BUILDING DESIGNS

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WHERE WE ARE—BACKGROUND

The context of this workshop is complex and of grave concern to those involved in health care:

- A growing number of newly diagnosed cases of tuberculosis (TB) in the general population of the United States.
- 32 recent deaths due to multidrug-resistant (MDR) TB—many of which were the result of nosocomial infections (CDC, 1991).
- And the fact that 23 % of the New York State inmate population has tested positively for TB (Greifinger, 1992).

While inner city hospitals have faced the growing numbers of TB patients, the majority of the nation's health care facilities have not. Focus throughout the country has rested largely on developing the appropriate responses to acquired immuno-deficiency syndrome (AIDS) and other major public health issues. These include continuing efforts to combat and treat cancer, substance abuse, infant mortality and cardiovascular disease. Coupled with increased efforts to control capital and operating expenditures for health care and the subsequent move toward health care reform, little attention has been left for an affliction largely unknown by

many Americans other than a threat from times past. In addition, past efforts to slow or limit increases in health care expenditures, such as construction moratoria and certificate of need processes, have increased the extent of our aging health care infrastructure. And, because of changing health care needs, delivery patterns and funding, TB sanitoria have long been abandoned as have many of the nation's state-run psychiatric centers. Newer facilities with energy efficient mechanical systems have allowed potentially dangerous concentrations of TB through the use of recirculated air (Iseman, 1992).

The public awareness of the return of tuberculosis as a major public health threat has been so relatively recent and limited that very little attention has been paid to building design as a specific response. An indicator of the relative concern about TB and its impact on facilities can be seen in a review of recent health care industry journals and publications such as *Health Facilities Management*, *Modern Health Care*, and *Hospitals*. Very few feature articles on facilities dealing with TB have appeared, with the most notable article appearing in *Health Facilities Management* which emphasized ventilation requirements and options (Neill, 1992). It is the opinion of the writer that only two programs out of approximately one hundred will address any TB-related issues at the upcoming International Planning, Design and Construction Symposium sponsored by American Society of Hospital Engineers (ASHE).

Within general acute care institutions such as hospitals and medical centers, the majority of attention regarding the isolation needs of patients have dealt with AIDS patients and others with immunosuppression and their need to be protected from opportunistic disease. Thus, in may facilities, the emphasis has been on protective isolation. In general, pediatric facilities have been more concerned about infectious isolation and limiting nosocomial infections.

Thus the perceived need for infectious isolation facilities has not been high. In fact, it is the writer's observation that many facilities regard the need for full-blown protective and infectious isolation

rooms with anterooms to be largely unnecessary especially in light of the move toward greater percentages of, if not total, private patient accommodation. Only in 1992 did the American Hospital Association (AHA) issue a member briefing specifically focused on TB (Technical Panel on Infections Within Hospitals, 1992).

Our charge is to develop a research agenda which will support the protection of health care workers from TB. The risk has increased because of, according to one team, various cough-generating procedures used with AIDS patients (Nardell, 1990). In preventing the airborne transmission of TB, the greatest impact is generally on the patient. And many of the traditional measures to combat or contain TB appear to ignore concerns about patient autonomy, ranging from involvement in medical decision-making and limited inpatient stays to control over one's individual environment in the health care facility. One of our challenges, or that of those who take up the implementation of our agenda, is to address public health needs effectively without totally losing sight of individual patient needs.

Many patients, after initial diagnosis, do not require inpatient hospitalization for medical management (Stead, 1992, Berkow and Fletcher, eds.,1987). However, many others do. They include those with conditions requiring other supportive measures not possible on an outpatient basis and those with multidrug-resistant TB. There are now also increasing numbers of patients who are not compliant in terms of continuing medication and observing proper infection control precautions. Recommendations have been made to consider involuntary confinement for non-compliant patients during the chronic phase of their illness—not just during the time when they are infectious (Rothman, 1992). It is because of these patients that the concerns for other patients and staff arise. These patients already have and will continue to tax the available isolation facilities. The lack of adequate numbers of acid-fast bacilli (AFB) isolation rooms was clearly implicated in the recent outbreaks of nosocomial TB (CDC, 1991).

In response to the Centers for Disease Control's (CDC) published guidelines for control of TB transmission (CDC, 1990), it appears that the primary focus of building design in this area should be isolation facilities within health care institutions. CDC recommendations for the medical management of infectious patients requiring hospitalization include the use of AFB isolation precautions (CDC, 1991). CDC indicates that this includes use of isolation rooms with requirements which mirror those listed in the American Institute of Architects (AIA) *Guidelines* (AIA, Committee on Architecture for Health, 1993).

