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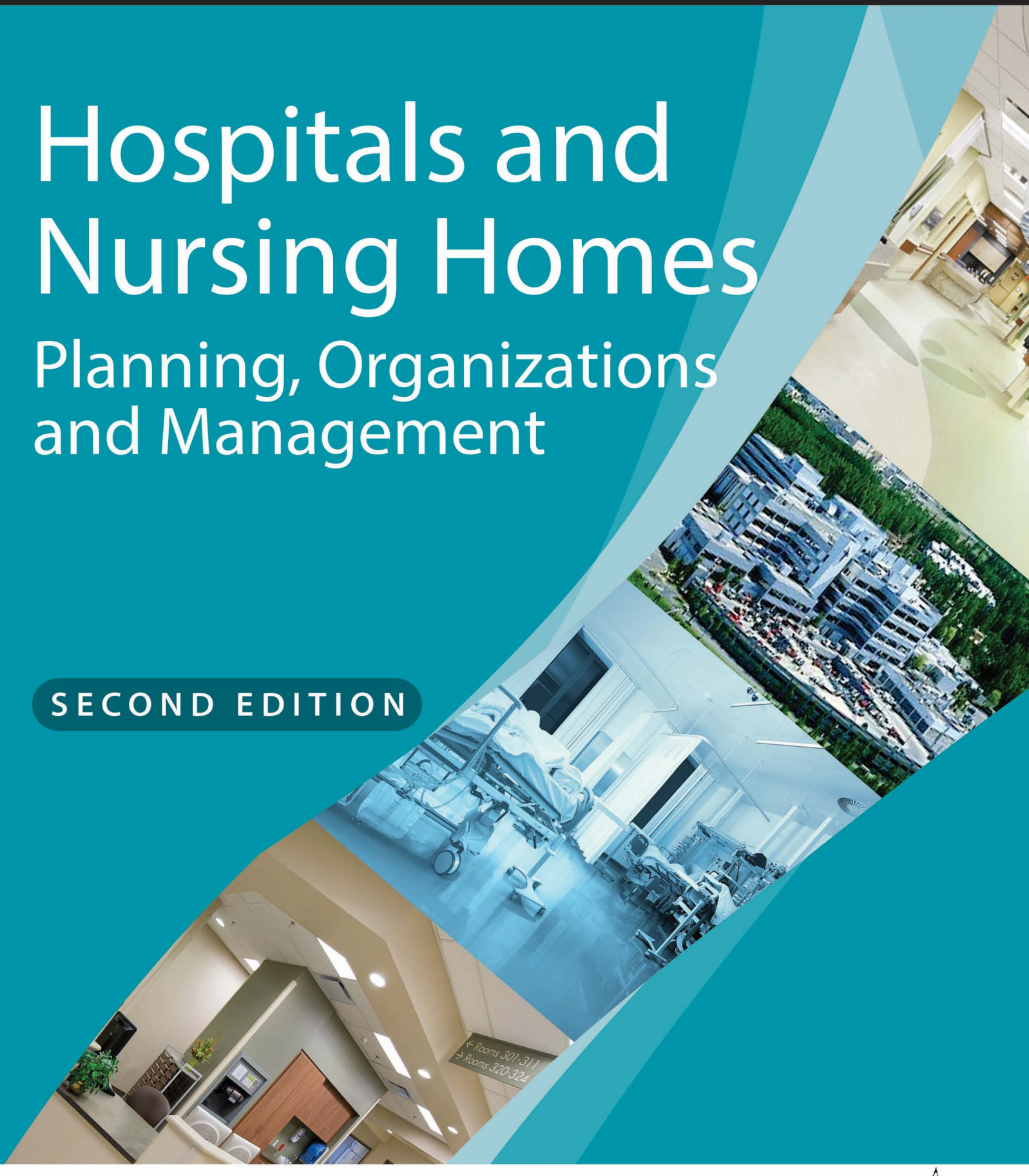
Hospitals and Nursing Homes

Planning, Organizations and Management



SECOND EDITION

Syed Amin Tabish

JAYPEE

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CHAPTER

4

Hospitals: The Challenge of Change

The concept of the hospital has evolved over the centuries. Hospitals are the most complex of building types. For hospital patients and their families, the hospital experience is often a central point in their life—where their child was born, their beloved died, where they received lifesaving treatment, rejuvenating therapy or care to overcome an episode of illness. Each hospital is comprised of a wide range of services and functional units. These include diagnostic and treatment functions, such as clinical laboratories, imaging, emergency rooms, and surgery; hospitality functions, such as food service and housekeeping; and the fundamental inpatient care or bed-related function. This diversity is reflected in the breadth and specificity of regulations, codes, and oversight that govern hospital construction and operations. Each of the wide-ranging and constantly evolving functions of a hospital, including highly complicated mechanical, electrical, and telecommunications systems, requires specialized knowledge and expertise. No one person can reasonably have complete knowledge, which is why specialized consultants play an important role in hospital planning and design. The functional units within the hospital can have competing needs and priorities. Idealized scenarios and strongly held individual preferences must be balanced against mandatory requirements, actual functional needs (internal traffic and relationship to other departments), and the financial status of the organization.

The rise in the number of patients who are aged and those who are chronically ill, challenge hospitals to extend the parameters of hospital-based care from inside the medical center, to the community and into the home.

High healthcare costs and inadequate access to specialized care are fueling fast growth in medical tourism. Would-be patients in developed countries are traveling thousands of miles—most often to India and Thailand—to receive high-quality care at dramatically lower costs and with no wait. Medical tourism is now a multi-billion-dollar industry. Today, a medical tourist is as likely to be seeking full or partial joint replacement, cardiac surgery or even stem cell therapy. The phenomenon of the medical tourist seeking complex and necessary care for their well-being outside of their own "health jurisdiction" raises important concerns for the hospital of the future.

Hospitals are the settings where cutting-edge medical advances relieve suffering, and bring healing and even new life for those whom, even a few short years ago, there would be little hope.

A functional design can promote skill, economy, conveniences, and comforts; a nonfunctional design can impede activities of all types, detract from quality of care, and raise costs to intolerable levels.

Hospitals will have to meet the high expectations of the public and all stakeholders in an increasingly challenging environment. There are many issues with which hospitals must now contend. These include escalating healthcare costs that are no longer publicly—or politically—tenable, changing trends in reimbursement for services, demands for transparency of cost and quality data, and workforce shortages.

Hospitals must serve and support many different users and stakeholders. The design process incorporates direct input from the owner and from key hospital staff early on in the process. The designer also has to be an advocate for the patients, visitors, support staff, volunteers, and suppliers who do not generally have direct input into the design. Good hospital design integrates functional requirements with the human needs of its varied users.

The basic form of a hospital is, ideally, based on its functions:

- Bed-related inpatient functions
- Outpatient-related functions
- Diagnostic and treatment functions
- Administrative functions
- Service functions (food, supply)
- Research and teaching functions

PRINCIPLES TO GUIDE DESIGN

- Incorporate evidence-based design (EBD) principles that improve patient safety, including single rooms, decentralized nursing stations and noise-reducing materials, in hospital construction.
- Address high-level priorities, such as infection control and emergency preparedness, in hospital design and construction.
- Include clinicians, other staff, patients and families in the design process to maximize opportunities to improve staff work flow and patient safety, and create patient-centered environments.
- Design flexibility into the building to allow for better adaption to the rapid cycle of innovation in medicine and technology.
- Incorporate "green" principles in hospital design and construction.

