
CHAPTER 11. CANCER SERVICES AND THE COMPREHENSIVE CANCER CENTER

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Figures: 2

Maps

Tables

Abstract

The modern cancer system is composed of the comprehensive set of functions starting with population based cancer plans, cancer registries, public health functions, health system institutions that deliver all components of clinical care. Recent emphasis on health systems focuses on the population wide intervention. However, cancer centres, or cancer programs within health care institutions, are critical to the delivery of cancer care. Cancer centers are complex organizations that evolved over time to being able to provide a comprehensive set of interventions and act as champions for cancer prevention, treatment and supportive care, while at the same time promoting cancer research and education. Cancer centres may be supported in a country regardless of its resource level and they play an important role in advancing the clinical functions of cancer systems. In this chapter we describe a framework for a comprehensive cancer center which although focused on clinical care acts as an important anchor for a cancer system. The framework we propose outlines structures for clinical management, clinical services, core services, and system support with quality as an integrating theme. We describe the elements

required for each clinical service to deliver care and the core services to support their functions. The significant benefits of comprehensive centers are identified.

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Introduction

Cancer, one of the noncommunicable diseases, is a growing global health challenge (Knaul, Gralow, Atun and others, 2012; Knaul, Alleyne, Atun and others, 2012; Frenk and others 2014). In 2012, 14.1 million new cancer cases were diagnosed worldwide, and 8.2 million people died from cancer (GLOBOCAN 2012a; IARC world cancer report 2014). By 2030, the number of new cases is predicted to grow to 21.7 million, with an estimated 13 million people projected to die from the disease (GLOBOCAN 2012b).

Most countries in the world and a multitude of global and local organizations are engaged in varying degrees in addressing the challenges of cancer (Blanchet and others 2013; Knaul, Alleyne, Atun and others, 2012). One key solution is to develop a plan for a

population based comprehensive cancer systems that address planning, policy, advocacy, prevention, treatment, and supportive care (WHO 2006a-2006e, 2008). Comprehensive cancer systems—which reflect the full cancer panorama are composed of *functions* that correspond to broader health systems and *components* of cancer control.

The features of comprehensive cancer centers have been described elsewhere (Gralow, Krakauer, Anderson and others, 2012; Hensher, Price and Adomakoh, 2006; Sloan and Gelband, 2007). This chapter describes an optimal framework for a comprehensive cancer center, irrespective of how it is organized, as a free-standing dedicated institution, a program within an academic health science center or within a large community hospital, or a group of hospitals providing an integrated program. While the chapter does not address the full set of the complexities in cancer control, it provides the nucleus around which an entire program can be developed, highlighting examples of experiences and considerations for LMICs.

The first section presents an overview of the framework for a comprehensive cancer center, which includes three levels that are embedded within a comprehensive cancer system. Detailed information on each level is presented, followed by a discussion of quality as an integrating theme for the framework. The chapter concludes by detailing the benefits that a comprehensive cancer center provides to a country's cancer control and health care efforts.

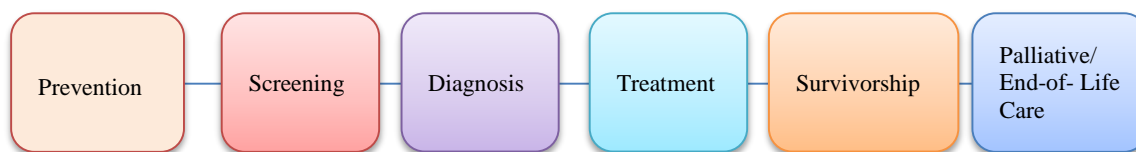
Cancer System Functions

The *functions* of health systems are stewardship, financing (budgeting and allocating resources), service delivery, and resource generation (WHO, World Health Report, 2000; Knaul, Alleyne, Piot and others, 2012). Cancer system planning includes the development of population-based or national cancer plans. Such plans address all aspects of cancer control including cancer registration, establishment of practice and operating standards and ensuring compliance, promoting and implementing research, establishing health care education and practice standards, certifying and accrediting service providers, evaluating and monitoring system performance.

Cancer System Components

The World Health Organization (WHO) (2006a) recommends that all states have a cancer control plan to meet the needs of the population for the *components* of cancer control: prevention, screening, diagnosis, treatment, survivorship, and palliative and end-of-life care (figure 11.1). In this chapter, the single term—*cancer control*—is used to describe these components, based on the assumption that control refers to preventing cancer and reducing the impact of the disease on survival, function, and quality of life.

Figure 11.1: Cancer Control Components



Adapted from Cancer Care Ontario 2013b.

Many of the cancer control components are provided in comprehensive cancer centers, regardless of a country's resource level. World Health Organization (WHO) and leading work in global cancer has emphasized that every country should aim to have at least one publicly supported cancer center that advances the broad objectives of control and provides exemplary patient care, appropriate to local circumstances and available resources (Gralow, Krakauer, Anderson and others, 2012; Knaul, Gralow, Atun and others, 2012; Sloan and Gelband, 2007).

Comprehensive Cancer Centers

Many low and middle-income countries (LMICs) are developing comprehensive cancer centers supported with public and/or private resources. These model centers help to establish best practices in clinical management, and they provide clinical and core services to meet the cancer control needs of the population. The set of specialized human and technical resources enables centers to provide best practice cancer control treatments to large catchment areas and populations. Patients can be managed directly at the centers or - for many although not all aspects of treatment - in other, less specialized hospitals and local health clinics, with the center providing oversight and transfers of knowledge about best practices for care. Comprehensive cancer centers also educate health care professionals and the public, and conduct research into the causes, prevention, diagnosis, and treatment of cancer (National Cancer Institute 2012).

Importantly, centers can act as focal points for cancer control nationally (Sloan and Gelband, 2007) and can play an influential role shaping and advancing cancer functions and health systems through the stewardship function. By strengthening health system capacity, cancer centers go beyond treating cancer as a vertical disease-specific program to enable a diagonal approach that cuts across horizontal initiatives that target system-wide constraints to address the overall goals of the health system (Knaul, Alleyne, Piot and others, 2012).

The capacity for countries to develop comprehensive cancer systems varies with available resources, national governance, management effectiveness, public accountability, engagement of civil society, and other factors (English and others 2006; Knaul, Alleyne, Atun and others, 2012; Mills, Rasheed and Tollman, 2006; Preker, McKee, Mitchell and others, 2006; WHO 2012). Each country, depending on population size and available resources, should strive to develop one or more comprehensive cancer centers that considers local conditions, including the cancer burden, and leverages the

experience and expertise gathered in other countries (Sloan and Gelband, 2007; Knaul, Alleyne, Piot and other, 2012; Gralow, Krakauer, Anderson and others, 2012).

Although this goal will take time to attain in many countries, it is being successfully achieved in multiple settings (Knaul, Gralow, Atun and others, 2012). For example, the King Hussein Cancer Center in Jordan, a middle-income country, is using a broad approach to develop its cancer center (box 11.1). This center went from offering very limited access to poorly organized, low quality cancer services to providing internationally accredited cancer care, engaging in cancer-related education and research, leading national control planning efforts, and contributing to regional and global cancer efforts.

Box 11.1 King Hussein Cancer Foundation and Center, Jordan

The King Hussein Cancer Foundation in Amman, Jordan, is an independent, nongovernmental, non-profit organization that oversees the operations of the cancer center. The hospital first opened in 1997 as the *Al-Amal Center* or the *Center of Hope* and was renamed in September 2002 as the King Hussein Cancer Center. This comprehensive center treats all types of cancer in adult and pediatric patients from the Middle East and North Africa.

The center's evolution was accomplished by strategies that included the following:

- Reversing brain drain by convincing accomplished clinical and executive leaders trained and working in high income countries to return to the region to direct and manage the change and create the foundation for and expansion of clinical excellence in cancer care
- Designing and building a well-functioning and appropriately equipped physical facility that meets accepted standards for quality and patient safety.
- Raising the standard of clinical services in surgery, systemic/chemotherapy, radiation therapy, nursing oncology, bone marrow transplantation, and psycho-oncology.
- Developing formal operating policies and procedures to ensure effective, efficient, and safe operations.
- Establishing cancer education, training, and public awareness programs, including oncology fellowships and residency programs.
- Developing a research program.
- Collaborating with other global cancer centers to improve adult and pediatric cancer care, training, and research. Examples include the St. Jude Children's Research Hospital, H. Lee Moffitt Cancer Center, and MD Anderson Cancer Center in the United States; the Hospital for Sick Children and the Princess Margaret Cancer Centre in Toronto, Ontario, Canada; the National Cancer Institute in Cairo, Egypt; the American University of Beirut, Lebanon; the Augusta Victoria Hospital in Jerusalem the Stefan Morsch Foundation in Germany; and the Leeds Cancer Centre in the United Kingdom.

