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DEPARTMENT OF VETERANS AFFAIRS

Report of the Task Group for

INNOVATIVE 21ST CENTURY BUILDING ENVIRONMENTS FOR VA HEALTHCARE DELIVERY

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PART 2

REPORT OF THE TASK GROUP FOR "INNOVATIVE 21st CENTURY BUILDING ENVIRONMENTS FOR VA HEALTHCARE DELIVERY"

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PART 2 Innovative 21st Century Building Environments for VA Healthcare Delivery

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PART 2 Innovative 21st Century Building Environments for VA Healthcare Delivery

INTRODUCTION

The Department of Veterans Affairs (VA) recognizes that the design of facilities critically affects the effectiveness and efficiency of the performance of VA's missions. True high-performance buildings will support the VA healthcare delivery mission and goals for transformation to 21st-century care. Transforming VA facilities' processes and services requires the critical input, feedback, and enthusiastic support of the broad spectrum of highly dedicated VA architects, engineers, healthcare, and other professionals throughout the VA system.

It is in that context that all committee recommendations regarding VA healthcare facilities support, at least tangentially, all four strategic goals described in the *Department of Veterans Affairs Strategic Plan FY 2006-2011*. However, the committee recommendations are intended to directly and significantly relate to the Department's single enabling goal: Deliver world-class service to veterans and their families through effective communication and management of people, technology, business processes, and financial resources.

In order to study and make recommendations to VA across the full range of innovative design principles, technology, and business practices for transforming the environment of care, the Task Group, supported by the VA Advisory Group, divided into nine topical committees. The committee discussions were not made in isolation of the broad context of the Task Group challenge.

The chapters of Part 2 report the recommendations of the nine committees: Care Optimization, Healing Environments, Satisfaction, Adaptability, Sustainability, Building Operations and Maintenance, Building Acquisition, Data Acquisition, and Continuous Innovation. While the nine chapters focus on individual aspects, the recommendations and discussions overlap due to the essential inter-relationships within the healthcare environment.

It is important to reinforce that the Task Group considered and universally expressed that cross-functional and inter-organizational collaboration within VA, as well as strong external alliances, are considered prerequisites for all subsequent Task Group conclusions and recommendations.

CHAPTER 1 Care Optimization

Care Optimization Committee Principal Recommendation: ***Provide more effective and efficient building environments that can flexibly accommodate and adapt to more optimized functional processes and procedures.***

Optimization of care is the central objective of all VA operations, and nothing in this report should be construed to indicate otherwise. That said, the Committee on Care Optimization proposes a new focus on opportunities for coordination of care strategy assessments and changes with anticipated periodic assessments of the effectiveness of VA facilities. In this context, care optimization encompasses recommendations regarding identifying VA healthcare service needs, informing service and facility programming (operational concerns/objectives), and developing improved management and built solutions for healthcare service delivery.

Care optimization should be considered from a very pragmatic and practical perspective: healthcare reinvents itself every five to seven years. Since most buildings cannot be easily modified, major construction projects should be designed recognizing this cycle of change and should allow for rearrangement and resizing (growth or contraction) to facilitate changes in clinical flow patterns. Some redesign may be very simple; for example, an out-patient facility may need to convert nurse rooms to physician rooms, or vice versa. Some may be very complex.

When planning a facility to accommodate changing healthcare priorities and demands, consider a structure that could be altered in size without major structural revisions to the original building, allowing for easy expansion or contraction. Over the past 10 years, many facilities have run out of space due to clinical expansions, resulting in large financial outlays for major new construction. On the other hand, when VA downsized buildings in the 1980s and 90s, there was no good way to do this without selling or destroying buildings, both costly processes.

It is important that VA design and build new facilities with an understanding and vision of the processes that will occur within the building. The building should be designed with an awareness of how the new space will enable and support future service expectations—what is referred to as accommodation capacity. This will require the design team to work closely with the Office of Construction & Facilities Management as well as other VA offices and programs and the clinicians or service providers who will be using the space.

Optimization of the facilities and processes will require a focus on efficiency (i.e., use of VA resources), effectiveness (i.e., clinical and process outcomes), and

customer experience (i.e., veteran, family, and staff). Without well coordinated processes, it is possible for VA to design a facility that is efficient, but may be more expensive in the long run or may not be veteran-friendly. Alternatively, a veteran-friendly facility may also be costly or inefficient from a work process perspective. These drivers and potential trade-offs must be considered during the planning and design stages, in order to make informed decisions.