Physical relationships between these functions determine the configuration of the hospital. Certain relationships between

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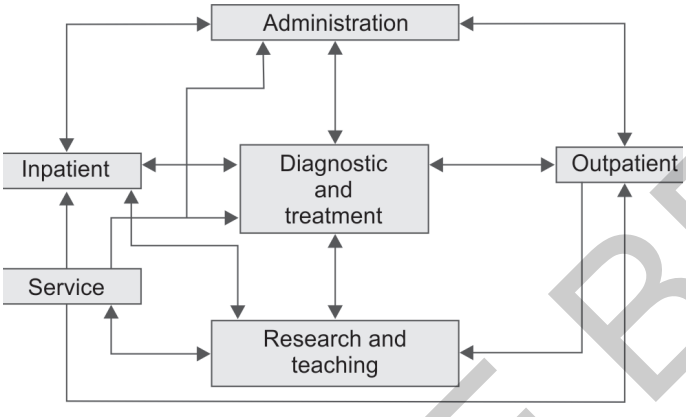
the various functions are required—as shown in **Flowcharts 4.1 and 4.2**.

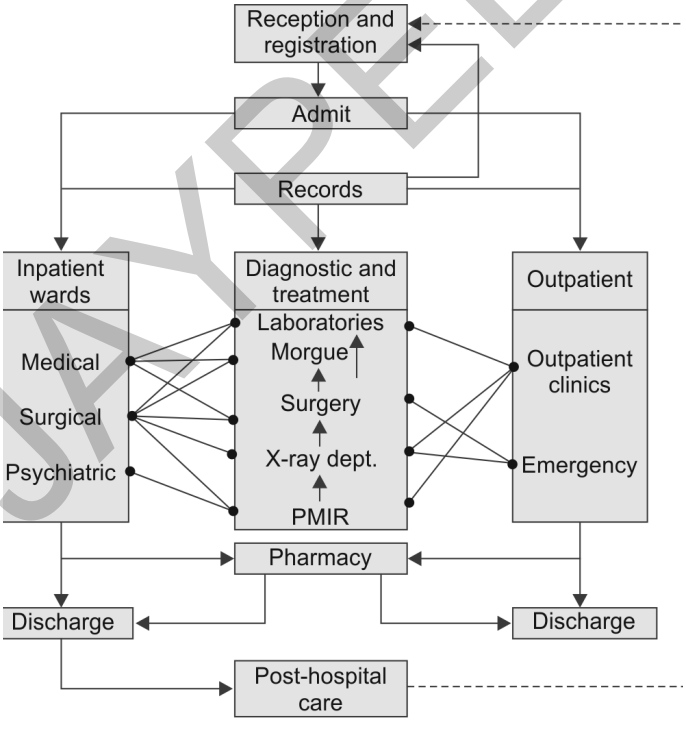
The **Flowchart 4.1** shows the movement and communication of people, materials, and waste. Thus, the physical configuration of a hospital and its transportation and logistic systems are inextricably intertwined. The transportation systems are influenced by the building configuration, and the configuration is heavily dependent on the transportation systems. The hospital configuration is also influenced by site restraints and opportunities, climate, surrounding facilities, budget, and available technology. New alternatives are generated by new medical needs and new technology.

In a large hospital, the form of the typical nursing unit, since, it may be repeated many times, is a principal element of the overall configuration. Nursing units today tend to be more compact shapes than the elongated rectangles of the past. Compact rectangles, modified triangles, or even circles have been used in an attempt to shorten the distance between the nurse station and the patient's bed. The chosen solution is heavily dependent on program issues, such as organization of the nursing program, number of beds to a nursing unit, and number of beds to a patient room.

Flowchart 4.1: General hospital relationships.



Flowchart 4.2: Major clinical relationships.



BUILDING ATTRIBUTES

Regardless of their location, size, or budget, all hospitals should have certain common attributes.

Efficiency and Cost-effectiveness

An efficient hospital layout should:

- Promote staff efficiency by minimizing distance of necessary travel between frequently used spaces.
- Allow easy visual supervision of patients by staff.
- Include all needed spaces. This requires careful predesign programming.
- Provide an efficient logistics system, which might include elevators, pneumatic tubes, box conveyors, manual or automated carts, and gravity or pneumatic chutes, for the efficient handling of food and clean supplies and the removal of waste, recyclables, and soiled material
- Make efficient use of space by locating support spaces and by making prudent use of multipurpose spaces.

Combine Functional Areas with Similar System Requirements

Provide optimal functional adjacencies, such as locating the surgical intensive care unit adjacent to the operating suite.

Flexibility and Expandability

Hospitals should:

- Follow modular concepts of space planning and layout.
- Use generic room sizes and plans as much as possible.
- Where size and program allow, be designed on a modular system basis.
- Be open-ended, with well-planned directions for future expansion.

Therapeutic Environment

Various important aspects of creating a therapeutic interior include:

- Using familiar and culturally relevant materials.
- Using cheerful and varied colors and textures.
- Admitting ample natural light wherever feasible and using color-corrected lighting in interior spaces which closely approximates natural daylight.
- Providing views of the outdoors from every patient bed; photo murals of nature scenes are helpful where outdoor views are not available.

Designing a "Wayfinding" Process into Every Project

A patient's sense of competence is encouraged by making spaces easy to find, identify, and use without asking for help. Building elements, color, texture, and pattern should all give cues, as well as artwork and signage **(Fig. 4.1)**.

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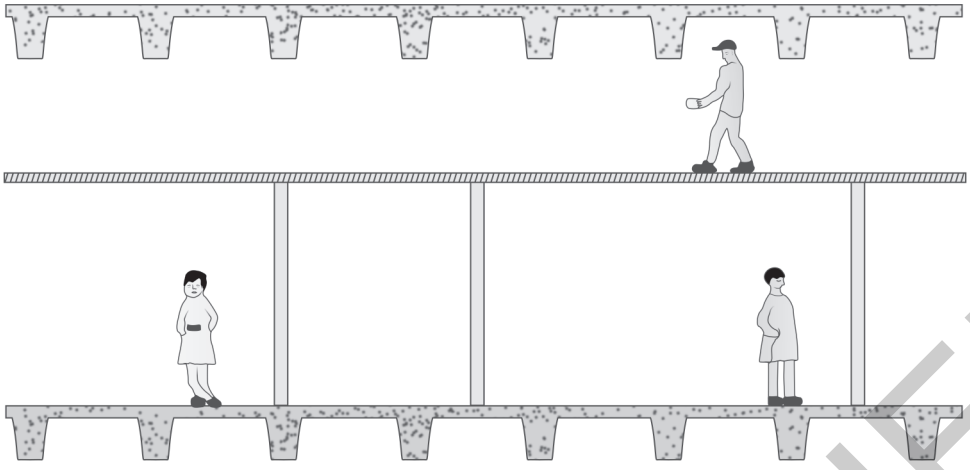

Fig. 4.1: Cross-section showing interstitial space with deck above an occupied floor.

