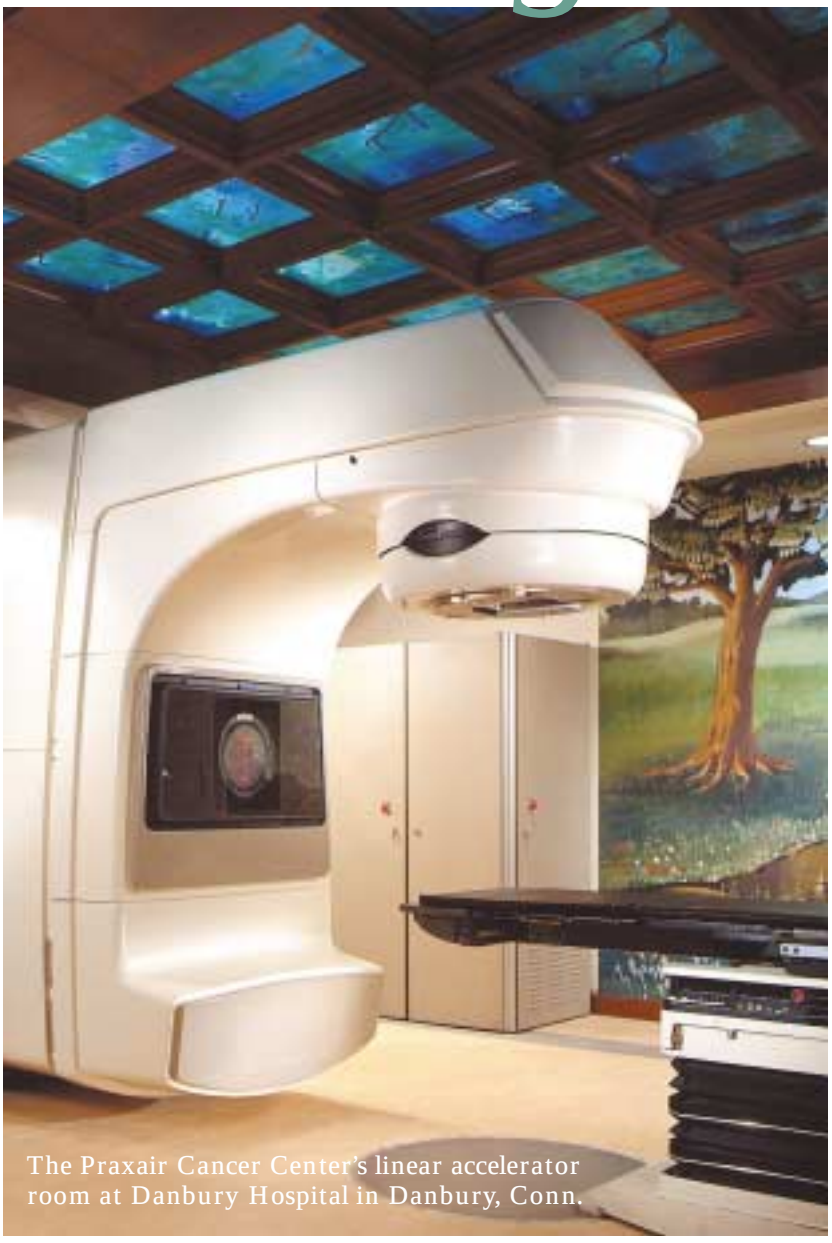
Compassion, Design, & Budget

Current Trends in Cancer Center Design

by Sheila F. Cahnman, M.Arch., AIA, ACHA



The Praxair Cancer Center's linear accelerator room at Danbury Hospital in Danbury, Conn.

The dream has come true— your organization has committed the resources to create a new cancer care facility. Now where do you start? If you begin by understanding the architectural design trends in recently completed and planned cancer centers, your project can obtain the best value for your new construction/renovation dollars. A well-designed facility can improve operational efficiency; enhance patient, family, and staff satisfaction; and increase your program's marketability and market share.

Budgeting and Cost Projections

Whether you should upgrade an old cancer care facility or build a new one should be determined by evaluating both construction costs and the long-term effect the improvements will have on marketing possibilities and the center's operating budget.

