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Planning and Programming: The Building Blocks to Designing A Cancer Center

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Cancer centers are becoming an increasingly common facility type. Understanding the history and evolution of cancer care helps us to understand the recent growth in cancer center construction. As treatments, and access to them, improve, the cancer survivor population will continue to grow.

To address these trends, this paper is organized into four sections:

- The history and patterns of cancer are discussed
- The key trends in providing cancer care are summarized
- Descriptions of three types of cancer care centers are presented, including preliminary programming guidelines
- Guidelines to creating a therapeutic environment based on the psychosocial needs of cancer patients are identified.

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Introduction

According to *Modern Healthcare's* annual survey, 109 cancer center projects were completed in 1998, which is a significant increase over previous years. (1) This trend shows that cancer centers are becoming an increasingly common facility type.

Understanding the history and evolution of cancer care helps us to understand the recent growth in cancer center construction. It is not surprising that today most people have encountered cancer in some way either personally or through a family or friend. In fact, approximately 8 million Americans alive today have a history of cancer. (2) As access to treatments and efficacy improve, the cancer survivor population will continue to grow. (3)

Cancer is widely recognized because it is the second leading cause of death in the United States, accounting for approximately 24 percent of deaths annually. The prevalence of this chronic disease is significant. Over the lifetime, a male has a 50 percent risk of developing cancer and a woman has a 33 percent risk. (4) The occurrence of cancer increases with age; therefore, most cases affect middle-aged or older adults. Due to the high prevalence of this disease, it has been recognized as a public health problem and is evidenced by the growth of cancer programs.

This paper is organized into four sections. First, the history and patterns of cancer are discussed. Second, the key trends in providing cancer care are summarized. Third, descriptions of three types of cancer care centers are presented, including preliminary programming guidelines. Fourth, guidelines to creating a therapeutic environment based on the psychosocial needs of cancer patients are identified.

Historic Overview

As recently as 25 years ago, the diagnosis of cancer was virtually a death sentence. In most cases, the disease destroyed a relatively healthy body through the rapid spreading and growth of abnormal cells. In the past, people with cancer had very few options for learning about and managing the disease.

The passage of the National Cancer Act by President Nixon in 1971 was a turning point in the field of oncology. Since then,

dedicated cancer programs have been developed, treatments have improved, and funding for research has increased. Since 1971, new strategies in the management of cancer have been developed and access to care has improved.

Abstract Next

Why Is the Number of Cancer Cases Increasing?

Despite the advances in cancer research and technologies, research studies show that incidence rates are increasing for most types of cancer. (5) The influence of carcinogens in our environment, such as exposure to hazardous chemicals and drugs, is one reason cancer cases are increasing. Demographic trends, particularly the growth of the elderly population, are another reason for this increase, since 60 percent of all cancer cases occur in people over age 65.

Because the occurrence of cancer increases dramatically with age, the elderly population is at a greater risk of being diagnosed with or dying from cancer. (6) Data show that in the cohort between the ages of 60 and 79 years, one out of three males and one out of five women will develop cancer. In comparison, among their younger counterparts ages 40 to 59 years, one out of 12 men and one out of 11 women will develop cancer. (7)

These percentages are particularly significant when viewed in the context of demographic trends. According to population projections, the population 65 years of age and older will increase from representing 12.5 percent of the U.S. population in 1990 to almost 23 percent of the population in 2040. And the 80-and-over group will increase from 1.5 percent to almost 8 percent of the entire population within the next 40 years. (8) Since the incidence of frailty, disability, and chronic conditions increases with age, the high-risk elderly population should be considered when planning cancer services and programs.

Good News: A Decline in the Cancer Death Rate in the United States

After consecutive increases in cancer deaths over the past 70 years, data have confirmed a downward trend in cancer mortality. Current research shows a reduction in the total number of new cancer types and a decline in the overall cancer death rate. (9) These findings indicate that cancer prevention and cancer treatment protocols are working.

This unprecedented event-an increase in the survival rate-yields a promising future for those afflicted with the disease and an increased sense of hope for full recovery.

In order to achieve the goal set forth by the American Cancer Society, to reduce mortality by 50 percent and incidence rates by 25 percent by the year 2015, (10) the planning, organization and delivery of cancer programs and services will need to continue to improve.

