

[M152]

Ergonomic Design: Understanding Outpatient Cancer Care

Monday, June 14
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What is Ergonomics?

Derived from the Greek words ergos meaning "work" and nomos meaning "laws"; laws of work.

Ergonomics in general is defined as the design of a workplace, product, environment, or system, taking into consideration human physical, physiological, biomechanical, and psychological capabilities. In other words, adjusting the task to the user, rather than forcing the user to the task. Ergonomics covers all aspects of a job, from the physical stresses it places on the body, to environmental factors which can affect hearing, vision, and general comfort and health.

Patient Ergonomics is a way of understanding the special needs of healthcare patients who require environments tailored to their capacities and needs, which go beyond those of the staff and workforce. In our experience, it is critical to look at the whole person, and to recognize the ways in which cancer patients, their families, and the staff who work with them have specific needs to be considered.

Cancer Patient Characteristics

The nature of cancer diagnosis and treatment means that these are long term patients, very familiar with the facility because they make frequent visits, often more than 100 in their first year. They are dealing with more serious potential conditions, anxiety, the unknown, and a possibly life-threatening diagnosis. During their course of treatment, they may be immuno-compromised, weaker, feeling physically ill, and on medication. Their physical range of motion and strength may be limited; they may have very low endurance, and may be distracted and confused. They are often accompanied by their family who are also stressed, and may need assistance.

Planning Techniques related to Ergonomics

The initial planning and design of facilities for cancer diagnosis and treatment needs to begin by considering these characteristics. Short travel distances and close adjacency of functions are important for people who have trouble moving and may become easily tired. Attention to patient flow and clear, effective, intuitive way finding starts with the basic floor plan, before signage and graphics are added. Because they are frequent patients, arrangements for easy access, convenient drop off or valet parking, and adequate support functions are important. Because many of these patients will need to have blood drawn on every visit, at the start of their daily treatment, the location of Phlebotomy services and easy access are important, as a way of recognizing these limitations on patient flow.

Ergonomic Design Toolkit

When designing for these specific ergonomic limitations of cancer patients there is a "toolkit" of design elements that can be incorporated into the interior design to improve ergonomics. These typically include:

Carpet

Carpet is a key decorative and functional element in cancer healthcare environments. Carpet offers comfort under foot, but also increased safety from slips and falls. Carpet absorbs sound and provides traction which helps unsteady patients to prevent falls and to maintain their balance. Carpet also eliminates reflected glare, minimizing visual disorientation, and its hospitality-based aesthetic is recognized as an asset to the patient environment.

Noise Reduction

A well-designed acoustical environment is critical in the cancer care environment in terms of addressing problems related to noise and communication of information for cancer patients who are stressed, distracted, and trying to absorb critical new information. Research suggests that environmental interventions may be effective in reducing the noise levels in hospitals and improving the acoustical environment; a key intervention includes installing high-performance sound-absorbing ceiling tiles (*Joseph, 2006*).

Daylighting

If direct access to nature is not available, windows that let in natural light have the additional benefit of providing views to the outside that orient patients and staff to the time of day as well as provide positive distraction. A research study in 1984 found that patients recovering from surgery recovered faster, had better emotional well-being, and required fewer strong pain medications if they had bedside windows with a view to nature (looking out onto trees) than if their windows looked out onto a brick wall.

Even simulated views of natural environments, where no direct views are possible, have had positive effects. One study revealed that while using virtual reality as a distraction during chemotherapy patients experienced fewer adverse effects and fatigue (*Oncology Nursing Forum, 2004*).

Access to nature

Spending long hours in a healthcare facility, either as a cancer patient, family member, or employee, is stressful. Providing access to nature through natural views or gardens in healthcare settings has been shown to increase patient, family, and staff satisfaction as well as foster access to social support, positive escape and recuperation from stressful clinical situations. Healing gardens in healthcare facilities can provide a setting for staff to conduct various therapies with patients, for staff to retreat from the stressors within the walls of the cancer care environment, and provide an opportunity for patient-family interaction. Positive mood change and reduced stress was reported within several post-occupancy studies of patients and families who use such gardens.

Key design considerations to consider for optimal garden use in hospitals and cancer care facilities include clear visibility, easy accessibility, an encouraging familiarity, and a quiet sound environment. Carefully chosen, unambiguously positive art can provide both visual focus and inspiration.

