Chapter 11

Cancer Services and the Comprehensive Cancer Center

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INTRODUCTION

Most countries and numerous global and local organizations are addressing the challenges of cancer (Blanchet and others 2013; Knaul, Alleyne, Atun, and others 2012), including the development of comprehensive national cancer control programs designed to reduce the number of cancer cases and deaths and to improve the quality of life of cancer patients through evidence-based strategies for prevention, early detection, diagnosis, treatment, and palliation. A national cancer control program addresses the *functions* and delivery of many *components* of cancer control (http://www.who.int/cancer/nccp/en/). The delivery of most services is anchored in comprehensive cancer centers (Gralow and others 2012; Hensher, Price, and Adomakoh 2006; Sloan and Gelband 2007).

This chapter describes an optimal framework for a comprehensive cancer center, which can be a free-standing dedicated institution, a program within an academic health science center or a community hospital, or a group of hospitals providing an integrated program.

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

Cancer system planning includes the development of population-based cancer plans, at the national or lower levels. Cancer plans address all aspects of cancer control, including cancer registries, practice and operating standards, research, health care education and practice standards, certification and accreditation of service providers, and system performance.

Cancer System Components

The World Health Organization (WHO) (2006b) recommends that all nations have a cancer control plan that includes these *components*: prevention, screening, diagnosis, treatment, survivorship, and palliative and end-of-life care (figure 11.1).

Many cancer control components are provided in comprehensive cancer centers, regardless of a country's resource level. WHO and others have recommended that every country aim to have at least one publicly supported cancer center that advances

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the broad objectives of control; provides exemplary patient care, appropriate to local circumstances and resources; and concentrates the specialized human and technical resources of the country (Gralow and others 2012; Knaul, Gralow, and others 2012; Sloan and Gelband 2007).

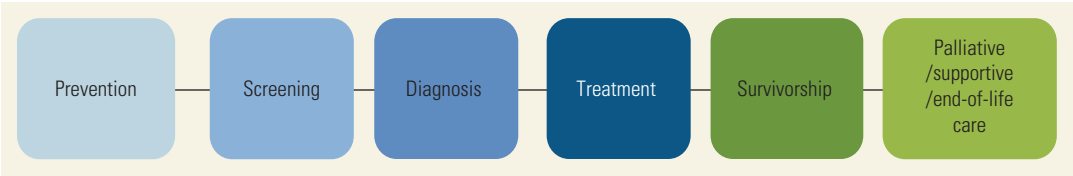
Comprehensive Cancer Centers in LMICs

Many low- and middle-income countries (LMICs) are developing comprehensive cancer centers with public or private resources. Patients can be managed directly at the centers; for many aspects of treatment, they can be managed in less specialized hospitals and local health clinics, with the center providing oversight and care plans. Comprehensive cancer centers educate health care professionals and the public, and they conduct research on the causes, prevention, diagnosis, and treatment of cancer (National Cancer Institute 2012).

Comprehensive cancer centers can act as focal points for cancer control nationally (Sloan and Gelband 2007) and influence cancer and health system development. 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 to develop comprehensive cancer systems varies with available resources, national governance, management effectiveness, public accountability, engagement of civil society, and other factors (Knaul, Alleyne, Atun, and others 2012; WHO 2012).

Although this goal will take time to attain in many countries, it is being successfully achieved in multiple settings (Knaul, Gralow, and others 2012). For example, the King Hussein Cancer Center in Jordan, an upper-middle-income country, progressed from offering 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 efforts (box 11.1).

Figure 11.1 Cancer Control Components



Source: Adapted from Cancer Care Ontario 2013.

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 *Center of Hope* and was renamed the King Hussein Cancer Center in September 2002. The center treats all types of cancer in adults and children from the Middle East and North Africa.