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New Approaches to Providing Cancer Care

As previously indicated, great strides in cancer care have been achieved within the last decade. There are several key trends that will impact the design of cancer centers in the future.

Providing Comprehensive Services Along the Full Continuum. Because of advances in cancer treatment, cancer is now considered a chronic disease as opposed to a terminal disease. To address the needs of chronic illness, successful cancer programs must provide services along the full continuum of care. (11)

Figure 1: The Continuum of Cancer Care Services

Prevention >>	Diagnosis >>	Treatment >>	Continuing Care >>
• Education	• Diagnosis Testing	• Surgery	• Counseling/Support
• Counseling	• Staging	• Chemotherapy	• Rehabilitation
• Screening	• Treatment Planning	• Radiation Therapy	• Pain Control
		• Immunotherapy	• Home Care
		• Biologic Therapy	• Hospice Care
		• Multimodal Therapy	• Bereavement

A cancer center is a physical manifestation of some, but rarely all, of the services that comprise an organization's cancer care continuum of services. Because it is visible, the physical facility often becomes a symbol of the cancer program to the community. But in planning a cancer center, it must be remembered that the physical facility, although highly visible, is only a portion of the components that make up the cancer program. Therefore, the design must support the integration of, and accessibility to, other components of the program.

Accessing Information Via the Internet. Rapid advances in the development of information systems, particularly the Internet, provide patients with access to extensive information on cancer topics, vehicles to contact various providers of cancer care services, and links to new research findings and protocols. As a result, patients are becoming extremely knowledgeable and willing to participate in research programs throughout the nation. Similarly, physicians have access to extensive information as well as a way to consult with physicians around the world. Healthcare providers in remote locations actively collaborate in treatment coordinated through a national center. With information technology, cancer services can be coordinated from various geographic locations, eliminating the need to consolidate all of the services in one location.

Decentralizing Basic Cancer Care Services. As multihospital

healthcare systems are evolving and integration of clinical services is considered, cancer care is often one of the first services evaluated. A key issue is whether to physically consolidate or simply coordinate services. (12) During the early 1990s many organizations chose to consolidate services, but many organizations are now rethinking that strategy. The primary disadvantage to consolidation of services is that it limits the geographic access to services, and, with contemporary information systems, it is not necessary. Therefore, many systems are planning basic oncology services (i.e., radiation therapy, medical oncology) at the community level with more comprehensive services provided at the regional or national level.

Providing Interdisciplinary Care. Historically, cancer care has been described as multidisciplinary. In reality, this meant that the patient saw multiple providers in sequential order, often repeating tests and procedures. Each provider recommended a course of treatment, and the patient became the coordinator of opinions and actions. The new approach is interdisciplinary care where the providers, often representing numerous disciplines, work together—typically but not necessarily in one location—to evaluate and develop a course of treatment for the patient. This has resulted in the development of interdisciplinary clinics generally organized by disease site (e.g., breast, prostate, GI) within cancer centers.

Treating with Multiple Modalities. In the early part of the 20th century, surgery was the only treatment for cancer. During the second half of the century, there was dramatic growth in the modalities available to treat cancer. These modalities include chemotherapy, radiation therapy, immunotherapy, and biologic therapy. Future trends indicate the continued use of multiple modalities as opposed to single ones. (13) Therefore, cancer centers of the future must be designed to accommodate multiple specialties and therapies.

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Cancer Centers: Three Facility Types

Three facility types have evolved that reflect the recent trends in delivering cancer care:

- The community cancer center that provides basic cancer services to the community in a convenient location
- The regional cancer center that provides more specialized treatment planning and treatment modalities to a larger service area or several communities
- The comprehensive cancer center that offers the most extensive and specialized clinical services, including access to the latest research protocols.

Community Cancer Center

The community cancer center provides basic, routine cancer care services close to home. Historically, many of these "centers" were only radiation therapy centers. In the future, these centers will include medical oncology, radiation therapy, supportive services, and complementary care. Typical components of a community cancer center will include:

- Medical/radiation oncology exam rooms and offices
- Radiation therapy linear accelerators, simulators, and associated support space
- Shared offices to be utilized by supportive and complementary care professionals on an as-needed basis
- Resource room/conference room to be used for education and support groups.

Inpatient care at the community level is typically provided within the hospital. Because the volume is not large enough for a dedicated unit, patients are typically congregated on a designated medical/surgical unit.