Artwork

Growing research is showing that purposefully selected art can play a helpful role in healing sick people. It actually can reduce blood pressure, reduce the sensation of pain, and minimize the need for pain medication.

A new study on the use of art in facilities for cancer patients confirms that art with a focus on nature is best. The research involved 345 patients in three cancer centers in Italy - Messina, Ancona, and Perugia.

"*Beyond traditional treatment... Establishing art as therapy*," found that the great majority of cancer patients prefer art on the walls of hospitals, instead of white, sterile walls. The art preferred, in order, is:

1. Nature landscapes (most popular)
2. Animals
3. Scenes of everyday life
4. Portraits
5. Urban landscapes
6. Abstract (least popular)

The control group's *fiducia* (trust or hope) decreased from viewing only white, sterile walls, whereas the experimental group who viewed nature photos for several months, had an increase in *fiducia*.

An example of using art for ergonomic and therapeutic purposes is at the Evelyn H. Lauder Breast Center at Memorial Sloan-Kettering Cancer Center. From its inception, the objective of the art collection of has

been to create an environment that offers a soothing and peaceful visual experience for these cancer patients and their families, based on a passionate belief in the power of beauty in art and nature to promote the healing process. Starting with the core group of approximately 300 photographs transferred from the original breast center in 1992, the collection was recently augmented by more than 200 works of art. The artists in the collection represent a wide spectrum from internationally known artists whose works are included in major museums to talented amateur photographers on the hospital staff. There were many artists, dealers, and collectors who donated works to the breast center's collection.

Designing for ergonomics in ambulatory cancer centers

This evolving approach reflects the history of cancer care, and even infusion therapy, is one of ad hoc creativity with respect to ergonomics, comfort, or the ability to speak to the human being in all of us.

An identity for the facility that is more closely linked to a residential space than that of a hospital-style healthcare context has been key to our approach to welcoming and supportive cancer centers. We took a very concerted effort to use materials that reflected the residential character of the facility's setting, allowing it to blend with the surroundings rather than being an obvious "healthcare structure." A building massing that expresses its purpose is important to patient perceptions, and detailed planning places a tremendous reliance on human contact, with a private and dignified setting that is focused on the familiar.

No matter where you are situated in our cancer facilities, the patient should find it to be a very clear, simple building to navigate. What we add to that picture is location of the patient and staff in the best part of the building and then to consciously place the "back of the house" functions in a secondary area.

Waiting rooms always have views to the outside and are flooded with natural light.

We translate conceptual diagrams from organic to rational. These are consensus building concepts that determine what is important to the stakeholders – and then how we design to accommodate those distinguished ideas.

Designing to drive away the fear and clinical esthetic helps to create environments that are more soothing and allow for comfort, serenity, and the ability to meet the expectations of the private vulnerable person in us all. Thoughtful planning helps to provide support for the cancer patient and family safety net and includes elements of respite to stabilize the daily situation of coming back for more of a treatment protocol no matter how light it might be.

It is also important to create environments and work places that actually meet the expectations and tasks that the staff are to perform. Ergonomic design for repetitive tasks and multi tasking with many types of staff situations and work places is paramount for the attraction and retention of the best staff.

A primary thought process when designing cancer infusion therapy spaces is the consideration of socialization or private spaces for the patient during their chemotherapy treatment. Most recent designs have provided the ability to augment spaces so they allow both, sliding doors of semi-transparent materials or light weight curtains that allow light to penetrate and provide privacy have been most effective. These areas can also be opened up to allow socialization between multiple patients in the infusion bays.

Designing for cancer care is a very sensitive building type. There is a large and diverse group of users that will use this type of environment. The key stakeholders are patients, families, clinical staff, researchers, support staff, and administrators. There may be amenities with a boutique and a cafe and a library for educational purposes. All of these stakeholders will need to respond to the ergonomics and design issues in setting up the way the spaces work and the particular furnishings that are appropriate.