Cleanliness and Sanitation

Hospitals must be easy to clean and maintain.
There should be appropriate, durable finishes for each functional space.

- Adequate and appropriately located housekeeping spaces.
- Special materials, finishes, and details for spaces which are to be kept sterile, such as integral cove base.
- The new antimicrobial surfaces for appropriate locations where ever necessary.

Accessibility

All areas, both inside and out, should:

- Comply with the minimum requirements of accreditation agencies [Joint Commission International (JCI), National Accreditation Board for Hospitals and Healthcare Providers (NABH)].
- Be designed so as to be easy to use by the many patients with temporary or permanent handicaps.
- Ensuring grades are flat enough to allow easy movement and sidewalks and corridors are wide enough for two wheelchairs to pass easily.
- Ensuring entrance areas are designed to accommodate patients with slower adaptation rates to dark and light; marking glass walls and doors to make their presence obvious.

Controlled Circulation

- Outpatients visiting diagnostic and treatment areas should not travel through inpatient functional areas.
- Typical outpatient routes should be simple and clearly defined.
- Visitors should have a simple and direct route to each patient nursing unit without penetrating other functional areas.
- Separate patients and visitors from logistical areas.
- Outflow of waste (trash, soiled materials) should be separated from movement of food and clean supplies, and both should be separated from routes of patients and visitors.
- There should be dedicated service elevators for deliveries, food and building maintenance services.

ESTHETICS

For enhancing the hospital's public image and as an important marketing tool, esthetics is essential. A better environment contributes to better staff morale and patient care. Increased use of natural light, natural materials, and textures are some useful options.

Use of Artwork

Important considerations are:

- Attention to proportions, color, scale, and detail
- Bright, open, generously-scaled public spaces
- Homelike and intimate scale in patient rooms, and consultation rooms.
- Compatibility of exterior design with its physical surroundings.

EMERGING PERSPECTIVES

The emerging perspectives influencing hospital design include:

- The increased use of emergency facilities for primary care.
- The increasing introduction of highly sophisticated diagnostic and treatment technology.
- Laws requiring earthquake resistance.
- Preventative care versus sickness care; designing hospitals as all-inclusive "wellness centers".
- Use of hand-held computers and portable diagnostic equipment to allow more mobile, decentralized patient care, and a general shift to computerized patient information of all kinds.
- Emergence of palliative care as a specialty in many major medical centers.

A growing interest in more holistic, patient-centered treatment and environments is an emerging trend. This might include providing mini-medical libraries and computer terminals so patients can research their conditions and treatments.

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RELEVANT CODES AND STANDARDS

Hospitals are among the most regulated of all building types. Like other buildings, they must follow the local and/or state general building codes. However, federal facilities on federal property generally need not comply with state and local codes, but follow federal regulations. To be licensed by the state, design must comply with the individual state licensing regulations.

State and local building codes are based on the model International Building Code (IBC).

NURSING HOMES

Nursing homes serve patients requiring preventive, therapeutic, and rehabilitative nursing care services for nonacute, long-term conditions. Specialized clinical and diagnostic services are obtained outside the nursing home. Most residents are frail and aged, but not bedridden, although often using canes, walkers, or wheelchairs. Stays are relatively long, the majority for life. Nursing homes also care for a smaller percentage of convalescent patients of all ages. These patients are in long-term recovery from acute illnesses, but no longer require hospitalization.

Nursing homes present special design challenges in that for most residents the nursing home is not just a facility, but indeed their home. The reality is that in most cases the residents will live there for the rest of their lives and, moreover, rarely leave the premises at all. The nursing home becomes their entire world in a sense. The challenge is to design a nursing home that is sensitive and responsive to long-term human needs and well-being, both physical and emotional.

Building Attributes

A nursing home operates primarily in a patient care mode rather than a medical mode. Consequently, its more important attributes are those focusing on the general well-being of its residents rather than high-tech considerations. The principal attributes of a well-designed nursing home are discussed here.

Homelike and Therapeutic Environment

Inherent in any institutional stay is the impact of environment on recovery, and the long-term stays typical of nursing home residents greatly increase this impact. The architect and interior designer must have a thorough understanding of health facility's mission and its patient profile. It is especially important that the design address aging and its accompanying physical and mental disabilities, including loss of visual acuity. To achieve the appropriate nursing home environment, every effort should be made to:

- Give spaces a homelike, rather than institutional, size and scale with natural light and views of the outdoors.
- Create a warm reassuring environment by using a variety of familiar, nonreflective finishes and cheerful, varied colors and textures, keeping in mind that some colors are inappropriate and can disorient or agitate impaired residents.
- Provide each resident a variety of spatial experiences, including access to a garden and the outdoors in general.
- Promote traditional residential qualities of privacy, choice, control, and personalization of one's immediate surroundings.
- Alleviate possible disorientation of residents by providing differences between "residential neighborhoods" of the nursing home, and by use of clocks, calendars, and other "reminders".
- Encourage resident autonomy by making their spaces easy to find, identify, and use.
- Provide higher lighting levels than typical for residential occupancies.

Efficiency and Cost-effectiveness

The nursing home design should:

- Promote staff efficiency by minimizing distance of necessary travel between frequently used spaces.
- Allow easy visual supervision of patients by minimal staff.
- Make efficient use of space by locating support spaces so they may be shared by adjacent functional areas, and by making prudent use of multipurpose spaces.

Cleanliness and Sanitation

An odor-free environment is a very high priority in nursing homes, since many residents are occasionally incontinent, and the pervasive odors can give an impression of poor cleanliness and poor operation to family and visitors. In addition to operational practices and careful choice of furniture, facility design can help odor control by:

- Adequate and highly visible toilet rooms in key locations near spaces where residents congregate.
- The use of appropriate, durable finishes for each space used by residents.
- Proper detailing of such features as doorframes, casework, and finish transitions to avoid dirt-catching and hard-to-clean crevices and joints.
- Adequate and appropriately located housekeeping spaces.
- Effective ventilation, which may need to exceed nominal design levels.
- Incorporating operations and maintenance (O and M) practices that stress indoor environmental quality (IEQ).

Wayfinding

A well-thought-out system of wayfinding helps to maintain the residents' dignity, thus it should:

- Use multiple cues from building elements, colors, texture, pattern, and artwork, as well as signage, to help residents understand where they are, what their destination is, and how to get there and back.
- Identify frequently used destination spaces by architectural features and landmarks which can be seen from a distance, as well as symbols, signage, art, and elements, such as fish tanks, birdcages, or greenery.
- Avoid prominent locations and high visibility of doors to spaces which patients should not enter.
- Use simple lettering and clear contrasts in signage.
- Clearly identify only those rooms that residents frequent.

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Accessibility

All spaces used by patients should:

- Be designed so that all spaces, furnishings, and equipment, including storage units and operable windows, are easily usable by residents in wheelchairs.
- Be equipped with grab bars in all appropriate locations.