In 2006, the King Hussein Cancer Center received Joint Commission International's (JCI) accreditation as a hospital, and in 2007, the JCI's Clinical Care Program Certification (CCPC) in cancer. The center is engaged in activities that have national and international impact. Nationally, the center helped to organize and support the Jordan Breast Cancer Program, a Ministry of Health national early detection and awareness program. The center is also leading efforts in Jordan to establish a national cancer control planning program. Internationally, the European Arab Society of Oncology has recognized the center as a Cancer Center of Excellence for the training of cancer health workers from the Arab world. The center has signed agreements with Petra University to establish the first diploma program in tobacco dependence treatment in the region, and with the German Jordan University to establish a diploma program in nursing oncology. The center is a WHO collaborating center. The center and foundation are actively involved in activities of the Union for International Cancer Control (UICC) and are helping other countries in the region to collaborate with UICC.

The center continues to develop to meet the increasing patient demand from Jordan and surrounding countries. Construction is underway to expand the physical infrastructure to double capacity, and completion is expected in mid-2016. Human resource and capacity building is ongoing with recruitment of additional staff members, including in cancer subspecialties, as is strengthening cancer research and education activities.

<<end of box 11.1>>

Framework for a Comprehensive Cancer Center Overview of the Framework

From the patients' perspective, the comprehensive cancer center can be seen to have three distinct layers, each with required elements (figure 11.2).

CLINICAL MANAGEMENT

The first layer describes the *clinical management*, and sets out the principles and the basis for clinical decision making. Individuals who are either likely to have or with diagnosis of cancer require an assessment by health care professionals. This is followed by recommendations about the goals of care, appropriate interventions, and optimal time frames. This information makes up each patient's individualized *clinical management plan*. The clinical management plan is based on the evidence-based or consensus-based clinical practice guidelines that standardize professional practice; the plan is reviewed in a multidisciplinary conference overseeing clinical decisions and monitoring the outcomes and the quality of the clinical management plan.

CLINICAL SERVICES

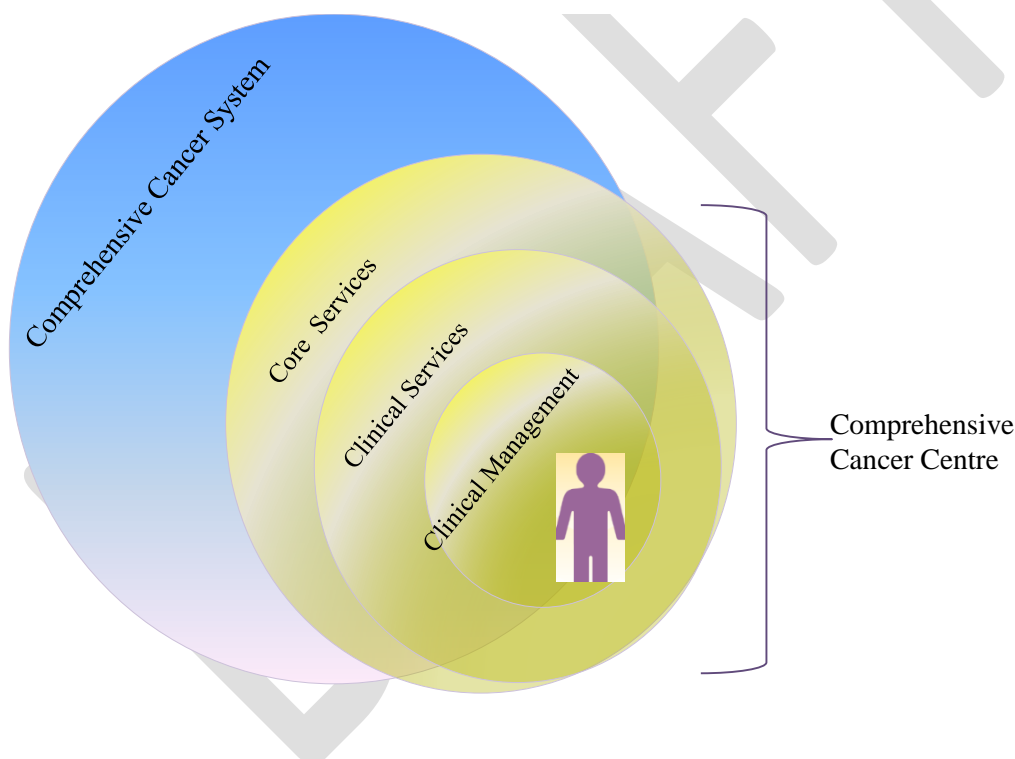
The second layer describes *clinical services* that are needed to implement the clinical management plans and ensure timely access to care and high quality interventions. For

example, cancer patients frequently require a combination of a number of services including laboratories and pathology, diagnostic imaging, surgery, systemic treatment / chemotherapy, and/or radiation, as well as pain management and supportive care. Clinical services must have a comprehensive suite of facilities, material and human resources, and processes required to deliver each of the diagnostic, treatment, and supportive care interventions.

CORE SERVICES

The third layer consists of *core services*, which support all of cancer services and include requirements for the safe, effective, and efficient operation and integration of clinical services. These services include administration and management, human resources, information technology and management, physical facilities, pharmacy, infection prevention and control, quality assurance, finance, as well as other key supportive platforms.

Figure 11.2: Framework for a Comprehensive Cancer Centre



The framework of layers and services is equally relevant to high-income countries as it is to LMICs. Although LMICs have fewer resources and may not be able to support the full range cancer control efforts, the framework provides a necessary reference point for structuring a plan to develop a comprehensive centre even if this is achieved in discrete stages as funding and capacity are build up.

Clinical Management

Clinical management sets out methods for clinical decision making. These plans are usually based on the histopathologic/molecular diagnosis specifying the type of cancer, the anatomic disease extent or *stage*, and the individual patient's characteristics such as age, co-morbidities, and performance status. Determining the best clinical management for cancer patients involves defining the goals of care (cure, disease control, symptom control, etc...), recommending appropriate interventions, and setting out the optimal timeframes for instituting and completing treatment. The clinical care plans vary from fairly simple to very complex ones, involving numerous services. Poor clinical decisions result in patients not receiving needed treatments or receiving treatments that are insufficient, poorly timed, or inappropriate for their condition.

Errors in clinical decisions can lead to increased morbidity and disability, causing premature death and requiring additional costly health services. For example, a study of children with acute myeloid leukemia in El Salvador, Guatemala, and Honduras found a high overall rate of treatment-related mortality of 23.3 percent (Gupta, Bonilla, Valverde and others, 2012). The most common causes were infection and haemorrhage – complications that could be reduced with the increased use of transfusion practices and better infection prevention and control practices.

The clinical management framework grounds clinical decisions on evidence and consensus-based treatment guidelines that have been developed to assist practitioner and patient decisions about appropriate care in specific clinical circumstances (Hensher, Price and Adomakoh, 2006). The importance of guidelines for ensuring standards of clinical care is recognized throughout the world. Comprehensive cancer centers play a leadership role in helping to develop and promote the use of treatment guidelines locally and nationally. Center clinicians and researchers work with professional bodies, such as the American Society of Clinical Oncology (ASCO), the European Society for Medical Oncology (ESMO), and many other professional associations to develop guidelines for a wide range of scenarios and are widely available. Some examples include the Cochrane Collaboration that publishes systematic reviews to inform the guidelines, the US Preventive Services Task Force for screening guidelines, and Cancer Care Ontario's Program in Evidence-Based Care that produces evidence-based guidance documents.¹ Guidelines are also published by the National Comprehensive Cancer Network, the Canadian Partnership Against Cancer, and the National Guidelines Clearing House in the United States, to name a few.² <<Footnotes 2, 3, and 4 will be converted to endnotes>>

¹ <<These will be converted to endnotes>>For the Cochrane Collaboration, see <http://www.cochrane.org/cochrane-reviews>. For the US Preventive Services Task Force, see <http://www.uspreventiveservicestaskforce.org/recommendations.htm>. For Cancer Care Ontario, see <https://www.cancercare.on.ca/cms/One.aspx?portalId=1377&pageId=10144>.