Designing for Cancer Care: Program and Elements

Planning for the unique ergonomic needs of cancer patients begins with a consideration of the typical functions which are part of the patient experience:

Patient Flow:

With each visit a patient should have an easily recognizable entry point; a welcome or concierge desk; and a check-in/check-out area providing privacy for conversations regarding current or future treatment. A visible and well-lit, welcoming canopy at the center entrance is an important first signal that the cancer patient's special needs for access and short travel distances are being recognized. Inside, an easily visible Concierge / Information desk and a visible, smiling person give the patient and their family a clear goal. The adjacent Check-in facility allows patients to confirm their appointment and be welcomed and assisted, with counter height and space to accommodate patients in wheelchairs as a normal thing. A close by Phlebotomy center allows blood samples to be drawn as the first step in most visits, as a normal part of the arrival sequence.

Patient/Family Waiting:

Due to the repetitive nature of the patient's treatment the waiting areas are designed to distract and stimulate over the course of many months. Family member and friends often accompany the patient; this area provides space for interaction and support. Amenities should include hospitality features such as beverages, snacks, and coat storage. Adjacent functions planned to minimize travel and to increase patient comfort and control of their care may include Patient Education kiosks or work stations, Nourishment, a patient Boutique offering unique patient needs, and Spiritual Spaces.

Waiting room furnishings are selected to harmonize with the high end hospitality impression that was established through use of finishes and architectural detailing in the space. In addition to researching available residential and hospitality furniture and choosing styles that are most appropriate for the space, it is often necessary for the selected pieces to be customized to meet the ergonomic needs of the patients visiting the facility. The design team may work with a manufacturer to reduce the seat height, firmness, and depth to the appropriate dimensions while maintaining the overall design esthetic of the seating groups within the lobby space.

Exam rooms:

Every institution may have developed pre-determined layout options for exam rooms; a key point is that these are discussed with the client and the best option for the particular facility is determined; from there clustering options are planned. Important ergonomic considerations include flexible layouts; embedded technologies, space for patients and their family members, and most of all careful planning to allow a personal, face to face interaction between patient and care provider during what can be a long visit and a stressful discussion of options. Often times the design team will create a full-size, exam room mock up which doctors, nurses, clinicians, and administrators can experience first-hand, allowing an easier understanding of adjacencies, placement, counter and table heights, etc. Exam rooms for cancer care need to provide for emotional as well as technical components.

Infusion:

Infusion (commonly known as chemotherapy) can occur in private or semi-private rooms; in the past large communal rooms were also available but research has shown that more privacy is preferred by the patient. Typically comfortable chairs are used during the treatment, but more frail patients may prefer a bed during their treatment. Specialized pharmacies are required to custom mix the chemotherapy "cocktails;" for each patient, based on their blood samples, with clean room standards to comply with USP 797 standards.

One example of the care needed to meet the special ergonomic needs of cancer patients was our recent research into creating the optimal Infusion Therapy Chair. The design process began in the summer of 2008, with a simple request for a patient recliner chair which was needed for mock up of a project's planned private Infusion Room.

Objective

The design of a new Infusion Therapy Chair was addressed to provide a comfortable recliner for patients as they receive Chemotherapy treatment for extended periods of time.

The design process began with a search of websites of major healthcare manufacturers resulted in the selection of latest recliners on the market. An Oncology Care recliner had been recently introduced at NeoCon 2007. The chair won the prestigious Nightingale Award recognizing excellence and innovation in healthcare product design.

Original Features

The designers requested the Oncology Care chair with an attached round side table, a flip down table, and the heated lumbar element for a mock-up of an Infusion Room. The motorized chair came standard with an electric wand that controlled the pitch of the back and the adjustment of the foot rest. This was the first time the design team had seen a recliner that was controlled with an electric wand. The wand offers the patient greater independence and sense of control, and less reliance on the nursing staff to adjust the chair.

Evaluation Process

After the evaluation at the mock-up room, the chair was sent to the previous facility. There, patients and the nursing staff could use the chair for an extended period of time. In general, the nursing staff approved of the chair. But, there were issues with the height of the arms. The nurses said that the arms were about 2" too high for the patients causing discomfort. Another mock-up chair was to be sent. Before the chair was sent, the team also streamlined the detailing on the back for a better appearance. The modified back and the lower arms are now part of the standard chair.