The AIA's *Guidelines* document does not specifically address TB as an infectious agent but does provide space and engineering requirements for infectious isolation rooms. These requirements include the use of a private room with negative air pressure in relation to surrounding areas and a minimum of six air changes per hour. All air is to be exhausted directly to the outside in such a way that it will not become pulled into supply intake vents for any area of the facility. *Guidelines* also indicates the need for an anteroom of 20 net square feet directly adjoining the intensive care isolation room and serving as a buffer between the isolation room and the general corridor (AIA, Committee on Architecture for Health, 1993).

Additional CDC recommendations indicate the need for the use of disposable particulate respirators by staff entering the isolation room (CDC, 1991). The use of surgical masks by the patient when he or she is required to leave the isolation room while still infectious has been instituted in at least one New York City hospital (Pearson et al., 1992).

While cohorting of patients and sharing of anterooms is not acceptable because of potential superinfection of MDR TB, one group feels that private rooms with positive air pressure can be used with window exhaust fans (Lutwick et al., 1992).

While the major facility response at the end of the last century and earlier in this century was the sanatorium (Dubos and Dubos, 1992), concerns about staffing, duplication of services and availability of specialized diagnostic and treatment equipment have argued against single-disease facilities as a current-day solution (Rothman DJ, 1992, Rothman SM, 1992). Thus, the continued development of hospital- and medical center-based inpatient isolation facilities is advised. However, these need to accommodate both acute care patients as well as intensive care patients. In addition, prison infirmaries should include AFB isolation rooms (CDC, 1992d, Glaser and Greifinger, 1993) and diagnostic services such as x-ray (Skolnick, 1992).

Issues arise regarding the best kind of facility or location of care for the patient who is not or is no longer acutely ill but is still infectious and requires on-going medication. Some patients are able to manage the appropriate precautions to avoid transmission to family members and others. Other patients, by virtue of their medical condition or lifestyle, are not able to manage on their own and require a supportive environment which may include personal care assistance (Torres et al., 1990). Such services are sometimes available in outreach facilities including shelters or nursing facilities. CDC recommendations have included establishment of special housing-treatment centers for the homeless with TB (CDC, 1992c).

WHERE WE ARE GOING—RESEARCH AGENDA

As indicated above, the nation has a shortage of appropriate isolation facilities. In some facilities, where they exist, their mechanical systems have not been properly maintained or balanced so that their effectiveness is limited.

Consideration should be given to the development of specific planning and design guidelines, including but not limited to:

Health Planning

- Developing methodologies to calculate the number of inpatient acute and intensive care infectious isolation rooms for a given service population.
- Developing methodologies to identify the type and number of hospital-based ancillary services needed to support that population including diagnostic and treatment facilities such as lab, x-ray, surgery, etc.
- Developing methodologies to identify alternative care delivery sites such as schools, shelters, residential treatment centers, etc. and their capacity based on the needs of the service population.

Design and Construction—Inpatient Facilities

- Identifying the criteria and parameters for determining the feasibility of renovation in existing construction to provide appropriate isolation capacity—both for acute and intensive care including:
  1. Staffing.
  2. Construction cost.
  3. Construction duration.
  4. Disruption to other ongoing facility operations.
  5. Access to other essential support and services.
- Developing specific programming guidelines for isolation facilities including the room itself, the anteroom and associated bathing and toileting facilities.
- Identifying the specific furniture, furnishings and equipment elements required in an isolation room.
- Confirming the necessity of providing an anteroom:
  1. As an airlock.
  2. As a work and storage area in which to practice infection control measures, etc.
- Developing specific construction standards for doors, windows and seals based on the results of the panel investigating ventilation design.

- Identifying specific design elements to be included in the anteroom, e.g., interlocks on the doors to prevent accidental airflow between patient room and corridor.
- Identifying specific design elements to be included in the patient room itself to accommodate ultraviolet (UV) light installations and/or high efficiency particle air (HEPA) filtration—should their efficacy be confirmed.
- Identifying the appropriate design to accommodate access to and from booths for use by patients required to perform sputum induction, etc.
- Identifying the different needs, if any, of the short-term versus long-term patient.

Design and Construction—Outpatient and/or Diagnostic and Treatment Facilities

The above suggested areas of investigation centered on a hospital or medical center's inpatient nursing units. In addition, consideration should be given to identifying the extent of isolation facilities needed in other settings such as residential TB treatment facilities (Brudney and Dobkin, 1991) and various diagnostic and treatment services.

- The emergency department
- Intensive care units
- HIV clinics and related services such as:
  1. Pentamidine administration clinics.
  2. Outpatient intravenous treatment areas (Abrutyn, 1992).

Specifically, within the emergency department, the triage and intake functions should be addressed in terms of the facilities required to accommodate the interaction required between patient and health care worker to determine the patient's potential for active TB. Given Joint Commission on Accreditation of Health care Organizations (JCAHO) requirements that the patient's first encounter is with triage staff, the physical setting of this interaction needs to be examined in light of protection of the staff as well as encouraging patient safety, confidence and comfort.