The center evolved by:

- Reversing the brain drain by convincing accomplished clinical and executive leaders working in high-income countries to return to the region to create the foundation for and expansion of excellent cancer care
- Designing and building a well-functioning and appropriately equipped physical facility

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Box 11.1 (continued)

- Raising the standard of care in surgery, systemic/chemotherapy, radiation therapy, nursing oncology, bone marrow transplantation, and psycho-oncology
- Adopting policies and procedures to ensure effective, efficient, safe operations
- Establishing cancer education, training, and public awareness programs, including oncology fellowships and residency programs
- Developing a research program
- Collaborating with other centers to improve cancer care, training, and research; these include 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 Princess Margaret Cancer Centre in Canada; National Cancer Institute in the Arab Republic of Egypt; American University of Beirut, Lebanon; Augusta Victoria Hospital in Israel; Stefan-Morsch Foundation in Germany; and Leeds Cancer Centre in the United Kingdom.

In 2006, the King Hussein Cancer Center was accredited as a hospital by Joint Commission International (JCI); in 2007, the center was certified by JCI's Clinical Care Program in cancer. The center helped organize the Ministry of Health's national early detection and awareness program. It is also leading an effort 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 region. The center has signed agreements with Petra University to establish the first diploma program in tobacco dependence treatment in the region, as well as 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 active in 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 increasing patient demand from Jordan and the region. Construction is underway to double capacity by mid-2016. Capacity building is ongoing with recruitment of additional staff, including in cancer subspecialties, as is strengthening of cancer research and education activities.

FRAMEWORK FOR A COMPREHENSIVE CANCER CENTER

The comprehensive cancer center has three layers: clinical management, clinical services, and core services (figure 11.2).

The framework provides a reference point for planning for a comprehensive center, even if this is achieved incrementally as funding and capacity are built up.

Clinical Management

Patient Care Plans

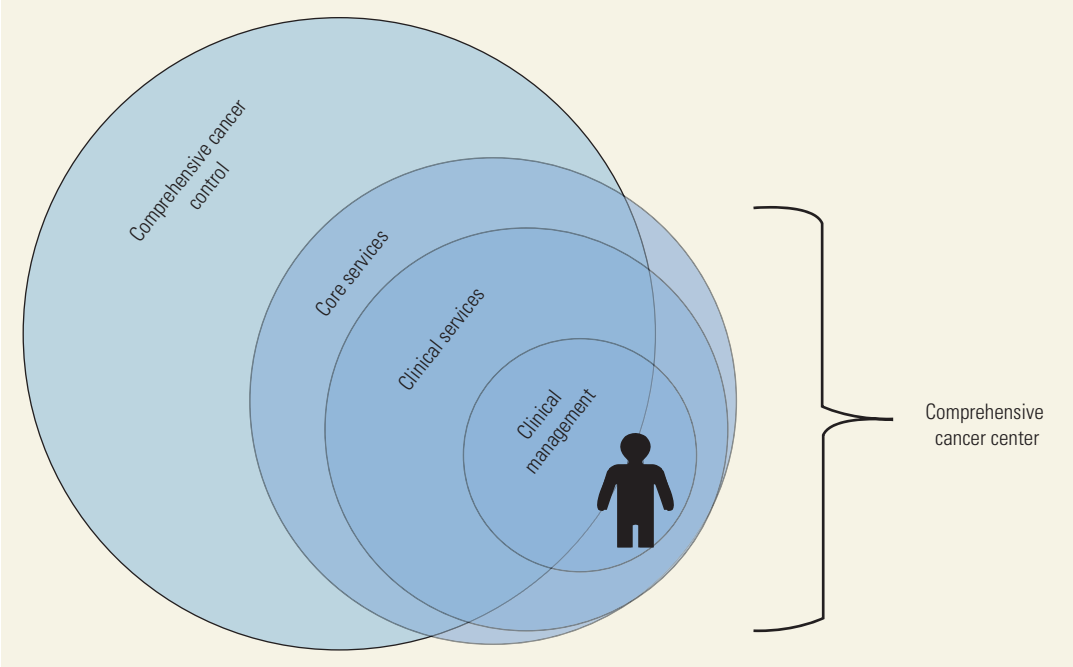
Clinical management sets standards for clinical decision making and formulating patient care plans. Patient care plans are based on the histopathologic and/or molecular diagnosis identifying the type of cancer; the anatomic disease extent or stage; and the individual patient's characteristics, such as age, comorbidities, and performance status. Determining the best clinical management for cancer patients involves defining the goals of care—cure, disease control, symptom control—recommending appropriate interventions, and setting out the optimal timeframes for instituting and completing treatment. The patient care plans vary from simple to complex, and may require a range of services.

