symptoms of cancer and the adverse effects of therapy should be systematically assessed by radiation oncologists in clinical practice:
 - (a) Symptoms of cancer and its treatment should be systematically monitored and documented before, during and after treatment;
 - (b) These patient related outcomes should be fundamentals of clinical radiotherapy practice and applied among the primary endpoints in published clinical trials;
 - (c) Specific training in palliative radiation oncology is highly recommended within postgraduate education for all physicians involved in palliative cancer care. Expertise in palliative radiotherapy and core evidence based recommendations for palliative cancer care should be required within postgraduate radiation oncology training programmes;
 - (d) Continuing medical education in palliative cancer care, including palliative radiotherapy, is essential for all disciplines involved in the care of cancer patients.
- (3) Palliative radiotherapy resources should be optimized:
 - (a) The most efficient planning process and fractionation schedule should be used;
 - (b) Health policy makers should ensure access to palliative radiotherapy for all cancer patients with advanced symptomatic cancer when there is evidence based indication, such as control of pain, bleeding, dyspnoea, and obstruction, and other treatments are not efficient or available;
 - (c) Palliative cancer care should be delivered with minimized treatment burden and financial costs to the patient.
- (4) Research related to palliative radiotherapy is a high priority, especially in low and middle income countries, since available data mostly comes from high income countries. Different patient populations may require different approaches that can be clarified through research protocols and careful monitoring and evaluation of treatment outcome:
 - (a) Palliative radiotherapy research should be performed in representative populations;
 - (b) Specific programmes must be developed for funding of palliative cancer care research;
 - (c) Palliative cancer care research should be interdisciplinary.

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