Development

The second chair arrived and was generally met with acceptance. There were several nurses at the review meeting, as well as the VP for design from the furniture manufacturer. The nurses were pleased with the modified chair but had the same request. They wanted the seat of the chair to be raised so that they would have easier access to the patient, and help eliminate the back and shoulder discomfort that many of them were having. The nursing profession has the second highest rate of occupational injuries and is highly prone to Musculoskeletal Diseases (MSDs). While this can be caused by the heavy lifting of patients, it is also caused by the long, repetitive periods of time nurses stand over patients in awkward positions. The VP mentioned that he had another chair called the Connect Chair, one that had an adjustable height seat. That chair for a side by side evaluation with the Oncology Care Chair.

The Connect Chair was designed so it can also serve as an exam table, this eliminating the need to transfer the patient from their room to an Exam Room at a distant location, reducing the chance of injuries to patients and staff. The chair reclines to a totally flat position and is able to be raised to exam table height (32"). In the case of this facility, the patient can also be transferred to a stretcher easily in case of an emergency. The fact that the seat can be raised to help nurses avoid the awkward postures when they attend patients and subsequent MSD injuries was an ergonomic benefit of this chair design.

The standard Connect Chair was sent for evaluation and immediately the nurses had issues with the chair. Since it is designed to also act as an exam table the overall chair proportions are oversized. The seat height was so tall that a typical patient's feet did not touch the floor. There was no lumbar support needed for the long stays in the Infusion Rooms. Compared to the Oncology Care chair, it was not very attractive; the scale of the chair would not work within the space of the Infusion Room. The nurses were ready to return to the original selection, but continued their request to get some sort of seat height adjustment added to the chair.

The designers asked the manufacturer if it was possible to fit the seat of the Oncology Care chair on the chassis of the Connect chair. It could be done. The fourth mock-up chair, now known as the Connect II chair was sent for evaluation. The nursing staff was pleased with the results and 21 chairs were planned to be ordered for the new facility.

Features of the Final Design

The new chair combined the best elements of the two chairs. From the Oncology Care chair, it had the comfortable back rest with added lumbar support and hand held electric wand for back pitch and foot rest flexibility. The base of the Connect Chair added seat height adjustability that was so desired by the nursing staff.

The Director of the Facility stated that the chair “does everything we asked for.” While the chair was primarily designed to provide the most comfort possible for the Chemotherapy Patients, during the design process, it was also customized to fulfill the ergonomic requests of nursing staff.

Imaging:

Imaging for cancer care has two purposes, Diagnostic Screening and Treatment/therapy planning. The ergonomic needs of patients and staff are quite different. Screening patients are apprehensive, but uncertain, and anxious to know the results. They are healthier, more adaptable, and are seen in greater numbers, so efficient patient flow and a welcoming, positive environment are important. A continuing consideration is always trying to soothe the patient as a focus of design for cancer care, with natural day lighting and windows not only in waiting rooms but also in imaging rooms where possible, along with, art depicting the natural environment.

The Diagnostic area may have separate spaces for patient/family waiting, sub-waiting for patients in street clothes, and spaces for patients in gowns. There is a desire to segregate the sexes due to the nature of the gowned waiting areas; a patient will wait after their imaging session to have the picture read, so pre and post imaging gowned waiting areas are needed. For more extensive nuclear imaging, there is also “hot waiting” for patients that require radioactive isotopes given by IV for their imaging session.

Imaging for Treatment Planning is a longer process, where staff convenience and ergonomic efficiency are as important as design to humanize a highly technical environment and to reduce patient anxiety. Staff areas such as control rooms can either be individual or shared for technicians but need to be planned for an effective and safe working environment. Reading rooms are advancing as imaging becomes a digital medium with instantaneous results, with a much greater need now for ergonomic spaces to accommodate good working conditions for medical staff who may now be spending long hours dealing with complex images under high stress.

What We Have Learned from Our Clients:

Perkins Eastman is a research and evidence based design firm. Following the completion of our projects we typically conduct a post occupancy review in the form of interview with key staff members. Most recently, following the completion of an ambulatory care breast and imaging center, we learned the following from one of the primary clinicians.