Security and Safety

Design to address security and safety concerns of nursing homes includes:

- Use of nonreflective and nonslip floors to avoid falls
- Control of access to hazardous spaces
- Control of exits to avoid residents leaving and becoming lost or injured.
- Provision of secure spaces to safeguard facility supplies and personal property of residents and staff.
- Homelike esthetic considerations include increased use of natural light, natural materials, and textures.

Use of Artwork

- Attention to proportions, color, scale, and detail
- Bright, open, generously-scaled public and congregate spaces.
- Homelike and intimate scale in resident rooms and offices.
- Appropriate residential exterior appearance, not hospital-like.
- Exterior compatibility with surroundings.

OUTPATIENT CLINIC

Outpatient facility should have the following:

Efficiency and Cost-effectiveness

The layout of the clinic should:

- Promote staff efficiency by minimizing distance of necessary travel between frequently used spaces.
- Make efficient use of space
- Group or combine functional areas with similar system requirements.

Flexibility and Expandability

Outpatient facilities should:

- Follow modular concepts of space planning and layout.
- Use established standard room sizes and plans as much as possible.
- Be open-ended, with well-planned directions for future expansion.

Therapeutic Environment

- Use familiar and noninstitutional materials with cheerful and varied colors and textures.
- Using cheerful and varied colors and textures.
- Admitting ample natural light wherever feasible and using color-corrected lighting in interior spaces, which closely approximates natural daylight.
- Promoting patient dignity and privacy by visual screening within examination rooms and sound insulation between examination and consultation rooms and other spaces.
- Encouraging patient independence by a patient-orientated layout, with clear and uncomplicated patient routes, visual cues, and clear signage.
- Providing quiet areas for meditation/spiritual renewal, such as meditation gardens.

Esthetics

Esthetic considerations include: increased use of natural light, natural materials, and textures.

PSYCHIATRIC FACILITY

The range of psychiatric facilities includes psychiatric hospitals, psychiatric and neuropsychiatric nursing units of general hospitals, facilities for the psychiatric medically infirm, geropsychiatric units, alcohol and drug addiction treatment facilities (both inpatient and outpatient), mental health clinics, day hospitals, day treatment centers, and others.

In addition to inpatient nursing units, psychiatric hospitals include their associated diagnostic and treatment areas, as well as the necessary dietetic, supply, housekeeping, and administrative spaces common to all hospitals. They do not generally include the complex and high-tech diagnostic and treatment areas of general hospitals.

Psychiatric hospitals may include outpatient psychiatric areas. These areas should be located on a direct path from the lobby, and circulation paths of the outpatients should be separated from the paths of the more acutely ill inpatients. Teaching hospitals will also include spaces for training and education, and often spaces for research studies.

The mental health clinic is the basic outpatient unit, providing an interface between inpatient care and the community. It provides preventative care, primary care, and aftercare. The clinic may also serve as a site for research and for training of mental health professionals on all aspects of outpatient treatment of mental health problems.

A substance abuse clinic provides outpatient care and treatment of alcohol and/or drug-dependent patients no longer needing inpatient care. In a hospital, it should be so located that its patients do not need to travel through other parts of the hospital.

The day hospital has no beds, but is typically located within or adjacent to a hospital. It offers total hospital psychiatric services for acutely-ill patients without removing them from the family and community.

The day treatment center provides a supportive learning environment away from a hospital in which patients having chronic difficulties with community adjustment and other psychosocial problems may receive help. Such patients have often had long periods of hospitalization, and need continuing monitoring of their general health and medication needs.

Efficiency and Cost-effectiveness

The design of a successful psychiatric facility should:

- Promote staff efficiency by minimizing distance of necessary travel between frequently used spaces.
- Allow easy visual supervision of patients by limited staff. Nurse stations on inpatient units should be designed to provide maximum visibility of patient areas.

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- Include all needed spaces, but no redundant ones. This requires careful predesign programming.
- For inpatient units, provide a central meeting area or living room for staff and patients and provide smaller rooms where patients can visit with their families.
- Make efficient use of space by locating support spaces so that they may be shared by adjacent functional areas, and by making prudent use of multipurpose spaces.

Therapeutic Environment

The character of the immediate surroundings can have a profound effect on the psyche of a psychiatric patient. Every effort should be made to create a therapeutic environment by:

- Using familiar and noninstitutional materials with cheerful and varied colors and textures, keeping in mind that some colors and patterns are inappropriate and can disorient older impaired patients, or agitate patients and staff.
- Admitting ample natural light wherever possible.
- Providing a window for every patient bed, and views of the outdoors from other spaces wherever possible. Views of nature can be restorative.
- Providing inpatients with direct and easy access to controlled outdoor areas.
- Providing adequate separation and sound insulation to prevent confidential but loud conversation from traveling beyond consulting offices and group therapy rooms.
- Giving each patient as much acoustic privacy as possible—from noises of other patients, toilet noises, mechanical noises, etc.
- Giving each patient as much visual privacy, and control over it, as is consistent with the need for supervision.
- Giving each inpatient the ability to control his immediate environment as much as possible, i.e., lighting, radio, TV, etc.
- Providing computer stations for patient use when patient profile and treatment program allow.
- Designing features to assist patient orientation, such as direct and obvious travel paths, key locations for clocks and calendars, avoidance of glare, and avoidance of unusual configurations and excessive corridor lengths.
- Designing a "wayfinding" process into every project. A patient's sense of competence is encouraged by making spaces easy to find, identify, and use without asking for help. Color, texture, and pattern, as well as artwork and signage, can all give cues.
- Providing exercise equipment for patient use where appropriate for the program of care.
- Providing access to kitchen facilities, preferably on the unit, where snacks or meals can be prepared by patients, when patient profile allows.

Cleanliness

Psychiatric facilities should be easy to clean and maintain. This is facilitated by:

- Appropriate, durable finishes for each functional space.
- Proper detailing of such features as doorframes, casework, and finish transitions to avoid dirt-catching and hard-to-clean crevices and joints.
- Adequate and appropriately located housekeeping spaces.
- Incorporating standard practices that stress IEQ.

Esthetics

Esthetics is closely related to creating a therapeutic environment. It is also a major factor in a facility's public image and is thus an important marketing tool for patients and staff. Esthetic considerations include:

- Use of new lighting systems, high performance glazing, increased use of natural light, natural materials, and colors
- Use of (soothing, not exciting) artwork
- Attention to details, proportions, color, and scale
- Bright and open public and congregate spaces
- Comfortable nursing units

Security and Safety

Design to address safety and security issues includes:

- Plumbing, electrical, and mechanical devices designed to be tamper-proof.
- Use of breakaway shower-rods and bars, no clothes hooks
- Elimination of all jumping opportunities
- Control of entrances and exits by staff
- Provision for patient bedroom doors to be opened by staff in case of emergency.
- Laminated glass for windows in inpatient units
- Fiber-reinforced gypsum board for walls
- Special features in seclusion rooms to eliminate all opportunities for self-injury, including outward opening door with no inside hardware.
- Careful consideration of appropriate locations for grab bars and handrails.
- Eliminate the use of door knobs and handles.