² For the National Comprehensive Cancer Network, see www.nccn.org. For the Canadian Partnership Against Cancer Standards and Guidelines Evidence (SAGE) Directory of Cancer Guidelines, see <http://cancerguidelines.ca/Guidelines/inventory/index.php>. For US National Guidelines Clearing House, see <http://guideline.gov/browse/by-topic-detail.aspx?id=19187&ct=1>.

In addition to guidelines for clinical treatment, numerous guidelines help direct the management of symptoms, treatment complications, prophylactic interventions, and other aspects of care. These practice guidelines are not limited to therapeutic interventions and include indications for medical imaging and other diagnostic interventions.³ Nursing and other allied health professions develop guidelines to better organize and direct care.⁴

Since most cancer patients require a multimodality treatment, guidelines and standards have been developed for decision making (National Breast and Ovarian Cancer Centre 2008). Many jurisdictions mandate a structured and systematic review of patient data and treatment plans prior to the initiation of therapy. Multidisciplinary care teams (National Cancer Action Team 2010), multidisciplinary clinics, and multidisciplinary cancer conferences, all form the elements of modern clinical cancer management. In these instances, teams regularly come together to bring evidence-based practice guidelines to bear on their discussions of appropriate diagnostic tests, suitable treatment options, and recommended treatments for each patient (Cancer Care Ontario 2013a; National Cancer Action Team 2010). Increasingly, decision support tools are being developed and made widely available to help guide complex clinical management decisions about treatment. A modern comprehensive cancer center should have the practice guidelines adapted to local conditions available for review and a process in place for multidisciplinary decision-making and review.

Most guidelines assume access to optimal resources and are adapted for use in circumstances in which these resources are limited (Anderson and others, 2008; Kerr and Midgley, 2010). The National Institute for Health and Care Excellence (NICE) in the United Kingdom considers costs and cost-effectiveness when developing recommendations for funding (Chalkidou, Marquez, Dhillon and others, 2014). Clinicians in comprehensive cancer centers in LMICs can bring their experience and expertise to bear in adapting guidelines to the local context and available cancer services. The process expertise in LMICs (how to get something done in a resource-constrained setting) combined with HIC content expertise (the international gold standard for clinical care for a certain cancer) can lead to locally appropriate standard protocols and a baseline standard of care (Strother, Asirwa, Busakhala and others, 2013).

Many guidelines have been adopted and adapted by national and local communities for use in LMICs (Gralow, Krakauer, Anderson and others, 2012; Konduri, Quick, Gralow and others, 2012). Although the focus of most of these initiatives is broader than the comprehensive cancer centers, their impact has influenced the clinical management of patients within centers. A well-known international example is the Breast Health Global

³ For example, see the Royal College of Radiologists <http://www.rcr.ac.uk/index.aspx>; and the American College of Radiology <http://www.acr.org/Quality-Safety/Standards-Guidelines>.

⁴ For example, see the Oncology Nursing Society <http://www.ons.org/ClinicalResources>; European Oncology Nursing Society <http://www.cancernurse.eu/education/guidelines.html>; Association of Oncology Social Work <http://aosw.org/standards-of-practice/>.

Initiative, which has developed evidence-based, economically feasible, and culturally appropriate guidelines for breast health and cancer control in LMICs (Breast Health Global Initiative (*DCP3Vol 6, Breast cancer chapter*; El Saghir, Adebamowo, Anderson and others, 2011; Varughese and Richman, 2010). The matrix guideline spans the spectrum of breast health care, from early detection to treatment and palliation, and considers the available resources at each stage (Sloan and Gelband, 2007). Another example is the U.S.-based National Comprehensive Cancer Network, which collaborates to produce international adaptations and translations of its guidelines that may include modifications based on local circumstances.⁵ <<Footnotes 5 and 6 will be converted to endnotes>> Other examples include efforts in India to establish a wide range of guidelines adapted to local resource availability,⁶ and consensus group recommendations for imaging techniques for head and neck cancers in Asia as developed by Wee and colleagues depending on resource availability (Wee, Anderson, Corry and others, 2009). In some countries, national guidelines and norms have been developed by governments, and specifically ministries of health, although implementation and monitoring is an ongoing challenge. Mexico, for example, has a series of *Norma Oficial Mexicano* (NOM) that guide cancer services and finance.

Clinical Services

Clinical services are essential to implement the clinical management plans and ensure access to high quality interventions. Each clinical service includes a comprehensive suite of facilities, equipment, skilled personnel, and policies and procedures required to deliver a diagnostic, treatment, or supportive care intervention. The cancer centres work to effectively integrate these services. For example, cancer screening is only effective in reducing mortality if effective diagnostic measures and treatment are available and provided.

Clinical services are commonly viewed as the cancer control continuum (Canadian Partnership Against Cancer 2013), although many patients do not use the services in a unidirectional manner (Knaul, Alleyne, Piot and others, 2012). For example, patients who receive treatment may need ongoing screening and diagnostic services, followed by additional treatments.

Access to the full range of clinical services is critical for timely and appropriate cancer diagnosis and treatment. Incorrect or incomplete pathology and radiology results can result in a missed or wrong diagnosis. Life-saving treatment may be too late or not provided at all, resulting in unnecessary illness, premature death, and costs to patients, their families, the health care system, and society. A timely and accurate diagnosis is critical, especially for many cancers where early detection makes a difference in the probability of cure. Incorrect, delayed, poor quality, or lack of access to treatment result

⁵ See http://www.nccn.org/international/international_adaptations.asp.

⁶ See <https://tmc.gov.in/clinicalguidelines/clinical.htm>.

in unnecessary illness, disability, premature death, and costs to patients, their families, the health care system, and society.

Frequently, clinical services require special accreditation and are subject to external review and control, such as in radiation protection and safety for imaging and radiotherapy, external accreditation for laboratory services, and cell therapy. Countries or regions may have general accreditation standards that generally address the cancer center's clinical services, as well as service-specific credentialing bodies (Econex 2010). If they do not have such standards, countries can access accreditation standards through other organizations, for example, various national accreditation organizations have international practices.⁷ <<Footnote 7 will be converted to endnote>>

Despite the critical importance of a full range of services, many patients do not have the opportunity to get timely access. This is especially true in LMICS because a much higher proportion of patients present with advanced stage of disease at diagnosis when cure is unlikely. Many of the reasons for late diagnosis relate to the lack of organized programs; lack of health care providers and infrastructure; lower levels of education, income, and social status; lack of awareness about health, cancer, and available programs; and social stigma, cultural beliefs, and discriminatory practices (Agarwal, Ramakant, Forgach and others, 2009; Gralow, Krakauer, Anderson and others, 2012; International Atomic Energy Agency 2003; Price, Ndom, Atenguena and others, 2012; Sharma, Costas, Shulman and others, 2012; Varughese and Richman, 2010).

OFFICE AND CLINIC-BASED AMBULATORY CARE

The initial patient encounter most often happens in an office or a clinic settings. A formal hospital setting may not be required to provide various cancer-related ambulatory procedures, such as clinical interviews, physical examination, Pap smears, blood samples, or endoscopies. Guidelines help to determine when and where these procedures should occur and how they should be provided properly and safely by trained staff. Ambulatory facilities may need special equipment to address the needs of various patient populations, for example, special examining tables for gynecologic malignancies, chairs and special endoscopic equipment for assessing head and neck cancers. Depending on the activity and jurisdiction, special facilities to support these procedures may be required and should be accredited.

MEDICAL IMAGING (DIAGNOSTIC RADIOLOGY)

Imaging is used to help to determine a cancer diagnosis, assess the size and spread of cancer in the body, provide treatment through less invasive interventional procedures,

⁷ For example, see the Joint Commission International (<http://www.jointcommissioninternational.org/Accreditation-Programs/>); National Accreditation Board for Hospitals and Healthcare Providers International (<http://www.nabh.co/international/index.asp>); Accreditation Canada International (<http://www.internationalaccreditation.ca/en/home.aspx>).

assess the effect of cancer treatment and complications, monitor for the recurrence of cancer, and screen the general population for cancerous conditions. The examples of interventional procedures under image guidance include biopsies under ultrasound, computed tomography (CT) or a magnetic resonance imaging (MR); securing vascular access; and performing therapeutic interventions, such as embolization and high frequency ultrasound tumor ablation. Imaging for cancer ranges widely: from radiography with conventional x-rays, ultrasound, to CT, MRI, and molecular imaging (nuclear medicine). More common molecular imaging techniques include the use of position emission tomography, now frequently combined with CT (PET-CT).