To identify how a potential upgrade or new construction will positively affect patient volume and staffing needs, first analyze your operations. You may be able to reduce the number of maintenance and operating staff you employ by purchasing new equipment, creating a facility design that increases efficiency, or installing improved building systems. Floor and wall finishes that require less maintenance can reduce housekeeping staff costs, and more efficient heating, ventilation, and air-conditioning (HVAC) systems can reduce the number of in-house engineers that are needed and lower heating and cooling costs. Although savings such as these cannot be accurately determined until the building design is finished, even rough estimates can help in the budget planning process.

Knowing what resources are necessary to construct or renovate your new cancer

center is vital for budgeting in-house capital and, in some states, applying for a certificate of need. Here are some simple steps to follow.

Step 1. *Have an expert health care programmer/planner develop a hypothetical space allocation plan.*
Administrators and physicians should meet with the expert and share information before the plan is formed. The expert will then develop the plan based on projections of the number and type of treatments the center will offer, the number of physicians it will employ, and patient volumes. These projected figures are translated into square feet, and each square foot is assigned a dollar amount using typical health care construction costs in your region. This step will establish your hard construction costs.

Step 2. *Develop a preliminary project budget.*
A knowledgeable architect can estimate these expenditures, usually with the assistance of a cost consultant or construction manager. Allowances should be made for inflation and cost escalation, depending on market conditions.

Component costs must be added to the construction costs to come up with a total project cost.

At this early stage, total project costs are assumed to be 1.4 times the construction budget. For example, a project with a total construction budget of $1 million should plan for approximately $400,000 in components costs (listed below) for a total project cost of $1.4 million. The following components make up the remainder of the project costs and are listed with the typical percentage of the construction budget they require:

- Owner-supplied furnishings, movable equipment, window treatment, artwork, signage—10 to 15 percent
- Professional fees and expenses (architects, engineers, interior designers, cost consultants)—10 to 14 percent, depending on project complexity
- Moving, testing, and miscellaneous expenses—3 percent
- Contingency budget for owner-initiated changes and unforeseen conditions—8 to 12 percent. This figure can be higher for difficult renovations
- Site development and existing building system infrastructure improvements will be extra. If other departments must be relocated prior to renovation, this cost should also be accounted for separately. Major equipment purchases, such as CT simulators or linear accelerators, should also be accounted for with actual costs.

Step 3. *Develop a final space allocation plan.*
Your health care architect/planner should meet with each department in the cancer center to determine how much space the department will need in the new facility. Room sizes will be based on "test fits" and industry standards. Room sizes are referred to as net square footage or the programmed area within the room itself, but are not the total square footage.

Preliminary space allocations can be calculated by taking the net square footage (NSF) and multiplying it by 1.3 to 1.6, depending on the type of area. For instance, the 1.3 multiplier (30 percent) is used for a lobby/registration area, while the 1.6 multiplier (60 percent) is used for an inpatient unit. The resulting figure is called the Departmental Gross Square Footage (DGSF) and accounts for building circulation, including connecting corridors and vestibules.

The DGSF is then multiplied by an average of 1.15 (15 percent) to develop the Building Gross Square Footage (BGSF), which accounts for wall thickness, stairs, shafts, and mechanical/electrical support spaces. The BGSF may be reduced in a renovation project if the project is within a defined area.

Hypothetical Example: 10,000 net square footage x 1.5 = a departmental gross square footage of 15,000. 15,000 x 1.15 = a total building gross square footage of 17,250.

Step 4. *Develop concept diagrams to establish the relationship of each program element to each other, plus a narrative of mechanical/electrical systems.*
This kind of detailed information will be used to develop a more precise Programming Phase-Cost Model by your architect and cost consultant or construction manager. The firm creating this cost model should have experience with conceptual estimating and also have a good health care construction cost database. The architect/cost consultant will develop a more detailed cost per-square-foot figure for each departmental area. Offices, waiting areas, and other "soft spaces" have the lowest cost/per square foot, and highly technical clinical spaces (such as linear accelerator vaults) have the highest costs.

If the project is new construction, a separate "core and shell" cost per square foot will be shown. This report will include the cost of the building's structure, exterior wall enclosure, and major electrical and mechanical systems.

The previously outlined additional project costs must again be factored in, along with preliminary itemized estimates of furnishings and equipment (F&E) and negotiated professional design fees. A more defined design/construction schedule can confirm the inflation/escalation contingency. The completed cost model will form the operating budget for the project. All subsequent budgets should be equal to or less than this initial budget.