EVIDENCE-BASED DESIGN ACCREDITATION

Evidence-based design is the process of basing decisions about the built environment on credible research to achieve the best possible outcomes. Included in this process are the following eight steps:

1. Define evidence-based goals and objectives
2. Find sources for relevant evidence
3. Critically interpret relevant evidence
4. Create and innovate EBD concepts
5. Develop a hypothesis
6. Collect baseline performance measures
7. Monitor implementation of design and construction
8. Measure post-occupancy performance results.

A large and growing body of evidence attests to the fact that physical environment impacts patient stress, patient and staff safety, staff effectiveness and quality of care provided in hospitals and other healthcare settings. Basing healthcare facility planning and design decisions on this evidence to achieve the best possible patient, staff and operational outcomes is what EBD is all about.

FACILITY PLANNING AND DESIGN

- Master planning, space planning and programming
- Hospitals: General

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- Specialty hospitals
- Ambulatory care centers
- Miscellaneous planning and design

HOSPITAL DEPARTMENTS

- Nursing units
- Clinical and interventional services
- Diagnostic and testing
- Support services

HEALTHCARE INTERIORS AND GRAPHICS

- Interior design
- Wayfinding
- Healing environments

MEDICAL TECHNOLOGY

- Imaging and surgery
- General and patient care

CONSTRUCTION

- Project delivery and management issues
- Codes and regulatory issues
- Building materials and systems
- Client relations, business and legal issues

TRENDS IN MEDICAL CARE

- New trends in health care
- Space planning guidelines should reflect the dynamic healthcare environment and help healthcare providers, planners, and architects to achieve the:
  - Right **services** (consistent with strategic initiatives, market dynamics, and business plan).
  - Right **size** (based on projected demand, staffing, equipment, technology, and desired amenities).
  - Right **location** (based on access, operational efficiency, and building suitability).

DESIGN AND CONSTRUCTION

The rapid transformation of healthcare is changing the face of healthcare facilities. There are several factors contributing to this rapid change, including competition among providers, advanced medical practices and technology, patient privacy, safety for patients and staff, healing environments, operational efficiency and EBD.

Changes in healthcare delivery strategies, including diagnostic and treatment modalities, are significantly affecting facility strategies as well. For example, an increasing number of procedures are performed on an outpatient basis, leading to a growing number of outpatient surgery and related support facilities.

MEDICAL TECHNOLOGY ADVANCES

New technology is being rapidly adopted in the medical profession, which is leading to changes in the way healthcare facilities are designed and built. Robotic surgery, intra-operative magnetic resonance imaging (MRI), all-digital or paperless communications and data storage, and proton therapy cancer treatment are a few examples of advanced technologies that continue to change healthcare facilities.

Implementing new technologies requires a great deal of planning and a specialized construction expertise because of the requirements for housing this sophisticated equipment. Proton therapy cancer treatment, for instance, involves heavy equipment that must be located in a heavy building structure. The accelerator typically weighs 200–300 tons. The gantry apparatus usually adds another 100 tons. Proton therapy equipment requires a substantial building structure surrounding the proton beam generator, conveyance and treatment for structural support of the equipment and for radiation shielding. The shielding typically comprises steel plating and concrete walls, floors and roofs ranging from 6 feet to 12 feet thick.

A proton therapy treatment program requires two to five treatment rooms, an accelerator vault, beamline space, control rooms, simulation rooms, accelerator support spaces, typical patient care spaces (waiting, examination, gowning and nurse stations), administration and building support spaces.

Exponential advances in medical imaging equipment and procedures lead to major expansions of diagnostic imaging/radiology departments. These advances have increased magnetic shielding requirements and the number of cysto- and interventional-radiology rooms, and also have had significant impacts on mechanical, electric and plumbing (MEP) system and equipment supports. This has led to a greater awareness of the requirement to plan and design for the removal and replacement of large imaging equipment to keep up with technological advances.

Another factor transforming healthcare design and construction is the growth of translational medicine ("bench to bedside"), primarily in academic medical centers, where research facilities are adjacent to or incorporated within a hospital to enable rapid "translation" of research discoveries into patient treatment.

Hotel Facilities

Patients and their families are demanding the privacy of single bed rooms, where they have lot of privacy. Patients want larger, more esthetically pleasing rooms with large windows overlooking natural settings and control over the environment in their room, especially lighting and HVAC (heating, ventilation, air conditioning).

Family members are looking for in-room accommodations that enable them to stay overnight with their loved ones, on a comfortable recliner or window seat that converts to a bed. Internet access is also key. Patients and families want a hospital room that looks, such as their bedroom at home or a nice hotel. Patients can recover faster in this kind of "healing environment".

Go Green

It has become standard practice to improve operational efficiencies by optimizing patient and staff flow, equipment

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location, nursing unit configuration, and patient visibility. The goal of green building is to create a healthy, safe and productive environment. Hospitals and other providers are building flexibility into design and construction of new facilities to enable them to adapt to the changing face of health care in the future.

PLANNING, DESIGN, AND DEVELOPMENT

Any health care or educational facility requires four basic elements to succeed:

1. A clear vision
2. A strong development team
3. A scope that is in alignment with the available funding
4. A plan that lays out a strategy for long-term sustainability.

Infrastructure and Systems Planning

A well-designed and developed facility should be a reflection of the clinical and educational programs it was created to support. In an ideal project, our work begins long before construction. We play an active role in the preplanning stages, advising on strategy and helping to develop the clinical and educational program plans. Through the planning process, we help practitioners analyze how they deliver care or education in their existing environments and explore new models to increase their effectiveness. On projects focused on developing new hospitals or redesigning existing clinical services, we draw on clinicians and faculty working in top hospitals at the leading edge of advances in care. Similarly, when working on the development of new educational facilities, we apply the latest thinking on how to create student-centered learning environments.

Information Technology Systems Planning

Health information technology systems form the backbone of integrated healthcare delivery systems that are safe, effective, and efficient for providers and patients alike.

Nursing Program Development

Leading healthcare organizations understand that a highly competent, committed nursing workforce is critical to patient satisfaction, interdisciplinary team performance, and patient outcomes. Nursing leadership development is one of the most important factors to consider when developing quality healthcare systems.

AMBULATORY CARE

The transition of healthcare delivery from acute care hospitals to outpatient (ambulatory care) settings, along with ongoing outbreaks and patient notification events, has demonstrated the need for greater understanding and implementation of basic infection prevention guidance.

Over the past several decades, we have witnessed a significant shift in healthcare delivery from the acute, inpatient hospital setting to a variety of ambulatory and community-based settings. Ambulatory care is provided in hospital-based outpatient clinics, nonhospital-based clinics and physician offices, ambulatory surgical centers, and many other specialized settings. Vulnerable patient populations rely on frequent and intensive use of ambulatory care to maintain or improve their health. For example, each year more than one million cancer patients receive outpatient chemotherapy, radiation therapy, or both. It is critical that all of this care be provided under conditions that minimize or eliminate risks of healthcare-associated infections (HAIs) **(Fig. 4.2)**.