Many communities have a hospice program, which supports patients and their families during the terminal phase of their illness. Hospice services are primarily home based, but in some larger communities there may be an inpatient unit. A unit of this nature is typically designed to meet the physical as well as the emotional and spiritual needs of the patient. It will include private patient rooms, family areas, a patient kitchen, family dining areas, a chapel, etc. Therefore, the space requirements will be greater than a traditional inpatient unit. Space planning guidelines for a community cancer center are presented in Table 2 below.

Table 2. Space Planning Guidelines—Community Cancer Center

Component	Capacity	DGS	Comments
Linear Accelerator	8,000 to 10,000 annual treatments	6,500 DGSF/first linear accelerator 450 DGSF/each	Includes space for treatment planning

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		additional linear accelerator	
Exam Rooms	12 to 16 visits/day	450 DGSF/Exam Room	To support medical and radiation oncology
Treatment Bays/ Rooms	2 to 6 treatments/day 1 treatment bay/exam room	200 to 250 DGSF/ treatment bay	Assumes 25% enclosed rooms
Hospice		600 DGSF/bed	Typically, located remote from cancer center

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Regional Cancer Center

The regional cancer center typically provides a wider array of services to support several communities or an entire multihospital healthcare system's population. Additional services that may be provided at a regional cancer center are listed here.

Expanded prevention and education programs. Regional centers may have more extensive prevention and education programs, including screening programs and ongoing educational programs for the public and medical professional.

Interdisciplinary clinics. Interdisciplinary clinics are designed to permit several specialists to examine, evaluate, and develop a treatment plan for a patient. Because a small number of patients may be seen during a clinic session, only a few large exam rooms are needed, but workstations for consultants and a large conference room for treatment planning are necessary. The volumes at a regional cancer center generally will not support a dedicated use for a specific clinic. Therefore, the interdisciplinary clinic is typically utilized for different purposes (e.g., breast, head and neck, GI, prostate) on different days of the week.

Specialized radiation therapy services. Specialized radiation therapy services that may be provided at a regional cancer center might include CT simulation used for complex treatment planning, brachytherapy, placement of radioactive implants, and hyperthermia.

Stem cell transplants. Peripheral blood stem cell transplantation allows patients to undergo intensive radiation and/or chemotherapy and then to be infused with their own stem or white blood cells to support regeneration. Peripheral blood stem cell transplantation is easier and less expensive than bone marrow transplantation (14) and, may consequently become common at regional cancer centers. Stem cells are harvested using the process of apheresis, which can be done in a treatment room within the cancer center infusion area. The patient is connected to an apheresis machine, similar in size to a dialysis machine, for a period of several hours to collect the necessary blood products. Although this treatment remains controversial, it is currently offered at some regional cancer centers.

Table 3. Facility Requirements—Regional Cancer Center

Component	Facility Requirements
Prevention/Education Program	• Library Resource room
	• Access to classroom
	• Consultation rooms
Interdisciplinary Clinic	• Exam rooms and related support space
	• Workstations for consultants
	• Conference room
Specialized Radiation	• CT simulator room

Therapy Services	•	Lead-lined procedure room for placing implants
	•	Hyperthermia procedure room
Stem Cell Transplants	•	Apheresis Treatment rooms
Clinical Trials	•	Office for coordinators
	•	Secured storage for medications
Cancer or Tumor Registry	•	Office space for individuals collecting and analyzing data
Pain Management	•	Shared exam and procedure rooms
Medical Education	•	Additional exam rooms, charting stations and conference space.

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Regional Cancer Center (continued)

Clinical trials. Clinical trials are studies involving large numbers of patients trying an FDA-approved drug that may be helpful in treating cancer. Patients are enrolled in protocols by their physician, and their response is documented by clinical trial coordinators.

Cancer or tumor registry. A cancer or tumor registry is a system of collecting information on the diagnosis, management, and outcomes of persons with cancer, which serves as a valuable research tool. Staff responsible for collecting and recording data may be located within or outside the cancer center.

Pain management. Pain management specialists typically consult with patients in the exam rooms of the cancer center. Procedures, if minor, may be performed within a treatment room within the cancer center or, if more involved, in the surgical suite.