Errors in clinical decisions can lead to increased morbidity and disability, increased costs, and even premature death. For example, a recent study reported that almost one-quarter of children with acute myeloid leukemia in El Salvador, Guatemala, and Honduras died from largely avertable treatment-related mortality (Gupta and others 2012).

Clinical Practice Guidelines

Clinical practice guidelines are developed to assist practitioners and patients in deciding on appropriate care for their circumstances (Hensher, Price, and Adomakoh 2006). Comprehensive cancer centers play a leadership role in developing and promoting treatment guidelines locally and nationally. Center clinicians and researchers work with professional organizations to develop

Figure 11.2 Framework for a Comprehensive Cancer Center



guidelines for a wide range of scenarios. Some examples include the U.S. Preventive Services Task Force for screening guidelines and Cancer Care Ontario's Program in Evidence-Based Care, which produces evidence-based guidance documents.[1] Guidelines are not limited to therapeutic interventions and include indications for medical imaging and other diagnostic interventions[2] and for symptom management. Nursing and other allied health professions develop guidelines to organize and direct care.[3] Guidelines must be adapted for use in resource-constrained settings (Anderson and others 2008; Kerr and Midgley 2010).

Many clinical practice guidelines have been adopted and adapted for use in LMICs (Gralow and others 2012; Konduri and others 2012). Although the focus of most of these initiatives is broader than the comprehensive cancer centers, their impact has influenced the care of patients within centers. A well-known international example is the Breast Health Global Initiative, which has developed evidence-based, economically feasible, and culturally appropriate guidelines for breast health and cancer control in LMICs (chapter 3, this volume [Anderson and others 2015]; El Saghir 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 United States–based National Comprehensive Cancer Network, which collaborates to produce international adaptations and translations of its guidelines that may include modifications based on local circumstances.[4] Other examples include efforts in India to establish a wide range of guidelines adapted to local resource availability,[5] and consensus group recommendations for imaging techniques for head and neck cancers in Singapore and South Asia, as developed by Wee and colleagues depending on resource availability (Wee and others 2009). Mexico has developed a series of *Normas Officiales Mexicanas* (Official Mexican Standards) that guide cancer services and finance.

Clinical Services

Clinical service departments include facilities, equipment, skilled personnel, and policies and procedures to deliver diagnostic, treatment, or supportive care. The cancer center works to integrate these services effectively. For example, there is no point in offering screening if positive results cannot be followed up with definitive diagnostic tests and, if needed, treatment.

Access to the full range of clinical services is critical for timely and appropriate cancer diagnosis and treatment. A timely and accurate diagnosis is critical, because early detection makes the difference between a curable cancer and an untreatable one.

Many clinical service departments 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. Accreditation standards may be regional or national, or they may be international (Econex 2010).[6]

Office- and Clinic-Based Ambulatory Care

The initial patient encounter with a cancer system often happens in an office or clinic, where cancer-related ambulatory procedures, such as clinical visits, physical examinations, Pap smears, blood samples, or endoscopies, can take place. 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, and 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 a critical technology for diagnosis, to assess the effects of cancer treatment and complications, monitor for the recurrence of cancer, and screen the general population for cancerous conditions. It also is used to guide interventional procedures such as biopsies under ultrasound, computed tomography (CT), or magnetic resonance imaging (MRI); securing of vascular access; and therapeutic interventions, such as embolization and high frequency ultrasound tumor ablation. Imaging for cancer ranges from conventional X-rays to ultrasound, CT, MRI, and molecular imaging (nuclear medicine) with position emission tomography, frequently combined with CT.