Imaging services are not specific to cancer and are widely used in many other conditions. Although the implementation of imaging services requires an upfront investment, the benefits in terms of appropriateness and quality of care mitigate these costs.

Imaging services require equipment and specialized staff to operate and maintain within guidelines. Radiologists are specialist physicians, who interpret the images, provide diagnostic reports, and guide the practice in medical imaging facilities. The radiology technologists are trained to operate the imaging equipment, obtain appropriate images for accurate diagnosis, and support the patients through the diagnostic process. The use of ionizing radiation requires appropriate radiation protection for staff and patients. International organizations have developed and published standards, and guidelines about the safe installation, operation, and use of imaging equipment; these organizations include the International Atomic Energy Agency, the International Society of Radiology, and the World Health Organization. This information is used to guide the creation of national and regional standards and regulations (for example, Radiation Safety Institute of Canada 2013; Zaidi, 2010). <<Convert to endnote and renumber subsequent notes>> The use of picture archiving and communication systems (PACS) and web based systems allows for the offsite evaluation and reporting of images and is useful in managing care in remote communities as well as remote mentoring and quality control initiatives. These processes are especially useful in limited resource setting like often present in LMICs.

PATHOLOGY AND LABORATORY MEDICINE

Pathology and laboratory medicine are essential for diagnosing cancer by examining biologic specimens taken from individuals. Laboratory medicine services include pathology (examination of tissues and cells), hematology (analysis of blood), biochemistry, microbiology and, increasingly, cytogenetic and molecular testing. Pathology and laboratory medicine services are not specific to cancer and can be used to diagnose many conditions.

Pathology and laboratory medicine services require facilities equipped to handle biological specimens that require fluid and tissue precautions, and specialized equipment to process and analyze tissues, blood, serum, and body fluids. Laboratory and pathology services can range from basic to highly sophisticated in terms of required resources, skills, and technologies. Basic pathology can include the capability for specimen fixation, embedding into paraffin, tissue slicing, and staining; modern facilities must include

immunohistochemistry, flow cytometry, and molecular and cytogenetic testing (Gralow, Krakauer, Anderson and others, 2012). Given that the diagnosis of cancer, especially rare ones, is complex, subspecialty expertise, or access to such expertise via international networks is required. Telepathology provides opportunities to improve access to expert pathology opinion and definitive diagnosis within jurisdictions and across the globe. Telepathology services have been successfully piloted in many countries that service remote areas with small populations, such as Australia, Canada, Japan, and the United States (Trudel, Paré, Têtu and others, 2012). A number of collaborative or twinning initiatives have also been developed to support pathology services in LMICs. Examples include a Ghana-Norway partnership as part of the Breast Health Global Initiative (Masood, Vass, Ibarra and others, 2008) and Partners in Health, which includes clinics in a number of LMICs (Haiti and Rwanda) with close ties to the Brigham and Women's Hospital and Dana-Farber Cancer Center (Carlson, Lyon, Walton and others, 2010).

Laboratories require specialized accreditation to ensure that processes are in place to optimize the quality of specimen procurement and reporting.⁸ <<Footnote 8 will be converted to endnote>> These processes need to consider a series of timelines. Automation is helpful to augment throughput and rapid reporting.

The World Health Organization maintains the international classification of diseases and publishes the histopathologic classifications of cancer (IARC/WHO) that standardize the nomenclature. Synoptic pathology reporting, increasingly used to standardize the pathology reports, improves communications among health care providers. The International Collaboration on Cancer Reporting Group—composed of the College of American Pathologists; the Royal College of Pathologists, United Kingdom; the Canadian Association of Pathologists, in association with the Canadian Partnership Against Cancer and the Royal College of Pathologists of Australasia—is exploring the development of an international pathology cancer dataset.⁹ <<Footnote 9 will be converted to endnote>>

SURGERY

Surgery is a fundamental element of cancer treatment. It is used to prevent and reduce cancer risk by removing precancerous body tissue, diagnose cancer through biopsy procedures, determine the size and spread of cancer, and to cure, especially early-stage, cancers by removal of tumors alone or in combination with other therapies, reconstruction or restoration of function or appearance, and, relief of symptoms or side effects of cancer. Surgery therefore is essential, not only for cure, but for long-term

⁸ For example, see the European Federation of Clinical Chemistry and Laboratory Medicine <http://www.ifcc.org/executive-board-and-council/regional-federations/efcc-european-federation-of-clinical-chemistry/>; National Accrediting Agency for Clinical Laboratory Sciences <http://www.naacls.org/>; the National Accreditation Board for Testing and Calibration Laboratories <http://www.nabl-india.org/>.

⁹ See <http://www.rcpa.edu.au/Publications/StructuredReporting/ICCR.htm>.

survival and management of complications (Gralow, Krakauer, Anderson and others, 2012; Smith, Ziogas and Culver, 2013). Most people with cancer have a surgical procedure as this often offers the greatest chance for cure (American Cancer Society 2011). Evidence suggests that initial surgical treatment for treatable cancers, such as breast, cervical, and colorectal cancers, is cost-effective for middle-income countries (MICs) and possibly cost-effective for LICs (Brown, Goldie, Draisma and others, 2006). However, currently many countries lack adequate access to surgical services and lives are lost because of these limitations.

Surgical services are needed to treat patients with many other conditions. Surgery requires the use of appropriately equipped facilities. Many elements are required to fulfil actions from the decision to proceed with surgery to the patient leaving the recovery room (specifically, preadmission evaluation, operative procedure booking, operating room, and recovery room, processes to prevent post-surgical infections) and the hospital. Patients require the support of anesthesia services and post-anesthetic recovery units, may require critical care/high dependency units, and frequently inpatient units for longer recovery periods. Surgeons work in multiprofessional teams with anesthesiologists, specially trained nurses, and many other support staff.

Surgery may be performed by general or specialty surgeons, depending on the procedure. Increasingly, subspecialty surgical oncologists deal with complex cancers (WHO 2006d) and perform complicated procedures. General surgeons may specialize in breast, and colorectal cancers; thoracic surgeons are skilled in complex lung resection and mediastinal procedures; hepatobiliary surgeons specialize and pancreatic and liver cancers.

Increasing evidence suggests that volume of work is associated with improved outcomes. The surgeons and hospitals that perform surgery on a larger number of patients have better outcomes in terms of complications and survival rates (Derogar, Azodi, Johar and others, 2013; Rabeneck, Davila, Thompson and others, 2004; Sundaresan, Langer, Oliver and others, 2007; Yun, Kim, Min and others, 2012). As a result, many jurisdictions are centralizing complex cancer surgery to centers with higher volumes of cases. This centralization also makes sense from a resource perspective, since services will be more sustainable when complex procedures are centralized along with specialized expertise and technologies (WHO 2006d).

The introduction of standardized practices, such as the Surgical Safety Checklist endorsed by the WHO, has improved the outcomes of surgical procedures (Gawande, 2010; Lingard, Regehr, Orser and others, 2008; Lingard, Regehr, Cartmill and others, 2011; World Alliance for Patient Safety 2008). The use of the Surgical Safety Checklist, has been shown to improve surgical services, regardless of a country's resource level (Farmer, Frenk, Knaul and others, 2010; Haynes, Weiser, Berry and others, 2009). The use of comprehensive standard policies and procedures also improves safe and efficient operations.

RADIATION THERAPY

Radiation therapy, or radiotherapy (RT), involves the use of ionizing radiation for therapeutic purposes. It is used with curative intent, as well as with palliative intent to alleviate symptoms due to cancer (Gralow, Krakauer, Anderson and others, 2012; IAEA 2003, 2010). Radiotherapy can be delivered as an “external beam RT” using cobalt 60 units or linear accelerators, as “brachytherapy” where the radioactive sources are placed in direct contact with the tumor, or through the use of radioactive pharmaceuticals.