It is also important that VA incorporates information technology (IT) planning from the outset of facility planning efforts. Too often, IT is not considered until late in the design process, resulting in the potential negative consequences of inadequate funding, inadequate space programming, lack of necessary IT resources, increased cost, and implementation delays.

VA might consider an increased level of standardization of especially routine support systems and then automate those systems to the extent possible (similar to the airline industry at present). The use of practical robotics should also be researched as a way of reducing errors and increasing efficiency for repetitive tasks.

The Care Optimization Committee recommendation consists of four subordinate recommendations for VA to consider.

- Describe the desired veteran as patient/resident experience and idealized service delivery venue from initial contact to departure from the VA care system. Detail each step; focus on transitions and hand-offs; and define facility/venue attributes.
- Investigate the application of business process improvement techniques to optimize delivery of healthcare, rehabilitative, mental health, and long-term care service delivery venues.
- Use workflow-based project delivery to implement test cases of cellular planning on VA healthcare facility design and operation, with a particular emphasis on evaluation of resulting facility adaptability.
- Develop a plan to integrate enabling technology (medical and information technology) to support performance effectiveness, veteran (as well as family, physician, and staff) experience, and facility optimization.

Additionally, the committee recommends that each organizational element involved in evaluation of facility optimization of care decision-making identify and describe specific performance metrics and data requirements.

Recommendation A, *Idealized Services and Venue*: *Describe the desired veteran as patient/resident experience and idealized service delivery venue from initial contact to departure from the VA care system. Detail each step; focus on transitions and hand-offs; and define facility/venue attributes.*

VA provides a continuum of care to include express and urgent care clinics, nursing homes, homecare, web-based services, residential mental health, and hospital-based acute and rehabilitation services, giving the veteran a variety of entry points and options into the system, depending upon need and level of acuity.

Optimization of care requires an integrated examination of process, facility, and customer experience. An effective approach to integrated planning and design is to review the concept of operations, which considers all components of patient-care delivery, including patient interactions, clinical and administrative support systems, facility design, and technology requirements. Concept of operations involves an in-depth examination of the operational processes, space, technology, and culture. An integrated concept of operations can provide a framework for innovation, optimization, and transformation of the care-delivery process and facility design for VA.

In developing a concept of operations, each core process is examined. For example, in an ambulatory setting a patient encounter includes pre-appointment activities (e.g., registration and scheduling), the appointment (e.g., check-in, provider visit, procedure), and post-appointment (e.g., check-out, follow-up care). In this example, VA would examine the full cycle of the ambulatory patient-encounter processes to document current process and define the future expectations.

Recommendation B, *Business Process Improvement*: *Investigate the application of business process improvement techniques to optimize delivery of healthcare, rehabilitative, mental health, and long-term care service delivery venues.*

Applying business process improvement techniques to optimization of healthcare and other care venues should involve three distinct activities.

> *1. Forecast the implications of medical care best practices on the built environment, and extrapolate case study examples to current VA facility portfolio.*
>
> The identification of proven best practices should actually drive a new methodology of organization of services and subsequently a modification of the approach to facility design. For example, sending potential heart and stroke patients directly to the appropriate intensive care units, by-passing the emergency room, has proven beneficial to patient care. Designing hospitals within hospitals for cancer diagnosis and specialized treatments allows teams to focus on maximizing the clinical care of those patients in a manner that vastly improves patient outcomes.

2. Determine how business process management concepts and practices from other industries and commerce sectors can be applied to VA operations.

Create an operational culture that eliminates specialty mentality and moves toward integrated, seamless services based on a cluster or cellular approach to organization so that the veteran's movement through the systems is natural and focused on the veteran's needs, not those of multiple departments. A significant benefit of a clinical team approach would be in redesign of facilities to support that type of operation and the opportunity to integrate services and monitor their improvement. Organize major, acute medical conditions around a broad diagnosis. For example, all heart care is bundled and fully integrated, accessed by the veteran as "one stop shopping."

Use both Baldridge[1] and lean[2] manufacturing technological principles applied to both clinical and support services to streamline processes, ease of access, and movement of veterans through the system at all levels.

Capture as much real-time information as possible to assist real-time decision-making.

3. Evaluate tradeoffs between management improvement (practices and use of information) and bricks-and-mortar (systems and facilities) in VA healthcare outcomes.