Imaging services require equipment and specialized staff, such as radiologists and radiology technologists, to operate and maintain the equipment. International organizations, such as the International Atomic Energy Agency, the International Society of Radiology, and WHO, have developed and published standards and guidelines for the safe installation, operation, and use of imaging equipment. This information is used to create national and regional standards (for example, Radiation Safety Institute of Canada 2014; Zaidi 2010). Picture archiving and communication systems and web-based systems allow for offsite evaluation and reporting of images and are useful in management of care in remote communities, remote mentoring, and quality control initiatives. These processes are especially useful in limited-resource settings.

Pathology and Laboratory Medicine

Pathology and laboratory medicine, including blood banking, are essential for diagnosing cancer by examining patient biologic specimens. Laboratory medicine services include pathology, hematology, biochemistry, microbiology, and, increasingly, cytogenetic and molecular testing, services that are not specific to cancer.

Pathology and laboratory medicine services require facilities equipped to handle biological specimens with appropriate precautions, and specialized equipment to process and analyze tissues, blood, serum, and body fluids. 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 and others 2012). Given that the diagnosis of cancer, especially rare cancers, is complex, subspecialty expertise or access to such expertise via international networks is required. Collaborative or twinning initiatives have been developed to support pathology services in LMICs. Examples include a Ghana-Norway partnership as part of the Breast Health Global Initiative (Masood 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 Institute (Carlson and others 2010). Laboratories require specialized accreditation to ensure that processes are in place to optimize the quality of specimen procurement and reporting.[7]

Surgery

Surgery is a fundamental element of cancer treatment and its pertinence to LMICs is the subject of chapter 13 of this volume (Dare and others 2015). Well-established interventions have proven effective in reducing surgical risk and provide promising strategies to improve outcomes (Weiser and Gawande 2015). The introduction of standardized practices, such as the Surgical Safety Checklist endorsed by WHO, has improved the outcomes of surgical procedures in countries at all economic levels (Farmer and others 2010; Gawande 2009; Haynes and others 2009; Lingard and others 2008; Lingard and others 2011; World Alliance for Patient Safety 2008). The use of comprehensive standard policies and procedures facilitates safe and efficient operations.

Radiation Therapy

Radiation therapy, or radiotherapy, involves the use of ionizing radiation for therapeutic purposes. It is the subject of chapter 14 in this volume. Strategies to

improve access to radiotherapy in LMICs have been suggested, including offering basic treatment techniques and optimizing fractionation to increase the throughput on radiotherapy machines, encouraging competitive pricing, and supporting long-distance mentorship for programs in remote areas (Gralow and others 2012). For many reasons, cobalt machines have frequently been considered more appropriate for LMICs (IAEA 2008, 2010). These views are changing as 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 Cancer Therapy or Chemotherapy

In systemic cancer therapy or chemotherapy, drugs are distributed in the body through the bloodstream. These drugs include chemotherapy, administered intravenously or orally; hormones; and immune and molecular-targeted therapies. Systemic therapy is used alone or in combination with surgery and radiotherapy to reduce recurrence, improve survival (Gralow and others 2012; Valentini, Barba, and Gambacorta 2010), and help preserve organs. Chemotherapy alone is used in hematologic cancers and in most metastatic cancers. Chemotherapy facilities can be used for other intravenous treatments, transfusions, minor procedures such as bone marrow biopsies, thoracentesis, paracentesis, and lumbar puncture for cancer and noncancerous conditions. Systemic therapy can usually be delivered in specialized ambulatory facilities in hospital outpatient units and community-based medical offices or clinics.[8]

Chemotherapy drugs may be expensive, although a host of agents are now off patent and can be effective and used extensively in LMICs (Konduri and others 2012). Several of the cancers endemic to the lowest income settings are amenable to treatment with relatively low-cost chemotherapy, but treatment cost is still a major barrier for many in LMICs.