Radiotherapy is mostly used in the treatment of cancer. It is unfortunately perceived to be a very complex and expensive treatment requiring large upfront investment, and therefore tends to be centralized in a few locations. As a result, its availability is limited or nonexistent in many countries (IAEC 2003; Barton, Frommer and Shafiq, 2006; Gralow, Krakauer, Anderson and others, 2012; Rosenblatt, Izewska, Anacak and others, 2013). In fact, radiotherapy is actually one of more affordable cancer treatments, given that one radiation machine can treat thousands of patients over many years (Rodin, Jaffray, Atun and others, 2014)

Radiotherapy requires specially designed facilities that provide adequate radiation protection for staff and patients (IAEC 2008). Many countries have regulatory bodies that govern the application of radiation and radioactive sources in health care, such as the Atomic Energy Regulatory Board in India, the Nuclear Regulatory Authority in Argentina, and the Canadian Nuclear Safety Commission, and others. The ongoing equipment maintenance and technical support are required for safe operation of radiotherapy facility. The RT facilities require clinical facilities for patients, RT planning facilities including simulators and specialized workstations for computerized planning software, and treatment rooms that house radiotherapy machines. Physics laboratories and QA rooms are required to support treatment facilities.

Radiotherapy is provided by an interprofessional team of radiation oncologists, physicians who assess the patient, prescribe and plan RT, and oversee the outcomes; medical physicists, who ensure the quality and safety of radiotherapy by securing the integrity of the equipment and overseeing the planning and electronic systems that link planning with treatment; and radiation therapists, who deliver treatments and support patients.

Various strategies to improve access to radiotherapy in LMICs have been suggested, including offering basic treatment techniques and optimizing fractionation to increase the throughput on RT machines; encouraging competitive pricing; and supporting long-distance mentorship for programs in remote areas (Gralow, Krakauer, Anderson and others, 2012). For many reasons, cobalt machines have frequently been considered more appropriate for LMICs (IAEC 2008, 2010). These views are changing as the access to more sophisticated technologies is improving. Although linear accelerators require a more reliable power supply, cobalt units present a higher radiation safety risk and require frequent source replacement, which presents a hazard and additional expense.

SYSTEMIC/CHEMOTHERAPY

Systemic therapy or chemotherapy is a cancer treatment in which drugs are distributed in the body through the bloodstream. These drugs include *chemotherapy*, generally administered intravenously or orally, hormones, and immune and molecular-targeted therapies. The systemic therapy is used alone or in combination with surgery and radiotherapy to reduce recurrence, improve survival (Gralow, Krakauer, Anderson and others, 2012; Livingston, 1997; Valentini, Barba and Gambacorta, 2010), and help preserve organs. Chemotherapy alone is used in hematologic cancers and in most metastatic cancers.

Systemic therapy services include the facilities and systems required for the safe administration of chemotherapy and immunotherapy. These facilities and systems can be used for intravenous treatment, and also for transfusions, minor procedures, such as bone marrow biopsies, thoracentesis, paracentesis, lumbar puncture, for cancer and noncancerous conditions.

Systemic therapy can be delivered on inpatient units, but it is more commonly delivered in specialized ambulatory facilities designed to provide intravenous therapy. These facilities can include hospital outpatient units and community-based medical offices or clinics, depending on their capacity to monitor the patient. In systemic therapy, policies and procedures to guide practice have more impact than specially designated facilities. Organizations, such as the American Society of Clinical Oncology and the Oncology Nursing Society, are developing standards for the safe administration of chemotherapy in outpatient and inpatient units.¹⁰ <<Footnote 10 will be converted to endnote>>

Medical oncologists are specialists who assess patients with cancer, prescribe systemic therapies, manage toxicities, and assess the outcomes of treatment. They work with specially trained pharmacists and pharmacy technicians, who procure medication orders and prepare medications for infusion and specialized nurses who administer treatment, manage complications and support patients. Laboratory facilities are essential as patients must be assessed before each infusion. With proper training of health care personnel and good policies and procedures, chemotherapy can be prepared, administered, and monitored at general hospitals with backup and support from specialists located offsite. Community systemic therapy facilities are important in LICs but also in developed countries with remote areas of low population density (Knaul, Bhadelia, Bashshur and others, 2012).

Systemic therapy/chemotherapy drugs may be expensive, although a host of agents are now off patent and can be effective and used extensively in LMICs (Konduri, Quick, Gralow and others, 2012). In fact several of the cancers endemic to the lowest income settings are amenable to treatment with low cost chemotherapy. Cost is a major barrier to

¹⁰ See <http://www.asco.org/institute-quality/asco-ons-standards-safe-chemotherapy-administration>.

chemotherapy in many jurisdictions including those without health insurance coverage. Lack of medical and nursing expertise, cost of drugs, and lack of support services are the barriers to adequate access to chemotherapy.

PALLIATIVE CARE

Palliative care is essential to manage symptoms associated with cancer and improve the quality of life of patients and their families facing the problems associated with life-threatening illness. Palliative care aims to prevent or relieve suffering, provide early identification and assessment of symptoms, and address other physical, psychosocial, and spiritual issues (WHO 2006).

Palliative care services range from basic to more specialized support reflecting the needs of patients and the skills of providers and are provided in a cancer center or a general hospital, in a community clinic, in a hospice, or at home. (Palliative Care Australia 2005). They are provided by physicians and nurses with specialty training working in a number of settings and supported by a number of other support staff. (Zimmermann, Seccareccia, Clarke and others, 2006).

The palliative need to be addressed in a timely manner. This is especially important for pain management. Providing training in adequate pain control and securing appropriate access to opioid medications are essential elements of cancer services. The Breast Health Global Initiative 2013 consensus statement on supportive and palliative care for metastatic breast cancer identified pain management as a priority at a basic level of resource allocation and emphasized the need for morphine to be readily available in LMICs (Cleary, Ddungu, Distelhorst and others, 2013). Regular pain assessments and the proper use of pharmacologic and non-pharmacologic interventions are also recommended.

The access to opioids is a major barrier to access to pain relief for cancer patients. Many cancer patients continue to die without access to pain relief. The poorest 10% of the world's population reports almost zero consumption of opioids per death in pain (Knaul, Adami Adebamowo and others, 2012) Yet, opioids are one of the most inexpensive and effective means for pain relief and their utilization may be used as surrogate for access to palliation. Even in the lowest income settings access to pain relief and palliative care should be considered as basic minimum in cancer treatment.

SURVIVORSHIP

Survivorship has been defined broadly as care of persons diagnosed with cancer, from the time of diagnosis throughout their lives, and the impact of cancer on family members, friends, and caregivers of survivors (Centers for Disease Prevention and Control 2013). A more explicit definition of survivorship can be developed by adapting the four essential components of quality cancer survivorship care by Hewitt and others (2005) to include: prevention of recurrent and new cancers and of other late effects; surveillance for cancer, recurrence, or second cancers, and assessment of medical and psychosocial late effects; intervention for consequences of cancer and its treatment such as lymphedema and sexual

dysfunction, symptoms including pain and fatigue, psychological distress experienced by cancer survivors and their caregivers, concerns related to employment, insurance, and disability; coordination between specialists and primary care providers to ensure that all of the health needs of survivors are met.

Increasingly, as treatments become more successful and life expectancy increases, patients face new issues. This is especially true in high resource countries, such as United States and Canada or parts of Europe, where the five-year survival exceeds 60 percent (American Cancer Society 2013; Canadian Cancer Society's Advisory Committee on Cancer Statistics 2013). With improvements in access to and quality of care, this will become also observed in LMICs where survivorship services are currently unavailable.

Psychosocial supports can be provided to patients and their families by a broader group of individuals, depending on the level of need: for complex mental health issues and social matters, engagement of other health professionals including primary care providers, community health workers, spiritual guides, volunteers, friends, families, and others lay individuals. Comprehensive cancer centers should have a survivorship program that includes a range of professionals including psychiatrists, psychologists, social workers, nurses, therapists, nutritionists, and educators, as well as patients in treatment and cured who support the others.

Cancer centers should ensure that all patients who have completed their primary treatment have survivorship care plans, as recommended by the Institute of Medicine; such plans include the information about the cancer type, treatments received, potential treatment consequences, specific information about the timing and content of recommended follow-up, recommendations for preventive practices and how to maintain health and well-being, information on legal protections regarding employment and access to health insurance, and availability of psychosocial services in the community. (Hewitt, Greenfield and Stovall, 2005)

Core Services

Core services including administration and management, human resources, information technology and management, physical facilities, pharmacy, infection prevention and control, quality assurance, finance and additional key supports, extend to support the full range of clinical services. The level of core services depends on the size of the center and whether it is a designated standalone facility, part of a larger hospital, or a consortium of providers. In the latter two instances, the core services may not be specific to cancer and may be used for the management of other diseases and injuries. Generally, core services must meet accreditation and licensing standards and guidelines. The lack of investment in core services leads to poor access and performance of clinical services (Grimes, Bowman, Dodgion and others, 2011) including poor quality, inefficient use of resources, and negative impacts on health (Mavalankhar, Ramani, Patel and others, 2005). In addition, external challenges to core service infrastructure can paralyze the best clinical service. For example, long-term increases in the price of petroleum needed for medical supplies, transportation of goods, personnel, and patients, and fuel for lighting, heating,

cooling, and medical equipment may have significant negative impacts on health sectors in LMICs (Dalglish, Poulsen and Winch, 2013).