The processes of care and services must override systems and facilities considerations with the latter designed to support optimization of the former. Focus the system on the needs of veterans and their families and design practices that directly address those needs. Design systems and facilities to support the satisfaction of those needs; then desired care outcomes may be achieved.

A current example of process improvements that optimize the delivery of care may be found in VA's new design model for mental health facilities[3] as developed for the (not yet built) inpatient psychiatric hospital at VA Palo Alto. In developing this facility, VA made significant efforts to promote healing, homelike, and recovery-oriented environments of care for veterans who require inpatient

[1] Baldridge Criteria Categories provide a systems perspective of the elements essential to achieving performance excellence. http://www.baldrige.com.

[2] Lean manufacturing is the practice of a theory of production that considers the expenditure of resources for any means other than the creation of value for the presumed customer to be wasteful, and thus a target for elimination.

[3] Karlin, B. E., and R. A. Zeiss. 2006. Environmental and Therapeutic Issues in Psychiatric Hospital Design: Toward Best Practices. *Psychiatric Services* 57(10): 1276-1378. http://ps.psychiatryonline.org/

psychiatric services, their families, and the professionals and staff who serve them.

Recommendation C, *Test Cases of Cellular Planning: Use workflow-based project delivery to implement test cases of the effects of cellular planning on healthcare facility design and operation, with a particular emphasis on evaluation of resulting facility adaptability.*

Planning cells, based on optimized workflows, address both optimization today and flexibility for tomorrow. Characterized by the ability to accommodate a broad range of human activity as a foundation of their spatial principles, these plans require far less movement of staff, patients/residents, and materials and are able to adapt readily to changes in activity.

Adaptability can be addressed through developing facilities based on cellular flow and interdisciplinary patient/resident care. Cellular facility planning concepts anticipate a wider range of functional healthcare delivery in any specific patient-care space than departmental planning provides. By basing facility planning considerations on more flexibility of use in a given space, the space is by nature more adaptable.

Cellular planning is not new to many industries, but it is almost revolutionary for healthcare. Where there is a strong benefit in the inpatient environment, there should be an obvious benefit throughout the provision of healthcare. The concept of cellular workflow reaches across the boundaries of workflow optimization and begins to address a variety of other concerns, such as adaptability, as well.

Recommendation D, *Plan for Technology Integration*: *Develop a plan to integrate enabling technology (medical and information technology) to support performance effectiveness, veteran (as well as family, physician, and staff) experience, and facility optimization.*

Facility design influences technology use and requirements in the clinical environment. Likewise, how and what technology is used will shape facility design. Both must be equally considered during the planning, design, construction, and adaptation of VA facilities. The lack of coordination between facility design at all levels of intervention and information technology can have significant negative consequences, such as increased cost, delays, inadequate space, and sub-optimized technology.

CHAPTER 2 Healing Environments

Healing Environments Committee Principal Recommendation: ***Provide buildings designed to support the creation of optimal healing environments that reduce adverse health and safety threats, improve health outcomes, expedite patient recovery, and promote the overall health and wellbeing of occupants, the communities in which facilities are located, and global environmental conditions.***

Therapeutic, healthy, and safe building environments can improve veteran and staff health and safety. This chapter focuses on ways to create facilities for the future that enable effective and safe delivery of health, rehabilitative, mental health, and long-term care and improve health outcomes.

The importance of the physical environment can be characterized by two key factors: first, the nature of the physical environment itself and its impact on the emotional, psychological, and physical health of veterans and supporting family members; and, second, how the physical environment actually predetermines and/or limits the care processes, their characteristics, and, subsequently, how caregivers interrelate with those processes and patients/residents themselves.

Physical environments that are designed in ways familiar to veterans can reduce the anxieties and potential stressors generated by being in a foreign environment. Environments that optimize veteran movement and continuity of care through multiple service centers and allow families to participate in the care process can improve both the perceived and measurable quality of care. Likewise, caregivers who are provided a healthy physical and social environment tend to be more satisfied, less stressed, and contribute better to the veteran. The physical environment should be designed to meet these ends.