Fig. 4.2: Outpatient (ambulatory care) settings.

Infection Prevention

Compared to inpatient acute care settings, ambulatory care settings have traditionally lacked infrastructure and resources to support infection prevention and surveillance activities. While data describing risks for HAI are lacking for most ambulatory settings, numerous outbreak reports have described transmission of gram-negative and gram-positive bacteria, mycobacteria, viruses, and parasites. In many instances, outbreaks and other adverse events were associated with breakdowns in basic infection prevention procedures (e.g., reuse of syringes leading to transmission of blood-borne viruses).

All healthcare settings, regardless of the level of care provided, must make infection prevention a priority and must be equipped to observe Standard Precautions.

Ambulatory care refers to care provided in facilities where patients do not remain overnight (e.g., hospital-based outpatient clinics, nonhospital-based clinics and physician offices, urgent care centers, ambulatory surgical centers, public health clinics, imaging centers, oncology clinics, ambulatory behavioral health and substance abuse clinics, physical therapy and rehabilitation centers). Healthcare personnel (HCP) are defined as all persons, paid and unpaid, working in ambulatory care settings who have the potential for exposure to patients and/or to infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air. This includes persons not directly involved in patient care (e.g., clerical, housekeeping, and volunteers) but potentially exposed to infectious agents that can be transmitted to and from HCP and patients. This document does not replace

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existing, more detailed guidance for hemodialysis centers or dental practices. Further, the reader is referred to other the Centers for Disease Control and Prevention (CDC) and the Healthcare Infection Control Practices Advisory Committee (HICPAC) guidelines and websites for more detailed information and for recommendations concerning specialized infection prevention issues (e.g., sterilization and disinfection of equipment, multidrug-resistant organisms).

Fundamental Elements

Infection prevention must be made a priority in any setting where health care is delivered. Those with primary administrative oversight of the ambulatory care facility/setting must ensure that sufficient fiscal and human resources are available to develop and maintain infection prevention and occupational health programs. This includes the availability of sufficient and appropriate equipment and supplies necessary for the consistent observation of Standard Precautions, including hand hygiene products, injection equipment, and personal protective equipment (e.g., gloves, gowns, face and eye protection).

Infection prevention programs must extend beyond Occupational Safety and Health Administration (OSHA) bloodborne pathogen training to address patient protection. Facilities should assure that at least one individual with training in infection prevention is employed by or regularly available to the facility. This individual should be involved in the development of written infection prevention policies and have regular communication with HCP to address specific issues or concerns related to infection prevention. The development and ongoing refinement of infection prevention policies and procedures should be based on evidence-based guidelines, regulations, or standards. These policies and procedures should be tailored to the facility and reassessed on a regular basis (e.g., annually), taking into consideration the types of services provided by the facility and the patient population that is served. This process (referred to as risk assessment by the Infection Prevention profession) will allow facilities to better prioritize resources and focus extra attention on those areas that are determined to pose greater risk to their patients. For example, an ambulatory surgical center, which performs on-site sterilization of surgical equipment, would be expected to have more detailed policies regarding equipment reprocessing than a substance abuse clinic, where on-site sterilization is unlikely to be performed.

Key Points

- Develop and maintain infection prevention and occupational health programs.
- Assure sufficient and appropriate supplies necessary for adherence to Standard Precautions (e.g., hand hygiene products, personal protective equipment, injection equipment).
- Assure at least one individual with training in infection prevention is employed by or regularly available to the facility.
- Develop written infection prevention policies and procedures appropriate for the services provided by the facility and based upon evidence-based guidelines, regulations, or standards.

Educate and Train Healthcare Personnel

Ongoing education and training of HCP are critical for ensuring that infection prevention policies and procedures are understood and followed. Education on the basic principles and practices for preventing the spread of infections should be provided to all HCP. Training should include both HCP safety (e.g., OSHA bloodborne pathogen training) and patient safety, emphasizing job- or task-specific needs. Education and training should be provided upon orientation to the facility and should be repeated regularly (e.g., annually) to maintain competency, including anytime policies or procedures are updated/revised.

Monitor and Report Healthcare-associated Infections

Surveillance is defined as the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health. Surveillance typically refers to tracking of outcome measures (e.g., HAIs) but can also refer to tracking of adherence to specific process measures (e.g., hand hygiene, environmental cleaning) as a means to reduce infection transmission. Surveillance for outcome measures in ambulatory care settings is challenging because patient encounters may be brief or sporadic and evaluation and treatment of consequent infections may involve different healthcare settings (e.g., hospitals).

Key recommendations for HAI surveillance:

- Adhere to local, state, and federal requirements regarding HAI surveillance, reportable diseases, and outbreak reporting.
- Perform regular audits and competency evaluations of HCP adherence to infection prevention practices.
- Adhere to Standard Precautions
- Hand hygiene
- Personal protective equipment
- Injection safety
- Environmental cleaning
- Medical equipment
- Respiratory hygiene/cough etiquette
- Additional considerations

Standard Precautions

Standard Precautions are the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where health care is delivered. These practices are designed to both protect HCP and prevent HCP from spreading infections among patients. Standard Precautions include:

- Hand hygiene
- Use of personal protective equipment (e.g., gloves, gowns, masks)
- Safe injection practices
- Safe handling of potentially contaminated equipment or surfaces in the patient environment.
- Respiratory hygiene/cough etiquette

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Education and training on the principles and rationale for recommended practices are critical elements of Standard Precautions because they facilitate appropriate decision-making and promote adherence. Further, at the facility level, an understanding of the specific procedures performed and typical patient interactions, as described above in Administrative Measures as part of policy and procedure development, will assure that necessary equipment is available.

Hand Hygiene

Good hand hygiene, including use of alcohol-based hand rubs (ABHRs) and handwashing with soap and water, is critical to reduce the risk of spreading infections in ambulatory care settings. Use of ABHR as the primary mode of hand hygiene in healthcare settings is recommended by the CDC and the World Health Organization (WHO) because of its activity against a broad spectrum of epidemiologically important pathogens, and because compared with soap and water, use of ABHR in healthcare settings can increase compliance with recommended hand hygiene practices by requiring less time, irritating hands less, and facilitating hand hygiene at the patient bedside. For these reasons, ABHR is the preferred method for hand hygiene except when hands are visibly soiled (e.g., dirt, blood, body fluids), or after caring for patients with known or suspected infectious diarrhea (e.g., *Clostridium difficile*, norovirus), in which case soap and water should be used.

Personal Protective Equipment

Personal protective equipment (PPE) refers to wearable equipment that is intended to protect HCP from exposure to or contact with infectious agents. Examples include gloves, gowns, face masks, respirators, goggles and face shields. Examples of appropriate use of PPE for adherence to Standard Precautions include: use of gloves in situations involving possible contact with blood or body fluids, mucous membranes, nonintact skin or potentially infectious material; use of a gown to protect skin and clothing during procedures or activities where contact with blood or body fluids is anticipated; use of mouth, nose and eye protection during procedures that are likely to generate splashes or sprays of blood or other body fluids. Hand hygiene is always the final step after removing and disposing of PPE.