Medical education. If medical education and residency programs are included, space will need to be planned at the high end of the space range to account for the additional space required for teaching activities.

At the regional level, inpatient volumes may be large enough to support a dedicated inpatient unit. Because of the chronic nature of cancer, amenities are provided to support the unique needs of the patient and family (e.g., private rooms with accommodations for families to room-in, patient kitchen, patient/family lounge, etc.). Therefore, the square footage per bed for an oncology unit is higher than a comparable medical/surgical unit.

Facility requirements for the major components of a regional cancer center are presented in Table 2 and the space planning guidelines for this type of facility are presented in Table 4.

Table 4. Space Planning Guidelines—Regional Cancer Center

Component	Capacity	DGS	Comments
Linear Accelerator	8,000 to 10,000 annual treatments	6,500 DGSF/first linear accelerator 450 DGSF/each additional linear accelerator	Includes space for treatment planning
Exam Rooms	8 to 12 visits/day	450 DGSF/Exam Room	Routine care
	2 to 4 visits/day	500 to 600 DGSF/Exam Room	Interdisciplinary clinics; includes conference and consultation spaces
Treatment Bays/ Rooms	2 to 6 treatments/day	200 to 250 DGSF/ treatment bay	Assumes more and longer infusions
	1 to 1.5 treatment bay/ exam room		

Inpatient Oncology Unit		500 to 550 DGSF/bed	

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Comprehensive Cancer Center

The term Comprehensive Cancer Center refers to the National Cancer Institute's (NCI) highest designation. These facilities must meet the standards set by NCI, including strong programs in basic research, integration of research into clinical practice, and participation in trials of new therapies.

Because there are fewer than 30 of these centers throughout the United States, patients are often seen at a comprehensive cancer center for treatment planning and/or unique treatments, and are then referred to their community cancer center and local physician for ongoing care. Thus, the space planning standards that apply to community and regional cancer centers are difficult to apply to a comprehensive cancer center. The space allocation for a comprehensive cancer center must relate to a clear understanding of the programs offered. In addition to the basic components of a community or regional cancer center, the unique components of a comprehensive cancer center may include:

Extensive screening programs. Comprehensive cancer centers provide extensive screening programs for individuals at high risk for particular types of cancer. These may include clinical as well as genetic testing.

Dedicated interdisciplinary clinics for disease-specific sites (breast, GI, head/neck, etc.). Because of the larger population served, there is typically adequate volume at this type of facility to dedicate clinic areas to specific disease sites. In addition to exam/consultation rooms, the clinics may include unique diagnostic and procedure rooms for that specialty (e.g., mammography suite in the breast clinic, endoscopy suite in the GI clinic, etc.).

Basic diagnostics. The size and patient volume at these centers can usually support basic diagnostic services (e.g., laboratory specimen collection, basic radiology, etc.) within the facility. These services are typically located near the entrance-convenient to patients as they enter the facility.

Specialized chemotherapy infusion and apheresis procedures. At comprehensive cancer centers, patients may receive specialized chemotherapy infusions that last longer than at a community or regional cancer center. Apheresis procedures, to harvest stem cells for transplantation, require a larger area or infusion room to accommodate the equipment. Some patients may require a short-stay admission and, in response, some centers have developed short-stay units with hotel-type accommodations for these patients. Other patients may require overnight accommodations proximate to the center to allow a daily regimen of chemotherapy.

Bone marrow transplantation. Because of the expertise required in matching donors and recipients and the high acuity of the transplant patients, bone marrow transplants are typically performed at comprehensive cancer centers. Unlike other cancer services, this service requires dedicated inpatient rooms with special air filtration and antibacterial considerations to protect the immunocompromised patient.