ADMINISTRATION AND MANAGEMENT

Cancer care is complex and requires skilled and accountable leadership and management at all levels. Generally, hospitals with better management have better clinical outcomes, and good management practices help to preserve or enhance the quality of care (Carter, Dorgan and Layton, others 2011). Useful frameworks exist to help to guide the development and ongoing excellence of administration and management. The WHO's health manager's website has information and tools to improve the management of the delivery of health services.¹¹ <<Footnote 11 will be converted to endnote>>

LMICs should take advantages of these resources, along with external assistance, mentorship opportunities, partnerships with neighboring countries and international organizations, and tools developed by leadership organizations. For example, the US-based Baldrige Performance Excellence Program focuses on performance excellence in leadership, strategic planning, customer focus, workforce focus, operations focus, results and measurement, and analysis and knowledge management (Baldrige Performance Excellence Program 2011-2012); the program has a self-assessment tool.

HUMAN RESOURCES

Human resources are the essential for cancer care. Cancer centers require appropriately trained and licensed clinicians and administrative and support staff. Centers need to recruit and retain staff and provide professional and career development opportunities to maintain competence and develop new skills. Core human resource services include identifying the roles and responsibilities of the range of positions within the center, setting compensation and benefit levels, developing performance evaluations, setting up management and supervisory structures, and providing conflict resolution services.

Making the best use of human resources also means maximizing their impact. For example, human resources can be increased in LMIC and remote areas by using nonspecialists or general medical professionals working under specific conditions. This practice promotes *task shifting* and optimizes the use of sparse, highly skilled personnel. For example, the use of community health workers, expert patients, and clinical officers (Knaul, Bhadelia, Bashshur and others, 2012) and in some countries, traditional healers who play an important role in influencing people's health care decisions (Price, Ndom, Atenguena and others, 2012), will enhance the capacity for health care delivery. Tele-services (telepathology, teleradiology, virtual consultation, etc.) can help to offer non-specialists support and guidance in cancer by tapping large international networks of highly trained professionals.

¹¹ See <http://www.who.int/management/general/en/>.

INFORMATION TECHNOLOGY AND MANAGEMENT

Generally, *information technology* (IT) refers to systems and their applications, for example, computer hardware and software and telecommunications that collect, store, use, and share information. *Information management* (IM) refers to the acts of organizing, linking, analyzing, and presenting data to guide decisions. IT tends to be electronic-based; IM can include both paper and electronic-based information.

In cancer centers, IT includes health records, operational systems, such as human resources, pharmacy, supplies, and equipment; financing; and other systems. IT also includes telemedicine and mobile information and communication technologies, such as cell phones (mHealth), which are being used to improve access to cancer-related health services. Telemedicine initiatives have the potential to decrease disparities in cancer care between resource-poor and resource-rich institutions by developing resources—human capital and telecommunication infrastructure—that link institutions with different levels of funding and expertise (Hazin and Qaddoumi, 2010).

Although IT requires funding for capital, training, ongoing maintenance, and technical backup, cancer centers need reliable electronic systems to manage the high volumes of information; inform safe, efficient, and effective care; and improve access. The benefits should outweigh the investment costs and can be especially important in LMICs for linking comprehensive centers to more remote areas and less specialized centers, but also for linking to international expertise and networks (Shekelle, Morton and Keeler 2006; Knaul, Bhadelia, Bashshur and others, 2012).

PHYSICAL FACILITIES

Physical facilities include buildings; internal areas, such as inpatient rooms and ambulatory clinic space; furniture; power supply; backup systems, waste disposal; and electrical, mechanical, ventilation, and plumbing systems. Physical facilities are extremely important for the effective functioning of clinical services.

While the effective and efficient use of physical facilities benefits from the economies of scale, it must also respect provision of equitable access. Health care services with high physical facility requirements will maximize health care resources if they are centralized in a few facilities (Debas, Gosselin, McCord and others, 2006; English, Lanata, Ngugi and others, 2006; Hensher, Price and Adomakoh, 2006; Gralow, Krakauer, Anderson and others, 2012). Similarly, physical facilities need to operate at sufficient capacity to ensure efficiencies of scale (Mills, Rasheed and Tollman, 2006). However, this requirement may challenge equitable access if people need to travel long distances for care (English, Lanata, Ngugi and others, 2006).

Innovative ways to provide cancer services can maximize the use of physical infrastructure. For example, health systems could be strengthened to provide more care in the community or at home, with telemedicine for expert consultations.

PHARMACY

The pharmacy services focus on safe and effective medication use and includes managing practice; policies on medication use; optimizing medication therapy; procuring drug products and managing inventory; preparing, packaging, and labeling medications; delivering medications; monitoring medication use; evaluating the effectiveness of the medication-use system; and conducting research (American Society of Health-System Pharmacists 2013).

The cancer pharmacy services reflect specialized knowledge about medications used for cancer, management of cancer complications, treatment side effects, and drug toxicities. The complexity of caring for patients with cancer; the costs of chemotherapy; the potential for severe drug toxicity and medication errors; and the requirements for safe preparation, administration, and disposal of cytotoxic drugs highlight the important role of pharmacies in cancer centers, regardless of a country's resource level (Wiernikowski, 2013). The International Society of Oncology Pharmacy Practitioners has developed Standards of Oncology Pharmacy Practice that take into account realities from both resource-rich and resource-poor settings.

INFECTION CONTROL

Infection control is a core service that focuses on preventing and controlling infections in cancer patients, especially those acquired while receiving care in the cancer center. It is also a key service for all other patients as well as hospital staff. Main infection prevention and control tactics include hand hygiene, disinfecting and sterilizing surfaces and equipment, investigating and monitoring suspected infections, managing outbreaks, providing personal protective equipment, taking appropriate precautions, and vaccinating and educating health care providers.

Leadership support and funding are important. To improve the quality of care, countries with limited resources need to increase their focus on infection control with government commitment and surveillance programs (Raka, 2010). For centers, this focus includes introducing prevention bundles,¹² <<Footnote 12 will be converted to endnote>> improving compliance with hand hygiene, making prudent use of antimicrobials, translating research results into practice, and upgrading the capabilities of microbiology (Raka, 2010).

¹² Bundles focus on aseptic procedures that potentially carry a high risk of hospital-related infection, for example, catheter-associated bloodstream infection, catheter-associated urinary tract infection, ventilator-associated pneumonia, and surgical site infections.

QUALITY ASSURANCE

Cancer care has many potential risks. Complex clinical management using multiple treatment paths and multiple health care providers highlight the importance of a center-wide commitment to a quality and safety agenda and ongoing performance improvement.

Centers need to select indicators that monitor and assess the quality and effectiveness of their structures, processes, and outcomes (Donabedian, 1966).

- *Structures* refer to the settings in which care takes place and their related supports, for example, the cancer facility, equipment, human resources, administrative structures, and program operations and policies.
- *Processes* refers to the care process, which includes the full range of care that patients receive; whether it was good care and how it was provided, for example, appropriate, complete, technically competent, coordinated, and acceptable. Values and standards impact the assessment of process indicators that question whether health care was properly practiced.
- *Outcomes* refer to patients' recovery, restoration of function, and survival.

Information systems should be used to help measure baseline performance for each indicator and track changes over time. Cancer centers should regularly monitor performance and identify problem areas, and focus improvement efforts in these areas.

FINANCE

All cancer centers, regardless of their location, need competent financial systems to monitor revenues and expenses. Sources of funding vary widely and can include national and subnational government funding; private user payments, either through health insurance or out-of-pocket; revenue-generating practices, for example, retail and parking; and philanthropic support from external donors. Available finances dictate the services that can be provided. Centers need to have systems in place for effective and efficient operations and to ensure appropriate quality services to optimize the use of funds.