Injection Safety

Injection safety includes practices intended to prevent transmission of infectious diseases between one patient and another, or between a patient and healthcare provider during preparation and administration of parenteral medications. Implementation of the OSHA bloodborne pathogens standard has helped increase the protection of HCP from blood exposure and sharps injuries, but there is room for improvement in ambulatory care settings.

Environmental Cleaning

Ambulatory care facilities should establish policies and procedures for routine cleaning and disinfection of environmental surfaces as part of their infection prevention plan. Cleaning refers to the removal of visible soil and organic contamination from a device or environmental surface using the physical action of scrubbing with a surfactant or detergent and water, or an energy-based process (e.g., ultrasonic cleaners) with appropriate chemical agents. This process removes large numbers of microorganisms from surfaces and must always precede disinfection. Disinfection is generally a less lethal process of microbial inactivation (compared to sterilization) that eliminates virtually all recognized pathogenic microorganisms but not necessarily all microbial forms (e.g., bacterial spores).

Emphasis for cleaning and disinfection should be placed on surfaces that are most likely to become contaminated with pathogens, including those in close proximity to the patient (e.g., bed rails) and frequently-touched surfaces in the patient care environment (e.g., door knobs). Facility policies and procedures should also address prompt and appropriate cleaning and decontamination of spills of blood or other potentially infectious materials.

Medical Equipment

All reusable medical equipment must be cleaned and maintained according to the manufacturer's instructions to prevent patient-to-patient transmission of infectious agents. The Spaulding classification is a traditional approach that has been used to determine the level of disinfection or sterilization required for reusable medical devices, based upon the degree of risk for transmitting infections if the device is contaminated at the time of use.

Critical items (e.g., surgical instruments) are objects that enter sterile tissue or the vascular system and must be sterile prior to use.

Semicritical items (e.g., endoscopes used for upper endoscopy and colonoscopy) contact mucous membranes or nonintact skin and require, at a minimum, high-level disinfection prior to reuse.

Noncritical items (e.g., blood pressure cuffs) are those that may come in contact with intact skin but not mucous membranes and should undergo low- or intermediate-level disinfection depending on the nature and degree of contamination.

Environmental surfaces (e.g., floors, walls) are those that generally do not contact the patient during delivery of care. Cleaning may be all that is needed for the management of these surfaces but if disinfection is indicated, low-level disinfection is appropriate.

Cleaning to remove organic material must always precede disinfection or sterilization because residual debris reduces the effectiveness of the disinfection and sterilization processes.

Facilities should establish policies and procedures for containing, transporting, and handling equipment that may be contaminated with blood or body fluids.

Cleaning, disinfection, and/or sterilization of medical equipment:

- Facilities should ensure that reusable medical equipment (e.g., blood glucose meters and other point-of-care devices, surgical instruments, endoscopes) is cleaned and reprocessed appropriately prior to use on another patient.
- Reusable medical equipment must be cleaned and reprocessed (disinfection or sterilization) and maintained according to the manufacturer's instructions.

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If the manufacturer does not provide such instructions, the device may not be suitable for multi-patient use.

- Assign responsibilities for reprocessing of medical equipment to hospital sterilization services (HSS) with appropriate training.
- Maintain copies of the manufacturer's instructions for reprocessing of equipment in use at the facility; post instructions at locations where reprocessing is performed.
- Observe procedures to document competencies of HSS responsible for equipment reprocessing upon assignment of those duties, whenever new equipment is introduced, and on an ongoing periodic basis (e.g., quarterly).
- Assure HCP have access to and wear appropriate PPE when handling and reprocessing contaminated patient equipment.

BUILDING FOR TOMORROW

Healthcare organizations are driven by a desire to rationalize their systems to drive down costs. Objectives of healthcare organizations will include an increased emphasis on community health, treating routine cases away from the expensive, high-acuity environment of the traditional hospital through networks of ambulatory centers, physician practices, urgent care clinics and similar facilities.

These facilities will be established closer to the population, tied together through electronic health record (EHR) systems and constructed under business occupancy codes rather than more expensive institutional codes.

As many of these low-acuity activities are shifted off-site, the main hospital likely will see increased intensity as it handles the sickest of the sick, experts say.

Hospitals really are going to be more the cost center than the revenue center in the scheme of an integrated health care delivery system. Chief among these efficiencies are safety features to assist health care organizations with patient quality measures. EBD strategies can help.

A certain degree of design standardization also can be economical. Consumer preferences are equally important.

Beneath the Surface

Energy, saving is likely to lead to more innovative energy-saving strategies, such as installing a geothermal heat pump system that uses some 250–300 feet bore wells. It also will lead to more advanced building control systems, especially as already-stretched operations-and-maintenance staff find themselves monitoring the energy and performance of far-flung networks of hospitals, ambulatory care centers, physician clinics and other less easily defined facilities. Information technology infrastructure will be another area of emphasis over the next 5 years.

Along with smarter, leaner and greener waste reduction and energy plans, hospitals are tightening operational control strategies, using innovative design techniques, such as simulation modeling and redesigning departments to reduce silos and expand shared services and facilities.

Collaboration increasingly is critical to cost-cutting, according to hospital engineers, environmental services professionals, infection control specialists, architects and construction managers, and supply chain leaders who say working in concert is the best way to maximize the resources and talents of one of a facility's greatest assets: people. More facilities are reinvesting in infrastructure by replacing older boilers, chillers and air handlers with more efficient units and increasing spending on control systems to achieve tighter operational parameters. Hospitals also are implementing operating room (OR) setbacks, an energy-saving strategy that reduces the amount of air supplied to an OR when not in use.

The energy-saving technique is a better option for patients and waiting rooms.

Streamline Operations

There is a shift toward freestanding ambulatory centers with an emergency and critical care component, reversing the current model. To speed construction and reduce cost, use prefabricated modular components for exterior walls and panels that are built off-site and trucked to the facility. The components have huge potential. Functionality continues to drive design and that collaborating with clinical staff who "basically teach designers how to be savvy about operation issues" becomes more critical. Using simulation modeling to develop smart, cost-effective workflow plans also is becoming more common.

Importance of Data

Performance improvement metrics and data are king and will be for the foreseeable future. But while cost reduction and operational efficiency are often part of a facility manager's DNA, self-promotion often is not. Nevertheless, facility professionals need to make that practice part of their job descriptions.

Equally important is staying focused on the shared goals that do not shift with the trends.

Smart Design

Efficient designs (smart sizing) can reduce a project's size by 20%, saving construction costs and operational costs as well. What it boils down to is every design must have utility to it and an outcome that produces favorable results. Therefore, by designing smart you need less capital and also spend less on the operational side since design is only about 4% of the cost of running a hospital amortized over the life of the building.

Elements of this approach, which may complement a healthcare organization's adoption of Lean operation principles, include an appraisal of the functional program and the work flow in the facility's planning stages, paying careful attention to reducing travel distances, increasing flexibility and eliminating unnecessary space.

Patient rooms and ORs are both likely to halt their decades-long, square-footage growth spurt.

With the goal of making the net-to-gross ratio of space for every department as lean as possible, project teams eliminate departmental barriers and combined them.