Evidence exists that demonstrates the potential of several built environment attributes to significantly influence care delivery, patient/resident safety, and health status and outcomes.[4] These attributes include views and connections to nature, access to daylight, natural ventilation, indoor air quality, and various forms of environmental therapeutic positive distractions. VA should consider optimizing opportunities for access to daylight and natural ventilation as a prerequisite for a healthful and safe facility. VA should investigate European, Japanese, and other international hospital examples that represent best practices for many of these opportunities.[5]

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[4] Ulrich, R., X. Quan, C. Zimring, A. Joseph, and R. Choudhary. 2004. The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Oportunity. The Center for Health Design. http://www.healthdesign.org/research/reports/physical_environ.php

[5] Examples include: Rikshospitalet in Oslo, Norway; St. Olavs in Trondheim, Norway; Martini Ziekenhuis in Groeningen, Netherlands; and Basel Rehab Hospital in Basel, Switzerland.

The Healing Environments Committee suggests that VA employ the emerging area of biophilic design. Biophilic design includes "buildings and constructed landscapes that foster a positive connection between people and nature in places of cultural and ecological significance."[6] Biophilic design is more than the inclusion of nature and natural elements in buildings. It incorporates environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, and evolved human responses to nature. Strategies include both programmatic and architectural/interior design features.

The Healing Environments Committee has developed four supporting recommendations for VA to consider.

- Develop and include design features that promote positive interactions and healthy, active behaviors for veterans, family, and staff in all facilities.
- Undertake a comprehensive report and additional sponsored research on the impact of the built environment on health and healing in healthcare settings on veterans who have experienced trauma, including individuals experiencing military-related trauma.
- Set priorities for improved indoor environmental quality in all facility construction, renovation, and maintenance protocols. Consider the specific connections between building materials and occupant, community, and global health. Investigate the health hazards associated with the installation and maintenance of building materials.
- Analyze best practices for infection control and the architectural features and mechanical system implications for inpatient and outpatient facilities.

Recommendation A, *Healthy Interactions and Behaviors: Develop and include design features that promote positive interactions, communication, teamwork, and healthy, active behaviors for veterans, family, and staff in all facilities.*

It is becoming widely recognized that the physical setting of healthcare facilities plays a vital role in making them safer, less stressful, and more conducive to promoting patient healing and providing quality healthcare from satisfied staff. Multiple organizations, such as the Institute for Healthcare Improvement (IHI), The Center for Healthcare Design, The Samueli Institute, and Planetree, are drawing correlations between the physical space in which providers work and patients heal and the quality of care provided and level of healing that occur.

A 2008 comprehensive review of the research literature on evidence-based healthcare design found a growing body of rigorous studies that indicate "well-designed physical settings play an important role in making hospitals safer and

[6] Kellert, S., and E.O. Wilson. 1993. *The Biophilia Hypothesis*. Washington, D.C.: Island Press.

more healing for patients, and better places for staff to work."[7] According to this review, design characteristics have an effect on a variety of patient and staff outcomes. Patient outcomes affected by physical design include infection rates, falls, quality of sleep, pain, stress, anxiety, depression, and spatial disorientation. The built environment also influences patient privacy and confidentiality, communication with and between patients, providers, and families, patient social support, length of stay, and patient/family satisfaction. Equally as important, the built environment directly affects staff outcomes such as injuries, stress, effectiveness, medical errors, ability to spend time in direct patient care activities, ability to work as part of a team, and staff satisfaction.

Specific examples from published research[8, 9, 10] show that:

- Patients recover faster in private rooms.
- Rooms that include the patient and family as integral team members achieve better outcomes.
- Providing positive distractions through music and art can improve the care experience and the patient's perception of pain.
- More access to natural lighting reduces patient anxiety and depression and shortens length of stay.
- Access and exposure to nature substantially reduce stress and anxiety and have a restorative effect.
- Single patient rooms reduce infection rates.
- Wider bathroom doors contribute to reducing patient falls.
- Adequate lighting levels reduce staff medication-dispensing errors.
- Variable acuity rooms reduce expensive and potentially dangerous patient transfers.
- Well-designed units can reduce the time providers spend walking and increase time spent in direct patient-care activities.
- A good acoustic environment can reduce patient and provider stress, improve patient sleep quality, and increase staff productivity.
- Effective air quality control and ventilation systems help to reduce the rate of air-born infections.

In renovating current facilities and planning future ones, VA will want to take into account the profound impact that facility design can have on both health outcomes and quality of service. Specific design recommendations follow.