ADDITIONAL KEY SUPPORTS

Additional key supports required in the cancer center include the following: *equipment and technology support services, supplies and materials management, supply chain processes, patient transport, fire safety and radiation protection, occupational health and safety, and security*. In areas of violence or conflict, security services may be especially important for patients and their families, as well as for guaranteeing the safety of health inputs and avoiding robbery. National and regional bodies generally set policies and standards for areas such as fire safety and radiation protection, occupational health and safety, and infection prevention and control. Organizations and providers usually determine how the other ancillary services will be provided, depending on local circumstances and resources. Group purchasing could be considered to improve the cost-effectiveness of the purchase of supplies and equipment.

Quality: An Integrating Theme

The complex nature of cancer care means it involves multiple providers and interventions. In addition, the highly technical nature of many clinical services and the increasing use of specialized and advanced technologies increase the number of risks for quality to be compromised. Having well developed and resourced centers and systems does not necessarily guarantee higher quality (Chalkidou, Marquez, Dhillon and others, 2014; WHO 2006f). Indeed, high quality care can be achieved in centers with fewer resources.

Quality is an integrating theme throughout the cancer center framework. Many organizations have highlighted issues and impacts of quality in health care (IOM 2000, 2001) and cancer care (IOM 2013). Poor quality of care can lead to increased injury, morbidity, disability, and death for patients. It also has financial, physical, and psychological impacts on patients and families; financial impacts on health care institutions and systems, especially if additional health services are needed; and economic impacts on societies (IOM 2000).

Many definitions and frameworks exist for quality of care (IOM 2001; Health Quality Ontario 2012; Martin, Nelson, Lloyd and others, 2007; OECD 2006). <<Convert to endnote and insert superscript here>> These vary, depending on whether the focus is on providers, institutions, or systems of care (WHO 2006f). Definitions and frameworks, along with quality measures, may also be influenced by a variable focus on structures, processes, and outcomes of quality.

A review of conceptual quality frameworks in six Organisation for Economic Co-operation and Development (OECD) member countries found the most commonly used dimensions of quality were the following (2006):

- *Effectiveness*: The degree of achieving desirable outcomes, given the correct provision of evidence-based health care services to all who could benefit but not to those who would not benefit
- *Safety*: The degree to which health care processes avoid, prevent, and ameliorate adverse outcomes or injuries that stem from the processes of health care itself; closely related to effectiveness, albeit distinct in its emphasis on preventing unintentional adverse events for patients
- *Responsiveness*: How a system treats people to meet their legitimate non-health expectations; also known as *patient-centeredness*
- *Accessibility*: The ease with which health services are reached; can be physical, financial, or psychological, and requires health services to be a priority and available
- *Equity*: Closely related to accessibility but assesses health-system financing and outcomes and health status

- *Efficiency*: The system's optimal use of available resources to yield maximum benefits or results; speaks to a system's ability to function at lower cost without diminishing attainable and desirable results.

Other dimensions of quality identified included acceptability (related to patient centeredness), appropriateness (related to effectiveness), competency or capability (related to effectiveness), continuity (related to patient centeredness), and timeliness (related to patient centeredness).

External accreditation, regulatory, licensing, professional, and evidence-based clinical practice organizations and bodies require cancer centers to meet quality standards for organizations and how they should operate. Countries or regions may have general accreditation standards as well as service-specific credentialing bodies¹³ <<Footnote 13 will be converted to endnote>> (Econex 2010). These external organizations provide cancer centers with arms-length quality reference points to guide their operations. Accreditation is also an external motivator for quality reform and is consistently seen as an effective driver for quality in LMICs (Barnett and Hort, 2013).

Conclusions

Every country needs to establish a comprehensive cancer center that aligns with the framework presented in this chapter respecting local practice, resources, and approaches. LMICs that implement centers will realize significant benefits.

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Comprehensive centers catalyze the development of effective national cancer control systems. A center's critical mass of clinical management expertise and clinical and core services results in effective and efficient quality cancer control. There is a spillover effect, as cancer centers can lead the development of regional systems of cancer care that include a wide range of care from very complex to simple basic interventions and community-based levels of care. Centers can also contribute to national cancer control efforts by being a credible voice for public education on prevention, and the signs, symptoms, and treatment of cancer. This contribution is especially important in LMICs, since many people present with advanced or metastatic disease (Sloan and Gelband, 2007). The establishment of regional cancer centers in every state of India illustrates the important contribution of these centers to supporting an effective national cancer control system (box 11.2).

¹³ A number of accreditation bodies have international accreditation programs which can inform centres in countries where national accreditation does not exist. See for example, Joint Commission International <http://www.jointcommissioninternational.org/Accreditation-Programs/>; Accreditation Canada International: <http://www.internationalaccreditation.ca/en/home.aspx>; National Accreditation Board for Hospitals and Healthcare Providers <http://www.nabh.co/>.

Box 11.2 Regional Cancer Centers in India

India has a fairly active National Cancer Control Program that was launched by the government in 1975 and subsequently revised in 1984. The main focus is primary prevention and early detection of cancer, which includes the following:

- Primary prevention of tobacco-related cancers
- Secondary prevention of cancer of the uterine cervix, mouth, and breast
- Tertiary prevention, including extending and strengthening therapeutic services nationally through regional cancer centres (RCCs) and medical colleges (including dental colleges).

The objectives of the National Cancer Control Program are to be met by creating one RCC in every state and developing oncology units in existing medical colleges across India.

The main functions of RCCs are cancer detection and diagnosis, treatment therapy, after care and rehabilitation, education and training, cancer registration, and research. RCC core requirements include divisions of surgical oncology, radiation oncology, and medical oncology, with support from the departments of anesthesiology, pathology, cytopathology, hematology, biochemistry, and radio diagnosis, with appropriate equipment and staff.

Oncology units in medical colleges form an important link between RCCs and the more peripheral health infrastructure, that is, district hospitals, Tehsil (regional) hospitals, and primary health centers). This three-tier model will help to make cancer care accessible across all socio economic groups and geographical areas.

At the peripheral level, a district cancer control program was launched in 1990/91 with elements of health education, early detection, training of medical and paramedic personnel, palliative treatment and pain relief, coordination, and monitoring.

Although the national cancer control program has been beneficial, given the geographic expanse and the vast population, cancer care facilities remain unavailable to the majority of the population from lower socioeconomic strata and those living in remote areas. For example, global standards require two radiotherapy treating units per 100,000 population; currently, India has 0.4 radiotherapy units per 100,000.

A wide disparity exists in the level of cancer care across various centers in India. Efforts are underway to create a national cancer grid linking major oncology centers across the country to facilitate the following:

- Develop a cooperative cancer management network for the transfer of standard treatment guidelines and expertise

- Facilitate uniform standards for education, training, and human resource development in cancer care
- Create a cooperative oncology research network to conduct research studies of national importance.

<<end of box 11.2>>

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Comprehensive centers play a significant role educating a country's health human resources. In addition to providing specialty training for individual professions, centers provide training on interprofessional team-based care. Other hospitals, community clinics, and primary care can provide training placement opportunities (Debas, Gosselin, McCord and others, 2006). Trained professionals can take on various roles and responsibilities for cancer and health care throughout the country. Developing countries that wish to train their own doctors need at least one teaching hospital (Hensher, Price and Adomakoh, 2006), which, in most instances, would include the comprehensive cancer center. Given that every developing country will not be able to train a full complement of health professionals on its own (Frenk, Chen, Bhutta and others, 2010) or train staff who need highly specialized skills, comprehensive cancer centers, especially in developed countries, can be part of education consortia that go beyond national borders.

For example, when the treatment of pediatric malignancy was expanded in Chile to include transplantation, clinical staff needed specialty training to support the development of this new program (Palma, Mosso, Paris and others, 2006). In collaboration with St. Jude Children's Research Hospital, Memphis, Tennessee, pediatric oncologists, nurses, and other specialists (immunologist, hematologist, intensivist, pathologist, and medical technologists) received training from international institutions, including St. Jude, Vall d'Hebron Hospital in Barcelona, and the Hospital de Clinicas in Curitiba, Brazil. The experiences and survival outcomes of the program have been positive.

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Comprehensive cancer centers guide and support the development of effective health systems. Centers model effective quality clinical management practices that are transferrable to all health care services. In addition, many of the clinical and core services in cancer centers—such as diagnostic imaging, pathology, surgery, and palliative care—can be used to support other clinical programs. Similarly, the referral systems that cancer centers establish with a continuum of providers can be used to meet other health needs.