- A dedicated entrance away from other traffic fosters a calm patient experience
- Easy access is imperative to cancer patients
- Minimizing travel distances is important for patients who are weak and disoriented
- Phlebotomy located off the main reception is a benefit to patients and reduces travel, as every visit which includes an active chemo treatment requires phlebotomy
- Calming elements of muted colors, artwork, Zen feeling, carpeting have all been well received
- A resting bench installed in the elevator cab for very weak patients is good but a grab-bar would also be helpful

- Lesson learned about waiting area seating: Individual seats/chairs are the most popular and allow for a patient to stand up slowly with use of the arms. Seats facing the windows are the first seats to be chosen and built in banquettes, which face away from the view, are the least popular
- Patient scales in the exam rooms need a grab-bar as the patient steps up, to assist their stability
- Occupational therapy in the facility allows patients to get back to their activities of daily living; back to normalcy. This includes how to reach and open upper cabinets, due to limitations of raising the arm after surgery. This can be a formidable issue for women coming back to the home after breast surgery.
- A Group Therapy room with storage is a dominant part of the program.
- A cancer center has all the elements of a retreat or hotel with areas of respite included. The ergonomics and sensitivity toward the stakeholders are in the details.

Research from Past Projects

Patient-centered care is a primary design goal for cancer care. Working with a variety of providers including a community hospital, a major academic medical center, a large international medical center, and several projects for one of the world's most respected specialty cancer centers, we have incorporated eight key ergonomic concepts in the planning and design of their new facilities:

1. **A focus on the needs and concerns of the patient and the caregivers drawn from their circle of family and friends.** Cancer patients are different because of the seriousness of their disease and the negative side effects of treatments. They often need assistance to get to and from treatment. They have had to adjust the pattern of their lives to accommodate this compelling new priority. They need the physical and emotional support of family and friends, and everyone in this extended group needs the support of the medical institution. During their treatment they need access to liquids and snacks, distractions like television or the Internet, and educational resources about their disease and its treatment.
2. **Minimizing stress-inducing environmental factors.** With the high levels of stress that patients and their families are already experiencing, they do not need the aural and visual clutter that is usually prevalent in medical facilities.
3. **Preserving patient privacy and dignity.** Given the invasiveness and discomfort of cancer treatment and its stigma in the community, the need for preservation of privacy and dignity is self-evident.
4. **Providing positive, comfortable environments designed with a hospitality vocabulary.** Hospitality environments recall positive experiences like meals out and vacations. Hospital environments, with the exception of births, recall negative experiences. Staff at ambulatory care centers have told us that some patients now refuse to visit their doctors in their hospital-based offices. Because of the tremendous development of new materials for the hospitality industry that meet the maintenance and code requirements of healthcare facilities, this type of environment is much easier to create than it was a decade ago.
5. **Incorporating life-affirming features.** The use of artwork, plants and even natural finishes, or finishes with an organic feel and texture, reminds patients and family members of the wonderful possibilities of life and gives them something to contemplate. Although they are difficult to maintain, we have also had the opportunity to incorporate water features that create calming sound and are interesting to contemplate.
6. **Accommodating rapid change in technology and treatment protocols.** Given the high first cost of these facilities, additional marginal spending required to accommodate flexibility and new technologies may quickly pay for itself in future staffing and renovation efficiencies.

7. **Separating staff areas and support space from patient areas.** In addition to facilitating the operation of the facility, this helps to reduce environmentally-based stress factors just as it does in a hotel.
8. **Efficient use of the care team's time with the patient and of the patient's time in the facility.** One very important feature of a dedicated cancer center with doctors' offices, imaging, infusion therapy, and radiation therapy under one roof is that the patient can do in one day what may take multiple visits at a hospital center. It also facilitates the ability for a physician to check the condition of a patient who is only scheduled for therapy. Other examples of this principle are organization of the facility so the nursing staff can visually monitor patient traffic to optimize the flow; and rooms where the clinical team can plan the next steps in treatment before the patient visit is over.

Conclusion

Patients will come to an ambulatory cancer center often dozens and dozens of times, even approaching 50 to 100 visits per year. The repetitive nature of the use of the environments and its familiar daily use is important to design for the patients and the staff who will be engaged every day. Creating an environment that fosters the human connection and friendliness plus the ability to provide areas of respite is unique in a healthcare setting.

In addition to surgery, cancer treatment usually involves extended therapy at a medical facility. This requires specialized facilities for imaging, radiation, and infusion. It, therefore, does not seem surprising that most major medical centers and many community hospitals have, or are developing, specialized cancer treatment facilities.

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