Additional diagnostic and treatment service areas which should be addressed include:

- Outpatient surgery and recovery.
- Clinic or ambulatory care center.
- Endoscopy suite or other components of a short procedure or minor surgery suite.
- 23-hour stay unit for pre- or post-procedural care or monitoring.
- Respiratory therapy.
- Dental operatory and clinic.
- X-ray.

In addition to the specific treatment spaces, waiting areas (Nolan, 1992), toileting facilities and possibly food service should be designed or planned to allow use by infectious patients or those suspected of being infectious. No standards, other than procedural protocols, generally exist for facilities such as these to deal with infectious patients. With the pressure to decrease inpatient utilization and attendant costs, it seems that pressure to develop such facilities will grow.

There are also issues of containment which need to be addressed in areas such as the morgue and autopsy suite (Abrutyn, 1992). The lab itself may need to include P-3 containment facilities (Culliton, 1992).

Psychosocial and Ethical Issues

The accepted means of preventing airborne transmission rely on physical barriers, which by their very nature reduce contact between health care worker and patient. This runs counter to an increasing trend to make the health care setting and interactions more humane. For those patients whose admission is not voluntary, the issues of confinement and separation can be even more severe.

Especially for those whose condition requires long lengths of stay, special consideration needs to be given to their psychosocial needs. In both acute care and intensive care settings, the possibility of isolation psychosis must be considered. Additional means

of providing diversion and stimulation must be included, such as TV, interactive computers, etc. An additional area of investigation should be the identification of minimum levels of recreational facilities, etc. and means of allowing interaction with family members and friends without risk to either visitor or patient.

Alternative Sites

Consideration should be given to use of other facility types as alternatives to hospital-based care. Even though it was stated earlier that single-disease facilities are not recommended, in certain urban or metropolitan areas existing building stock may not be able to accommodate the growing need for appropriate facilities—especially in areas with high percentages of homeless persons who may be subject to involuntary confinement (Brudney and Dobkin, 1991). Consideration may also be given to regionalization of care for TB patients at risk for MDR TB (Beck-Sague et al., 1991). In such circumstances, criteria should be developed for the adaptation of other building types including:

- Schools.
- Psychiatric centers.
- Unused military installations.

Criteria should include:

- Access to the facility from the community.
- Staffing availability and cost.
- Access to diagnostic and treatment services.

Whatever national or other jurisdictional health planning mechanisms may come out of the Clinton administration's reform program, CDC at a minimum should promulgate the results of the health planning analyses indicated above. In this same context, the Health Care Financing Administration (HCFA) must address financing of renovations and/or new construction to meet the needs of additional isolation facilities.

When specific facility design and construction standards are developed, they should be promulgated by whatever entity will be

responsible for publishing future editions of the *Guidelines* document. Depending upon the timing of this material's production, an addendum should be considered instead of waiting for a more comprehensive update. Because of the overlap, in many cases, of patient populations, those groups participating in research, public education, etc. programs on AIDS should participate in related TB programs.

Specific educational programs should be sponsored by interested and committed industry groups such as the following:

- American Institute of Architects
- American Hospital Association
- Joint Commission on the Accreditation of Healthcare Organizations
- American Correctional Association

Research participants should include the following:

- American Council of Schools of Architecture — Research Council
- American Hospital Association
- American Institute of Architects
- American National Standards Institute
- American Public Health Association
- American Society of Heating, Refrigerating and Air Conditioning Engineers
- American Society of Hospital Engineers of the AHA
- Centers for Disease Control and Prevention
- Department of Defense
- Department of Health and Human Services
- Department of Housing and Urban Development
- Department of Veterans Affairs
- National Fire Protection Association
- National Institute of Building Sciences
- National Institutes of Health
- National Institute for Occupational Safety and Health (NIOSH)

Evaluation should be performed by CDC and JCAHO, with specific emphasis on health care institutions. Local public health entities with assistance from CDC and NIOSH should evaluate other settings of care and risk such as schools, shelters, etc.

HOW WE GET THERE—IMPLEMENTATION

The areas of proposed research should be allocated to specific groups based on expertise and ability to accomplish the research task in appropriate time frames. If possible, a consensus-building model should be used. Based on personal knowledge, the writer recommends an approach similar to that taken in the preparation of the *Guidelines*.

It should be noted that the inclusion of certain elements is dependent upon the research activities coming under the jurisdiction of other panels. For example, the use of UV lights and HEPA filtration as devices in patient rooms is predicated on confirmation of their efficacy and practicality of use. The use of booths for containment of contamination generated during sputum production, aerosol pentamidine administration and bronchoscopy is predicated on outcomes by the source control panel and possibly the aerosol characterization panel. Therefore, it is recommended that an overall map or critical path be developed of the recommended tasks identified by each panel and that they be sequenced as needed.

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