Palliative Care and Supportive Care

Palliative care aims to prevent or relieve suffering, provide early identification and assessment of symptoms, and address other physical, psychosocial, and spiritual issues (WHO 2006a). It is the subject of chapter 9 of this volume (Cleary, Gelband, and Wagner 2015).

Survivorship

Survivorship is defined as the care of persons diagnosed with cancer, from the time of diagnosis throughout their lives, as well as the impact of cancer on family members, friends, and caregivers of survivors (Centers for Disease Control and Prevention 2013).

Increasingly, as treatments become more successful and life expectancy increases, patients face new issues. With improvements in access to and quality of care, this will increasingly be the case in LMICs, where survivorship services are currently unavailable.

Psychosocial support can be provided to patients and their families by a broad range of people, depending on the level of need. Complex mental health issues and social matters can benefit from the engagement of other health professionals, including primary care providers, community health workers, spiritual guides, volunteers, friends, families, and other lay individuals. Comprehensive cancer centers should have a survivorship program with a range of professionals, including psychiatrists, psychologists, social workers, nurses, therapists, nutritionists, and educators, as well as patients in treatment and long-term survivors.

Core Services

Core services are delivered by departments of administration and management, human resources, information technology and management, physical facilities, pharmacy, infection prevention and control, quality assurance, and finance. 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, the core services must meet accreditation and licensing standards and guidelines and are usually included in the hospital accreditation. The lack of investment in core services leads to poor access to and performance of clinical services (Grimes and others 2011), including poor quality, inefficient use of resources, and negative impacts on health (Mavalankar and others 2005).

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 adverse impacts on health sectors in LMICs (Dalglish, Poulsen, and Winch 2013). In addition, the absence of robust supply chain management may result in delays in pathology reporting because of the lack of reagents, and insufficient maintenance may result in equipment breakdowns that limit access to imaging or radiotherapy.

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 2011). Useful frameworks exist to help guide the development and ongoing excellence of administration and management. For example, the United States–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, National Institute of Standards and Technology, and U.S. Department of Commerce 2011); the program has a self-assessment tool.

Human Resources

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 means maximizing their impact. Human resources can be increased in LMICs 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, and others 2012) and, in some countries, traditional healers who play an important role in influencing people's health care decisions (Price and others 2012) will enhance the capacity for health care delivery. Teleservices, such as telepathology, teleradiology, and virtual consultation can offer support and guidance in cancer to nonspecialists by tapping large international networks of highly trained professionals.

Information Technology and Management

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 refers to organizing, linking, analyzing, and presenting data to guide decisions.

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 improve access to 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 systems can be especially important in LMICs for linking comprehensive centers to more remote areas and less specialized centers, as well as for linking to international expertise and networks (Knaul, Bhadelia, and others 2012; Shekelle, Morton, and Keeler 2006).

Pharmacy

Pharmacy services focus on safe and effective medication use and include managing practice; adhering to 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).

Cancer pharmacy services reflect specialized knowledge about the 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 resource-rich and resource-poor settings.

Infection Control

Infection control is a core service that focuses on preventing and controlling infections in cancer patients, including advice on the care of patients with infections, especially those acquired in the cancer center.

Main infection prevention and control tactics include complying with hand hygiene, disinfecting and sterilizing surfaces and equipment, investigating and monitoring suspected infections, managing difficult cases and outbreaks, wearing personal protective equipment, and vaccinating and educating health care providers. For centers, this includes introducing prevention bundles,[9] improving compliance with hand hygiene, making prudent use of antimicrobials, translating research results into practice, and upgrading the capabilities of the microbiology laboratory (Raka 2010).

Quality Assurance

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

Centers need to select appropriate indicators to monitor and assess the quality and effectiveness of their structures (for example, setting and facilities), processes (range of care), and outcomes (patients' recovery, restoration of function, and survival) (Donabedian 1966). Information systems should capture baseline performance measures for each indicator and track changes over time. Cancer centers should regularly monitor performance, identify problem areas, and focus improvement efforts in these areas.

Finance

All cancer centers 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 systems that allow effective and efficient operations and 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.