Innovative financing of cancer services through comprehensive cancer centers can drive efforts to develop financial protection in health as part of universal health coverage. In the case of Mexico, for example, pediatric and women's cancers were among the first to be included in *Seguro Popular* – the national, public insurance program focused on the

poor. The visibility and effectiveness of these efforts helped to develop confidence among citizens, legislator and policy makers alike regarding the feasibility and importance of establishing financial protection in health (Atun and Knaul, 2012; Knaul, González Pier, Gómez Dantés and others, 2012).

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Comprehensive cancer centers will provide a substantial return on investment as leaders in cancer control. Although countries will need to invest resources to establish and operate centers, tangible benefits will occur as the burden of disease decreases. An estimated 33 percent to 50 percent of premature cancer deaths globally (2.4 to 3.7 million annually) can be avoided with prevention, early detection, and treatment; 80 percent of these avoidable deaths are in LMICs (Knaul, Arreola-Ornelas, Atun and others, 2012). The total annual economic cost of cancer, excluding longer-term costs to families and caregivers, was approximately US\$1.16 trillion in 2010, or more than 2 percent of global GDP. Investing in comprehensive cancer care results in a positive annual return on prevention and treatment because of the number of deaths that are potentially avoidable (Knaul, Arreola-Ornelas, Atun and others, 2012)

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Comprehensive cancer centers can make important contributions to global health and health systems. Centers are part of the global health system and, as such, can contribute to broad global efforts to improve health (Frenk and Moon, 2013). International health organizations that cross national boundaries could benefit from the participation of centers in such areas as research and development and sharing of information for ongoing learning (Blanchet, Thomas, Atun and others, 2013; Jamison, Frenk and Knaul, 1998).

Successfully developing comprehensive cancer centers in LMICs requires locally developed and driven approaches that consider national and sub-national resources and circumstances. Gupta, Bonilla, Valverde and others, 2012 (**chapter 7: Childhood Cancers**) identify the basic personnel and infrastructure requirements for the ideal dedicated childhood cancer treatment center in a LMIC setting. The authors note that satellites can be especially important for decreasing the abandonment of treatment for children and recognize that much treatment occurs despite countries lacking such centers. Many LMICs have leveraged the experience, expertise, and resources of HICs to develop cancer services. For example, cancer twinning relationships can help to facilitate the development of cancer centers and help to achieve a country's cancer goals (Gralow, Krakauer, Anderson and others, 2012; Sloan and Gelband, 2007). Furthermore, research suggests that twinning improves cancer survival in LMICs (Hazin and Qaddoumi, 2010). **Box 11.3** provides examples of beneficial twinning relationships.

Box 11.3 Twinning Relationships

St. Jude Children's Research Hospital International and 20 Partners

The St. Jude Children's Research Hospital's International Outreach Program improves the survival rates of children with catastrophic illnesses worldwide by transferring knowledge, technology, and organizational skills to countries and regions, so they can become self-sufficient and successfully treat children close to home. The program involves local communities, supports the development of regional expertise and diagnostic capabilities, partners with medical institutions and fundraising organizations, and facilitates the involvement of other agencies and organizations to support key programs and the education of local personnel.

Located in Memphis, Tennessee, the program has pediatric oncology twinning programs with 20 partner sites in 14 countries, including Brazil, Chile, China, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Jordan, Lebanon, Mexico, Morocco, the Philippines, and the República Bolivariana de Venezuela. The results have been significant; survival rates for childhood cancers increased, and the rate of abandonment of treatment decreased. For example, the abandonment rate in El Salvador dropped from 13 percent to 3 percent from 2010 to 2012. As well, over their duration of the partnership, the five-year survival rate for children with acute lymphoblastic leukemia increased from 10 percent to approximately 70 percent. For additional information, see:

<http://www.stjude.org/stjude/v/index.jsp?vgnextoid=66166f9523e70110VgnVCM1000001e0215acRCRD&vgnnextchannel=f2fc6fa0a9118010VgnVCM1000000e2015acRCRD>
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Fred Hutchinson Cancer Research Center and Uganda Cancer Institute

The Uganda Cancer Institute (UCI), the only cancer treatment and training facility in the country of 32 million people, partnered with the Fred Hutchinson Cancer Research Centre in Seattle, Washington, to establish the UCI/Hutchinson Center Cancer Alliance in 2004. The alliance focuses on developing effective prevention and treatment strategies for infection-associated cancers through the following activities:

- Conducts advanced research in infection-related cancers to better understand the pathogenesis of these diseases and to develop and test more effective and safer treatment and prevention regimens
- Improves clinical capacity by providing medical support and revised clinical protocols for those with infectious cancers
- Trains cancer specialists, scientists, and support staff in Uganda to increase local human capacity for clinical care and research at the UCI and provides a training environment for United States-based personnel in Uganda.

For additional information, see: <https://www.fhcr.org/en/labs/vaccine-and-infectious-disease/international-programs/uganda/about.html> <<Convert to endnote with superscript here>>

Victoria Hospice and B. P. Koirala Memorial Cancer Hospital, Bharatpur, Nepal.

The International Network for Cancer Treatment and Research established the Palliative Access Program (PAX) to assist developing countries in initiating and sustaining

palliative care programs. In 2007, the B. P. Koirala Memorial Cancer Hospital, Nepal's national cancer hospital, expressed a desire to twin with a hospice to help expand its patient care services, develop education and research, and introduce home and community-based palliative care services. The hospital—which has a 12-bed inpatient palliative care unit and provides inpatient and outpatient consultations—twinned with Victoria Hospice in Victoria, British Columbia, Canada. Funds have been raised to help support the hospital's patient care services and increase health professional education. Medical supplies have been purchased, local staff have been hired and trained, travel funds have been provided for staff training opportunities, education material has been provided, as well as developed and co-developed. In addition, the partners exchange mutually beneficial knowledge and expertise in palliative care. For additional information, see sites.google.com/site/nepalhospicetwin/ <<Convert to endnote with superscript here>>

<<end of box 11.3>>

Other LMICs have raised funds locally to finance the development of cancer center services. Box 11.4 presents the experience of establishing the Fakous Cancer Centre in Egypt, which integrates tertiary services with primary health care to help prevent and treat cancer in a low-resource setting.

The Fakous Cancer Center

Fakous district is in the northeast of Egypt, where breast cancer is the most common cancer. Until 1992 when the Fakous Cancer Center was opened, the closest cancer treatment for the largely poor population of 660,000 was the National Cancer Institute in Cairo. It was a 3-hour trip and a world apart and most cancer patients simply went untreated. One of many challenges confronted in building the Fakous Center was financing. Using “crowd sourcing,” one million Egyptian pounds (\$US330,000) was raised in the first two months, and donations continued to come in after that. A second challenge was finding doctors to work in the center. In place of permanent staff, specialists from the National Cancer Institute and various universities come to the center to perform surgery and provide other specialized treatment. The Fakous center has become a center of excellence in training as well as treatment. The third challenge, the retention of good nursing staff was accomplished through establishment of a nursing school. The Fakous model integrates tertiary services with primary health care, taking both prevention and treatment to less-developed parts of Egypt. Fakous has 80 beds, 3 operating rooms, an 8-bed intensive care unit, basic diagnostic facilities with conventional X-ray, ultrasound for ultrasound-guided biopsy, mammography and endoscopy; and a histopathology unit equipped to provide cytology, tissue analysis, and hormone receptor assays as well as treatment modalities. Social support of cancer patients' families is also provided.

The center's outpatient facilities provide free clinical consultations for poor patients, who constitute the majority in this region—nearly 23,000 outpatients in the last 22 years. The inpatient wards have seen 29,000 patients admitted.

Care at Fakous is reflected in survival statistics: for women treated in 2008, 5-year survival is 89 percent for stage I, 77 percent for stage II, 71 percent for stage III and 19 percent for stage IV. A recent study of Fakous experience also documents stage shift at diagnosis from the time the center was opened through 2007-08 (Omar, Abdelgawad, Aboserea, & Omar, 2013).

Conclusions

The optimal framework for establishing a comprehensive cancer center presented in this chapter provides the nucleus around which an entire cancer control program can be developed. Many LMICs are developing comprehensive cancer centers supported with public and private resources, and these countries are using locally driven approaches that are appropriate to their local circumstances. Most importantly, they are having a significant impact on advancing cancer control and improving the health of their populations.

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