Step 5. *Retest the budget.*
Budget testing is the key to a fiscally successful project and should occur during the schematic design, design development, and construction document phases, prior to bidding. The cost consultant or construction manager hired for pre-construction services can estimate drawings and specifications at the end of each phase. There are many ways that a project can go over even the most well thought-out budget. Scope growth or unrealistic design expectations by designers or owners can inflate costs quickly, and unexpected construction conditions are always possible. By retesting the budget at the end of each phase, overruns can be corrected early.

Space Allocation

Since most facilities have tight budgets, the amount of square footage must be apportioned carefully. Space

Patients receiving infusion at the Harry W. and Mary Louise Shaw Regional Cancer Center in Edwards, Colo., can enjoy the scenic mountain vista made possible by a wall of windows.

allocation is especially important when determining the balance between functional and non-revenue producing space.

The "wow" or inspirational spaces make your cancer center stand out in the marketplace, but aesthetics must not compromise clinical functionality. Will the impact space be the entrance lobby to create a good first impression, or will you place a garden in the infusion room? Both are being seen today in cancer center design. Using extra space for "off-stage" rest areas that help the staff maintain psychological balance is another trend, as is creating larger, multidisciplinary conference rooms that feature the latest presentation technology and can be used for either tumor boards or support groups.

Another developing trend is providing more amenities for patients and their families. Vending machines have given way to chic snack bars in larger centers, and gift shops have been enhanced with boutiques, complete with private changing areas and support personnel, where patients can buy wigs, scarves, and prostheses. Moving its retail pharmacy adjacent to the cancer center substantially improved the pharmacy business of Danbury Hospital in Danbury, Conn., simply by making it easy to obtain prescription refills. Outpatient labs and diagnostic imaging centers are also being moved closer or into the cancer facility whenever possible.

Most new cancer centers include living room spaces in which families can relax, access the Internet, and view educational tapes. These spaces can also accommodate small support group meetings or even yoga classes. The most successful designs have windows that open on a corridor, inviting patients and family members to enter.

Although living rooms look great and have excellent philanthropic potential, they must be multifunctional. Research over the last several years has shown that printed library materials from a resource center are difficult to distribute, maintain, and update. Resource centers are being used less and less as home Internet access reduces the need to come into a center for information. Since family members are often allowed to stay with patients receiving infusion therapy, the need for waiting areas has also been reduced. Today, living room areas must serve a variety of functions to justify their existence.

Clinical spaces are becoming larger as patients' families accompany them through their treatment process. An exam room in the 1990s averaged 80 to 100 square feet. The room contained a sink, writing center, and exam table. Now, we are creating exam rooms in the 120 to 150 square-foot-size range. David DeLeon[1] suggests that pediatric exam rooms be 150 square feet to hold two parents, one sibling, the doctor, and a nurse. These rooms are wheelchair and sometimes gurney accessible, contain several seats for family members, and can be used for private infusion therapy.

The infusion bay has also evolved. In the past, planning standards suggested a 60- to 80-square-foot bay,[2] usually surrounded by cubicle curtains. This space was adequate for a patient recliner, the IV pump, a side table, and perhaps one side chair. The trend in recently built centers is towards 100- to 120-square-foot bays with private televisions (sometimes on an articulating arm) and space for several family members. Since this increased space is a repetitive design element, the larger bays drastically affect the overall size of the facility.

As technology changes, physics support areas are changing as well. With the advent of intensity modulated radiation therapy (IMRT), more space is needed for computers and personnel, but less need exists for mold rooms and block storage in linear accelerator areas. These last two elements may eventually disappear.

Physician/patient encounter areas are also changing from the conventional meeting over the doctor's desk to consult rooms. When located near a family waiting area, consult rooms become a convenient and medically neutral space to discuss outcomes for physicians, patients, and family members. Danbury Hospital's oncologists developed a combination physician office/consult room with greenhouse windows and family room seating that greatly reduces stress.

Many cancer centers are including spaces for complementary therapies, such as massage and aromatherapy. Although few centers have fully embraced rooms

completely designated for this use, many centers have multipurpose spaces that can be used for complementary treatments or more conventional activities, such as exams by timeshare consulting physicians.

Once open reception/registration areas and nursing stations are now becoming more enclosed to protect the privacy of patient information, a result of new guidelines from the Health Insurance Portability and Accountability Act (HIPAA). Of course, this design element conflicts with the trend towards open workstations that reduce the psychological and visual barriers between patients and staff. Attractively designed glass partitions are one option that provides both visual continuity and acoustic privacy.