CANCER CENTERS AND QUALITY OF CARE: AN INTEGRATING THEME

Having well-developed and resourced centers and systems does not guarantee higher quality (Chalkidou and others 2014; WHO 2006c). Indeed, high-quality care can be achieved in centers with minimal resources.

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). 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 member countries (OECD, Kelley, and Hurst 2006) identified the most commonly used dimensions of quality:

- *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:* The way 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, and 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 bodies[10] (Econex 2010). These external organizations provide cancer centers with arm's-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).

Catalyzing 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. Cancer centers can lead the development of regional systems of cancer care, with care ranging from very complex to basic interventions and community-based care. Centers can 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. 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).

Training Health Care Professionals

Comprehensive centers play a significant role educating a country's health care professionals. In addition to providing specialty training for individual professions, centers provide training on interprofessional

Box 11.2

Regional Cancer Centers in India

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

- Tobacco control measures to prevent tobacco-related cancers
- Screening for cancers of the uterine cervix, mouth, and breast
- Extending and strengthening therapeutic services nationally through regional cancer centers (RCCs) and medical colleges, including dental colleges.

The objectives of the program are to be met by creating one RCC in every state and developing oncology units in existing medical colleges across the country.

The main functions of RCCs are cancer detection and diagnosis, treatment, aftercare 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 radiologic 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 socioeconomic groups and geographical areas.

At the peripheral level, a district cancer control program was launched in 1990/91 with elements

box continues next page

Box 11.2 (continued)

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:

- Development of a cooperative cancer management network for the transfer of standard treatment guidelines and expertise
- Facilitation of uniform standards for education, training, and human resource development in cancer care
- Creation of a cooperative oncology research network to conduct studies of national importance.

team-based care. Other hospitals, community clinics, and primary care can provide training placement opportunities (Debas and others 2006). Trained professionals can take on various roles and responsibilities throughout the country. LMICs 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 and others 2010) or train staff in highly specialized skills, comprehensive cancer centers, especially in developed countries, can be part of education consortia that extend beyond national borders.

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

Supporting the Development of Effective Health Care Systems

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 support other clinical programs. Similarly, the referral systems that cancer centers establish with a continuum of providers can 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 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, legislators, and policy makers alike regarding the feasibility and importance of establishing financial protection in health (Atun and Knaul 2012; Knaul, González-Pier, and others 2012).

Contributing to Global Health

Comprehensive cancer centers can make important contributions to global health and health systems. Centers can contribute to broad global efforts to improve health (Frenk and Moon 2013). International health organizations that cross national boundaries can benefit from the participation of centers in such areas as research and development and sharing of information for ongoing learning (Blanchet 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 subnational resources and circumstances. Gupta and others (chapter 7, this volume) identify the basic personnel and infrastructure requirements for the ideal dedicated childhood cancer treatment center in an LMIC setting. The authors note that satellite centers can be especially important for decreasing the abandonment of treatment for children and recognize that much treatment occurs despite the lack of ideal centers. Many LMICs have leveraged the experience, expertise, and resources of high-income countries to develop cancer services. For example, twinning relationships can facilitate the development of cancer centers and help to achieve a country's cancer goals (Gralow 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.

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 Center in the Arab Republic of Egypt, which integrates cancer treatment with primary health care to help prevent and treat cancer in a low-resource setting.

Box 11.3

Twinning Relationships

St. Jude Children's Research Hospital's International Outreach Program 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, and the five-year survival rate for children with acute lymphoblastic leukemia increased from 10 percent to 70 percent.[a]

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 Center 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:

- Conducting advanced research in infection-related cancers to improve understanding of the pathogenesis of these diseases and to develop and test more effective and safer treatment and prevention regimens
- Improving clinical capacity by providing medical support and revised clinical protocols for those with infectious cancers
- Training cancer specialists, scientists, and support staff in Uganda to increase local human capacity for clinical care and research at UCI and providing a training environment for United States–based personnel in Uganda.[b]

box continues next page

Box 11.3 (continued)