Moving beyond space design to infrastructure elements, integrating such information technology assets as EHRs, diagnostic equipment and even telemedicine in a way that improves clinical flow and allows for future flexibility and

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expandability is also an important way to save long-term costs.

Assets can be built that are flexible enough to change with technology. Sustainable, energy-saving systems are another way healthcare organizations can achieve savings through their infrastructure and design choices.

Construction Performance

The key to turning these plans into a cost-effective reality, of course, is an efficient construction management process. Healthcare organizations want to know what measurable value you are going to bring the team, such as incorporating Lean principles into the design and construction process. So, one of the things to look at is construction efficiency—how quickly we deliver projects, how we can affect quality of projects—all with the idea of maximizing the organization's investments and getting them to generate revenue faster.

Bringing value to the construction process requires assembling the project team early. In fact, many recommend adopting an integrated project delivery (IPD) process to bring architects, contractors, facilities staff and even major subcontractors around the table to provide "design assist" services, work through any potential problems and eliminate potential wasted effort before construction begins. If a formal IPD process is not possible due to legal concerns, some say a "functional IPD" or "IPD lite" approach used in conjunction with another delivery process also can be helpful.

An important tool in any planning effort is building information modeling (BIM) software, which has become an industry standard over the past several years. It certainly does not replace the need to have hands-on mockups, but the visualization aspects of BIM are important for the team to get a sense of what they are going to end up with. It is immensely useful in the Lean project delivery process. Beyond providing help in spotting design conflicts, BIM also helps the project team plan work sequencing and monitor construction progress, experts say. On the architectural side, it also helps C-level executives visualize the finished project and allows hospital staff to understand the patient-flow plan better. BIM also plays a role in the healthcare design and construction industry's recent moves toward more prefabricated design and infrastructure elements, in which headwalls, mechanical-electrical-plumbing packages, examination rooms and bathrooms, masonry panels and even entire curtain walls are prebuilt in a controlled environment in a nearby facility and brought to the construction site for installation.

In addition to accelerating construction schedules and reducing labor costs, a prefabrication approach also can improve quality and reduce costly change orders or requests for information. As BIM adoption moves down the project management chain, other advantages will become apparent.

Another strategy playing a bigger role in the construction process as teams try to keep costs down is the Lean practice of "pull scheduling" milestones backward from the planned completion date.

SUSTAINABILITY STRATEGIES

Exploring sustainability strategies inherently forces hospitals to assess whether each department and system serving a facility's infrastructure is a peak performer. Experience shows that cost-saving opportunities exist at even the environmentally savvy hospitals and often require simple actions with minimal investments that can pay substantial financial dividends. Healthcare facilities also are learning that sustainability is an ongoing process rather than a single event; no facility climbs the green mountain in one day. Developing and executing effective plans that make efficient use of energy, water, waste management and environmental services take time.

Cost Savings

The hospitals can implement safer, low-investment strategies with a more immediate payback. The average simple payback period for energy conservation projects in health care is 3.8 years.

Common actions taken include retrofitting to more efficient T8 or T5 fluorescent lighting (76%) or light-emitting diode lighting, launching a preventive-maintenance program (88%) and upgrading building control and automation systems (55%).

Among energy-management strategies taken, 40% said they conducted an energy audit, the most common action taken and one that is still underutilized and can lead to the next tier of energy-saving actions.

Upgrading aging HVAC equipment is becoming more common as hospitals start to reach for the higher-hanging fruit in energy efficiency, he says. Those include changing out chillers, air handlers and boilers—replacements commonly paid for in part with more basic energy projects or through third-party funding, such as utility incentives.

Seizing Opportunities

Hospitals generate 6,600 tons of waste a day, with nonhazardous solid waste representing up to 80% of the total, according to the American Hospital Association's Executive Primer on Hospital Environmental Sustainability. All that waste represents an opportunity for cost savings.

For large systems, sustainability actions that eliminate or reduce waste streams can generate savings in the millions of dollars **(Box 4.1)**.

Box 4.1: Energy costs. Acute care hospitals' annual energy costs* per square foot (estimated).

Less than $2.50	**12%**
$2.51 to $3.00	17%
$3.01 to $4.00	**28%**
$4.01 to $4.00	21%
$5.01 to $6.00	**11%**
$6.01 to $7.00	5%
$7.01 to $8.00	**3%**
More than $8.00	3%

*Energy costs include electrical, natural gas, steam, oil, cogeneration, solar, etc., except water.

Source: Health Facilities Management/ASHE 2011 Hospital Energy Management Survey.

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Hospitals and Nursing Homes

Planning, Organizations and Management

Health care plays an important role in our lives, it affects the way we live together, and the expectations we have for our standard of living. Health is a matter of concern to the humanity and the ultimate performance and progress of any civilized society depends upon the state of health of its citizens.

During the last two decades of 20th century, medical science has made unprecedented progress that surpasses the achievements of the past 1,000 centuries. The 21st century is the century of knowledge and development. During the last four decades world has seen unprecedented challenges from emerging infectious diseases [HIV, H1N1, H5N1, severe acute respiratory system (SARS), Ebola, Zika, COVID-19, etc.] and lifestyle diseases (diabetes, heart diseases, cancers, mental health, injury, etc.). Multiple, but very powerful forces are imminently accelerating the need for transformation of healthcare delivery.

The future will undoubtedly witness revolutionary changes, new horizons opened up by cutting-edge science. We need to coalesce the efforts of the entire scientific community to commit ourselves to fulfilling the vision in a socially relevant and participatory mode. Synergy between science, technology, organization and public policy—a scientific mindset—is required to bring a sea-change in the planning, organization, architecture, design, construction, commissioning, and management of health facility. We must value life and spend enormous resources to maintain it. Investing in health should be considered as an investment in human resource development (HRD) to enhance the productivity of a nation.

Unique in its content, style and presentation, this book is comprehensive, simple and user-friendly. It covers almost all aspects of health facility planning—from "an" idea to "the" idea—step-by-step approach and has universal appeal. The beauty of the book is that in includes recent advances and future trends in healthcare delivery systems at international level.

This book is for the New Millennium—comprehensive treatise and a complete reference for all occasions for planners, policy makers, healthcare universities, medical colleges, hospital and health services administrators, nursing home managers, architects, engineers, nursing administrators, clinical, paraclinical and nonclinical professionals, legal experts; teachers, and students pursuing postgraduate courses in hospital and health services administration. This book (unique in its content) presents an integrated perspective and a step-by-step approach from "An" idea to "The" idea for New World Health.

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His strengths include an innovative vision, excellent analytical, conceptual and strategic planning skills besides quest for excellence through creativity. He possess multifaceted and wide-ranging interests and contributed immensely in the University Planning and Management, Medical Education, Planning, Organization & Management of Hospital and Health Services, Scientific Research, Global and National Health Policy, Regional Health Planning and Healthcare Delivery Systems Reform. His lifetime endeavors have been focused on continuous quality improvement in service organizations, optimizing the use of technology and human skills in achieving the highest standards of technical efficiency, clinical effectiveness, and quality in the higher academic institutions and establishing world-class health facilities.

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