Designing Your Rooms

Do patients respond better to consistency and comfort or variety and distraction when receiving treatment? Probably both, depending on how patients are feeling at any given time. Allowing patients to choose the environment in which they will receive treatment gives them a sense of control and empowerment. Providing choices is especially important since patients with cancer sometimes feel at the mercy of their illness. Architect Carl

Special Problems in Designing a Radiation Oncology Treatment Center

by Sonya Wade and Astara March

Radiation oncology centers have four special requirements that must be addressed during the design process: patient safety, patient privacy, patient flow through the center, and storage space for the custom-made molds that hold patients in place during treatment.

Safety. Radiation treatment areas must have controlled entry to prevent patients or family members from inadvertently walking into a vault and being exposed to radiation. Someone must be constantly stationed at the reception desk in the lobby, or the door to the treatment area must lock. Since by law the treatment vaults themselves cannot be locked while patients are in the building, vault room doors and wiring must be designed so that the machines automatically shut off if the door to the vault is opened. All areas that house radiation oncology equipment must be designed in this fashion, including the linear accelerator space, the CT simulator space, and rooms holding MRI and PET scanners.

Privacy. Radiation oncology patients are usually seen daily for five to seven weeks. During those five to seven weeks, their charts must be easily available to the center's radiation therapists, nurses, and physicians. HIPAA requires that all patient charts be monitored when patients are in the building and secured when the building closes and non-medical personnel (such as the cleaning and maintenance staff) are at work. Keeping charts for active patients on a shelf in the treatment control area is traditional, and since medical personnel are always in the treatment area during the day, part of the HIPAA rules are automatically satisfied. Returning the charts to locked file cabinets elsewhere in the building at night is impractical, so centers are handling night security requirements by either using rolling file cabinets that can be locked or converting the chart shelf on the wall into a cabinet or closet with lockable doors. Centers that are paperless will not have this problem, but staff members should sign off terminals when they are not being used, and a password should be required to log in. There should also be fixed time-outs when the terminal has sat dormant for a certain number of minutes so forgetful staff members don't create legal problems for the facility.

Patient flow. Unlike medical oncology patients who see their doctor first, then dress and usually receive treatment clothed, radiation oncology patients change into gowns when they arrive, receive treatment, then see their doctor. The patient flow through the center must be designed so that patients can move easily from the changing area to the treatment area to their physician's office without having to get dressed again and without traveling through public spaces. Since most patients with cancer are senior citizens, the distances between these areas should be short.

Storage. Rooms to make the molds that hold patients in place during treatment are an important part of radiation oncology centers. With the advent of IMRT, which requires more precise delivery than external beam radiation, enough space to make immobilization devices is even more important. Designers should find out what kind of fixation devices the center uses and make sure that space is ample for both fabrication and storage. Luckily, technology is already evolving to streamline the process.

The minimum modules necessary for a radiation oncology center on a shoestring include a treatment vault, a simulator room, a dosimetry planning area, a mold room, an exam room, a physician's office, a patient changing area, a front desk and waiting area, an office for billing/managed care, and a darkroom unless the center uses digital images rather than film. Make sure it is possible to add more planning space, at least one more treatment vault, additional physician offices and exam rooms, a nursing station, a break room, a conference room, and patient education areas so the building can expand as the center grows.

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Linter, fellowship holder from the American Institute of Architects and the American Hospital Association, suggests that giving patients control over noise levels and odors is important.[3] A gesture as simple as allowing patients their choice of room air freshener can enhance relaxation.

A variety of seating options gives patients a choice of socializing with fellow patients or relaxing alone. Recently constructed cancer centers offer enclosed private infusion rooms, semiprivate rooms, and open bays with cubicle curtains that form a group setting. Some group settings resemble living rooms that reinforce a sense of community. Seating (either indoor or outdoor) within garden spaces is also a new trend. Most facilities that have created garden infusion spaces find them well regarded but underutilized, possibly because patients in garden areas know that the medical staff cannot see or hear them in this setting and staff members also feel anxious when patients are out of sight. Perhaps staff and patient attitudes will change over time.

The courtyard infusion room at the Praxair Cancer Center in Danbury, Conn.