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

The International Network for Cancer Treatment and Research established the Palliative Access Program 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, and educational material has been provided and adapted. In addition, the partners exchange mutually beneficial knowledge and expertise in palliative care.[c]

a. For additional information, see: http://www.stjude.org/stjude/v/index.jsp?vgnextoid=2f166f9523e70110VgnVCM1000001e0215acRCRD&vgnextchannel=e41e6fa0a9118010VgnVCM1000000e2015acRCRD.
b. For additional information, see: http://www.fredhutch.org/en/labs/vaccine-and-infectious-disease/international-programs/global-oncology/uganda/uci-fred-hutch.html.
c. For additional information, see https://sites.google.com/site/nepalhospicetwin.

Box 11.4

The Fakous Cancer Center

In Fakous district in the northeast of the Arab Republic of Egypt, breast cancer is the most common cancer. Until the center was opened in 1992, the closest cancer treatment for the largely poor population of 660,000 was the National Cancer Institute in Cairo. It was a three-hour trip and a world apart, and most cancer patients went untreated.

One of many challenges confronted in building the Fakous Cancer Center was financing. Using "crowd sourcing," one million Egyptian pounds (US$330,000) was raised in the first two months, and donations continued to come in. 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 Cancer 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 the establishment of a nursing school.

The Fakous model integrates third-level services with primary health care, taking prevention and treatment to less developed parts of the country. The center has 80 beds; three operating rooms; an eight-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 230,000 outpatients in the past 22 years. The inpatient wards have seen 29,000 patients admitted.

Care at the center is reflected in survival statistics: for women treated for breast cancer in 2008, the five-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 the experience of the center also documents stage shift at diagnosis from the time the center was opened through 2007–08 (Omar and others 2013).

CONCLUSIONS

The optimal framework for establishing a comprehensive cancer center 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 appropriate to their local circumstances. Most important, they are having significant impacts on advancing cancer control and improving the health of their populations.

NOTES

World Bank Income Classifications as of July 2014 are as follows, based on estimates of gross national income (GNI) per capita for 2013:

- Low-income countries (LICs) = US$1,045 or less
- Middle-income countries (MICs) are subdivided:
  a) lower-middle-income = US$1,046–US$4,125
  b) upper-middle-income (UMICs) = US$4,126–US$12,745
- High-income countries (HICs) = US$12,746 or more.

1. For the Cochrane Collaboration, see http://www.cochrane.org/cochrane-reviews. For the U.S. 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 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.
3. For example, see the Oncology Nursing Society, http://www.ons.org/ClinicalResources; European Oncology Nursing Society, http://www.cancernurse.eu/education/guidelines.html; and Association of Oncology Social Work, http://www.aosw.org/aosw/Main/professionals/standards-of-practice/AOSWMain/Professional-Development/standards-of-practice.aspx?hkey=51fda308-28bd-48b0-8a75-a17d01251b5e.
4. See http://www.nccn.org/international/international_adaptations.asp.
5. See https://tmc.gov.in/clinicalguidelines/clinical.htm.
6. For example, see the Joint Commission International, http://www.jointcommissioninternational.org/achieve-accreditation/; National Accreditation Board for Hospitals and Healthcare Providers International, http://www.nabh.co/Index.aspx; and Accreditation Canada International, http://www.internationalaccreditation.ca/en/home.aspx.
7. For example, see the International 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/; and National Accreditation Board for Testing and Calibration Laboratories, http://www.nabl-india.org/.
8. See, for example, http://www.asco.org/institute-quality/asco-ons-standards-safe-chemotherapy-administration.
9. 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.
10. A number of accreditation bodies have international accreditation programs to inform centers in countries where national accreditation does not exist. See, for example, Joint Commission International, http://www.jointcommissioninternational.org/achieve-accreditation/; Accreditation Canada International, http://www.internationalaccreditation.ca/en/home.aspx; and National Accreditation Board for Hospitals and Healthcare Providers, http://www.nabh.co/.

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