Table 5. Facility Requirements—Comprehensive Cancer Center

Component	Facility Requirements
Extensive Programs	• Exam rooms
	• Consultation rooms
	• Genetic laboratory facilities
Dedicated Clinics	• Exam/consultation rooms
	• Clinician workstations
	• Conference room
	• Dedicated diagnostic services (e.g., mammography, endoscopy, procedure room)
Basic	• Specimen collection stations
	• Basic radiography services
	• EKG and other diagnostics
Clinical Research	• Exam/consultation rooms
	• Infusion bays
	• Short-stay or inpatient unit
	• Office space for research coordinators
Biological	• Exam/consultation rooms
	• Infusion center
Specialized Infusions and Procedures	• More infusion bays for prolonged or specialized infusions
	• More enclosed infusion rooms for sicker patients or apheresis
	• Short-stay infusion units for treatments lasting 24 to 72 hours
	• Nearby overnight accommodations for patients receiving daily treatments
Bone Marrow Transplantation	• Donor consultation rooms
	• Laboratory blood typing and marrow processing facilities
	• Inpatient bone marrow transplant rooms with specialized infection control systems and finishes
Specialized Therapy	• Expanded treatment planning areas
	• Reduced linear accelerator capacity due to longer patient setup and treatment times
Clinical Research	• Office space within clinical areas for research coordinators
Laboratory	• Rapid response lab
	• Bone marrow/stem cell processing
	• Tissue and blood typing
Research	• "Wet lab" space including traditional bench space and utilities
	• "Dry lab" space consisting of office space for researchers involved with demographics and data analysis.

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Comprehensive Cancer Center (continued)

Specialized radiation therapy. One type of specialized therapy, intensity-modulated radiation therapy, involves using computer imaging to develop 100 to 200 fields (significantly more than the standard process of using six fields) through which to aim the radiation beam. This approach minimizes the damage on surrounding tissue. (15)

Clinical research protocols. Comprehensive cancer centers are the focal point for clinical research protocols and trials. Similar to a regional center, clinical trial coordinators will be located within the center and will coordinate the treatment protocols.

Biological therapies. The use of biological therapies (i.e., monoclonal antibodies, tumor vaccines) is a new and evolving type of therapy. For purposes of facility planning, this type of therapy will obviously require research space, but most of the clinical applications will occur within the exam room, infusion center, or short-stay unit.

Laboratory facilities. Many comprehensive cancer facilities can support dedicated laboratory facilities to provide routine testing associated with clinical care. In addition, many facilities include dedicated and specialized laboratories for tissue and blood analysis. Of course, either of these types of laboratories could be remotely located and still provide support to the center.

Research facilities. Research facilities are an integral part of a comprehensive cancer center and are typically located within the cancer center facility to support individuals actively involved in clinical care and research. Many cancer centers are designed to encourage random interaction between researchers and clinicians that leads to new thoughts and ideas.

Comprehensive cancer centers can typically support one or more inpatient units. In addition, a bone marrow transplant unit may be a dedicated area of a larger inpatient unit with specialized infection control features.

Also, as previously mentioned, larger centers may develop a short-stay unit for healthy patients undergoing a 24- to 72-hour treatment protocol.

Table 6. Space Planning Guidelines-Comprehensive Cancer Center

Component	Capacity	DGS	Comments
Linear Accelerator	7,000 to 9,000 annual treatments	6,000 to 7,000 DGSF/ linear accelerator	Assumes provision of additional and complex modalities
Exam Rooms	2 to 6 visits/day	600 to 700 DGSF/Exam Room	Assumes focus is on consultation

			and interdisciplinary clinics
			Includes teaching space and counseling space
			Excludes specialized diagnostics
Diagnostic Services: Mammography/ Ultrasound suite		700 DGSF/ procedure room	Integrate into interdisciplinary clinics
Endoscapy Suite		1,200 DGSF/ procedure room	
Minor Procedures		400 to 800 DGSF/ procedure room	
Treatment Bays	2 to 6 treatments/day	300 to 350 DGSF/ treatment bay	Includes satellite pharmacy; includes 60% private rooms
	1 to 1.5 treatment bay/exam room		Additional capacity to support complex protocols
Bone Marrow Transplant Unit		550 to 650 DGSF/bed	

In summary, the three different types of cancer centers have many similarities but it is essential that the physical facilities be designed to reflect the unique set of services of the cancer care continuum that is provided.

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Where to Locate a Cancer Center

The patients visiting each of the types of facilities are very different. Some have recurring visits to receive a course of treatment (primarily at community cancer centers), and others may have episodic visits to a center for a consult or treatment plan (primarily at comprehensive centers). However, the site considerations for both patient populations is similar.

Wayfinding. Since many patients may be traveling from distant locations, particularly in the case of regional and comprehensive cancer centers, wayfinding should be simple and straightforward. This includes simple access from major thoroughfares, an easily identified main entrance, adjacent parking, and information available immediately within the main entrance.