Distraction can lessen anxiety by taking the mind away from an unpleasant situation. Distraction is especially useful for radiation therapy, where patients lie alone on a table in a concrete vault. Designers have developed beautiful concepts for linear accelerator room ceilings and walls, many with nature themes, to help ease the starkness of treatment. Certain design companies have pushed this idea one step further and created an environment in the room that changes to interest the patient.

At Danbury Hospital's Praxair Cancer Center, two existing linear accelerator rooms were renovated to achieve a changing and dynamic patient environment. Since the patient is either lying flat on the table or turned on one side, the design emphasis was placed on the ceiling and one side wall. The walls around the room are a rich cherry paneling, consistent with the rest of the cancer center. One wall has a mural with a detailed nature scene. The ceiling is glass etched with tree branches and flowers as if the patient were lying on the grass looking up at the sky on a spring day. The glass is backlit by fiber optics so the colors are constantly yet subtly changing. Each time a patient arrives for therapy, the ceiling is backlit differently and the effect is ethereal. Special care was taken to make sure that the fiber optics did not interfere with laser positioning lights.

For its linear accelerator vault, the Center for Advanced Clinical Studies at Methodist Hospitals in Merrillville, Ind., developed the same concept in a different fashion. Since the room is darkened during most of the treatment period, the ceiling acts as a projection screen and "gobos," or light stencils, play across its surface. These color images have simple nature shapes such as leaf patterns, sun rays, and snowflakes, and can be easily changed.

New Trends in Aesthetics

First impressions are powerful. What message is your center trying to convey?

Fifteen years ago, cancer centers had separate entrances to provide patient confidentiality. Today, a separate entrance is usually planned to increase the center's

marketability or provide a philanthropic opportunity.

In freestanding centers, the architectural statement sets the tone. One trend is to design a building of residential scale to project a homelike image and lessen patient anxiety. The Shaw Pavilion in Edwards, Colo., uses steeply pitched roofs and cedar siding to create a homelike atmosphere. The Robert Wood Johnson Cancer Center in New Brunswick, N.J., has an entrance that faces away from the main hospital and uses residential materials, such as clapboard siding, for a similar effect.

Another trend is to reflect an image of cutting-edge technical competency. The Center for Advanced Clinical Studies took this approach. The building features glass and curved metal surfaces juxtaposed with angular wall planes. The effect is contemporary and exciting, an interesting departure from the architecture of the rest of the hospital campus.

When the cancer center is internal to a facility, the departmental entrance sets the tone. The Praxair Cancer Center chose a wood and glass gateway framing a backlit colored glass "tree of life." The effect is calming and meditative.

In each case, the facility provided the concept for the architectural statement. The design of your new cancer center gives you an excellent opportunity to display your vision of the delivery of cancer care.

Most cancer centers are trying to incorporate as much access to nature as possible. In warmer climates, these designs include views and access to indoor or outdoor gardens from both infusion and family spaces. In colder climates, the challenge is greater. The Shaw Pavilion infusion area is next to a patio that overlooks the mountains. The center's theme is the vital elements of life. The vista entering the linear accelerator vault is a diorama of the Colorado sky. The Praxair Cancer Center created a faux "secret courtyard" of interior space, naturally lit by north-facing greenhouse windows and a glowing ceiling that simulates a skylight. Infusion rooms have sliding wood and glass panels that open so patients can view this courtyard, which contains plants and a large fountain.

Besides introducing as much natural light as possible, another recent trend is using indirect lighting where the source is hidden and the light bounces off walls or ceiling surfaces that glow. If standard fluorescent lay-in fixtures must be used, parabolic lenses can deflect the harshness of the light. Not only does indirect lighting create a less institutional look, it makes patients look better and thus feel better about themselves.

Water features have long been a staple in cancer centers, and aquariums have become almost cliché. A new trend in water features is a water wall or column that creates the sound effect of a waterfall with no splash that may raise infection control concerns. The goal is to create a pleasant, soothing atmosphere. Minimizing distracting noise by using sound-absorbing materials has the same calming effect.

During the initial planning phase of your new center, visit leading-edge facilities to see current architectural trends and learn how others have pushed the envelope. Further site visits during design development can help you define what you do and don't want to include in your building. An architect/health care planner that has experience building cancer centers can also contribute many useful ideas. Understand and work with the current design trends, and your new project may just set design trends for the future.

Patients at the Praxair Cancer Center enjoy design features such as private infusion rooms and unique works of art.

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