Accommodating disabilities. Due to the higher incidence of cancer in older persons, the majority of patients will be senior citizens. Consideration must be made for their frailty and chronic conditions that may be exacerbated by cancer. In addition, all patients may suffer some sort of disabilities due to cancer treatments. A cancer center must be designed to accommodate wheelchair and stretcher traffic throughout the center, provide a covered drop-off with assistance available, strive for short walking distances between areas, and consolidate as many services as feasible to provide "one-stop shopping."

Inpatient access. Since the center will most likely provide some services, typically radiation therapy, to inpatients, an enclosed connector between the hospital and cancer center is desirable. Alternatively, a separate entrance for patients arriving by ambulance from inpatient or nursing home facilities could be provided.

Linear accelerator considerations. Finally, the linear accelerators will require special shielding and a foundation to support the weight of the shielding and equipment. The location of these units may be one of the primary factors that determine where the center is located and how it is configured.

By addressing these issues, the cancer center can be sited to optimize patient access and convenience—for both recurring and episodic visits—while also addressing the specialized needs of the equipment.

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Creating a Therapeutic Environment

A therapeutic environment can be described as one that promotes healing. By understanding the psychosocial needs of a cancer patient, the environment can be used as one avenue to address these needs and promote healing. Research has shown that the psychosocial needs of patients are linked to patient outcomes in various healthcare settings, (16) including cancer centers. (17) From recent research, four psychosocial needs of cancer patients and their impact on health status have been identified and are summarized in Table 7.

Table 7. Psychosocial Needs of Cancer Patients and Key Research Findings

Psychosocial Need	Research/Organization Citations	Key Findings
Sense of Control/Choice	Rowe and Kahn, 1987	A lack of control has adverse effects on "emotional states, performance, subjective well-being, and on physiological indicators(i)
	Holland and Zittoun, 1990	Patient participation has been linked to patient outcomes (ii)
	National Cancer Alliance	Incorporate patients to be involved with treatment planning (iii)
Information	Koe and Kluka, 1998	Educational programs to increase awareness, understanding, and acceptance of cancer are important (iv)
	Kovach, 1999	Cancer patients benefit from knowing about the recent developments in cancer research and treatments (v)
	Koyani, 1999	Health care professionals need to know how to access educational information and deliver the information with sensitivity to cancer patients and families (vi)
Access to Nature	Cimprich, 1991	The natural environment or experiences with nature have restorative effects (vii)
	Ulrich, 1984	Natural light and views provide therapeutic benefits (viii)
Supportive	Pellow, 1996	Spatial behavior and privacy is an important human need (ix)
	Bland, 1997	Psychosocial support is needed to help cancer patients and families cope with the distress of therapy (x)
	Tomatis, 1990	60 percent of all cancer cases occur in people over 65 years of age (xi)

Notes on Table 7

i. J. W. Rowe and R. L. Kahn, "Human Aging: Usual and Successful," Science, 1987, 143-149.

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To create a therapeutic environment, the facility planner must translate these research findings into facility or design guidelines. Suggested design guidelines are presented in Table 8.

Table 8. Design Guidelines Supporting Psychosocial Needs

Psychological Need	Design Guildines
Sense of Control/Choice	• Choice of waiting areas: secluded vs. public, stimulating vs. quiet
	• Choice of infusing bays: open vs. enclosed, with family vs. alone, view vs. no view
Information	• Library/resource center with internet access and print materials
	• Information stations available in waiting areas
Access to Nature	• Access to the natural environment either internally or externally
	• Natural lighting in waiting and treatment areas
Supportive	• Acoustic and visual privacy protectors in exam, infusion, and radiation treatment areas
	• Private alcoves available for waiting
	• Access to private consultation areas for psychosocial support
	• Accommodations to support an older population.

Summary

Cancer center facilities are being completed at a rate of more than 100 facilities per year, nationally. With the success of the recent prevention and treatment approaches—as evidenced by the declining mortality rate—the construction of cancer centers will continue well into the next decade.

But with the shrinking of the dollars available for healthcare, it will become increasingly important for careful consideration to be given to the initial steps of designing a cancer center: planning and programming. The success of future cancer centers will depend on understanding the trends in cancer care, planning cancer centers to meet the needs of the population they serve, locating centers so they are accessible to the patients, and creating a therapeutic environment.

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