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[7] Ulrich, R., C. Zimring, X. Zhu, J. DuBose, H-B. Seo, Y-S. Choi, X. Quan, and A. Joseph. 2008. A Review of the Research Literature on Evidence-Based Healthcare Design (Part 1, Part 2, and References). *Health Environments Research & Design Journal* 1: 61-125. http://www.herdjournal.com

[8] Ulrich *et al*. The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity. http://www.healthdesign.org/research/reports/physical_environ.php

[9] Research Reports & Papers. The Center for Healthcare Design. Retrieved 12/18/2008 from http://www.healthdesign.org/research/reports/index/completelist.php

[10] Sadler, B., J. DuBose, and C. Zimring. 2008. The Business Case for Building Better Hospitals through Evidence-Based Design. *Health Environments Research & Design Journal.* http://www.herdjournal.com

- Locate stairs adjacent to elevators and in highly accessible, visible, and usable places within buildings to promote their use. Design stairs in ways that provide incentives for their use such as views to nature, access to daylight, places for the display of art, and as places for social interaction. Ensure there is a level of finish and security equal to corridor circulation.
- Provide adequate and well-outfitted exercise and break spaces for staff. Provide access to daylight, views, and connections to nature.
- Locate and design the entire facility to encourage active healthy lifestyles including the use of mass transit, walking, jogging, and cycling. Provide exterior walking trails and locate staff parking to encourage use of sidewalks, trails, or pathways.
- Provide low-stress, green, sustainable environments for veterans, staff, family, and visitors. Include multiple places, programs, and opportunities for therapeutic positive distractions including water features, music, meditation spaces, and therapeutic gardens and landscapes. Design building and landscape features to satisfy both stress-reducing and green design goals.
- Provide ease of wayfinding and navigation both on site and within buildings. Provide a legible hierarchy of circulation pathways, nodes, and landmarks. Separate front and back of the house circulation, whenever possible.

Recommendation B, *Trauma-Informed Care*: *Undertake a comprehensive report and additional sponsored research on the impact of the built environment on health and healing in healthcare settings on veterans who have experienced trauma, including individuals experiencing military-related trauma.*

A significant factor in ensuring safety for veterans, family, and staff includes a physical environment that minimizes risk of harm to self or others. A report on care environments sensitive to individuals impacted by significant military-related trauma should use evidence from private and state hospital systems and rely on an advisory panel that would include consumer and family advocates, leaders from non-VA hospital systems recognized for best safety practices, as well as VA officials. The report should result in specific recommendations for VA building environments to be optimally healing, safe, and able to expedite veteran recovery. Based on these recommendations, VA should consider developing a strategic plan with associated performance measures for full implementation of these safety standards.

Recommendation C, *Indoor Environmental Quality and Materials: Set priorities for improved indoor environmental quality in all facility construction, renovation, and maintenance protocols. Consider the specific connections between building materials and occupant, community, and global health. Investigate the health hazards associated with the installation and maintenance of building materials.*

Emerging science is uncovering strong linkages between indoor environmental quality (IEQ), occupant health, and productivity. The introduction of outside air, enhanced ventilation strategies (including improved maintenance and cleaning practices), moisture control and mitigation, occupant control, and air quality (pollutant source control) are all important strategies related to IEQ in buildings. Regulations that govern HVAC for healthcare facilities can be adapted to sustainable levels. Increasingly, new standards are challenging the thick footprint, "one building" nature of hospitals, moving toward more perforated (with courtyards) and articulate patient care and treatment, office environments, and public spaces with greater access to natural ventilation, operable windows for fresh air, and enhanced occupant control outside of the rigorous demands of pressurization and safety.

Health hazards associated with building materials should be given greater attention with an examination of the material components used to create hospitals—with a focus on defining and eliminating chemicals of concern and substitution of more sustainable alternatives. Material health extends to the topic of emissions, the indoor air pollutants generated by continual off-gassing. In terms of improving indoor air quality, indoor pollutant source control is a pivotal issue. Low- or zero-volatile organic compound (VOC) materials, including paints and adhesives, are rapidly becoming cost-competitive. Formaldehyde-containing materials, particularly in the area of insulation and cabinet substrates, are being challenged by formaldehyde-free alternatives. Materials that generate or contain persistent bio-accumulative toxic components (PBT)[11] in their lifecycle have been targeted for elimination worldwide. VA should seek effective substitutes for materials containing PBTs.

Recommendation D, *Infection Control: Analyze best practice current concepts of infection control and the architectural features and mechanical system implications for inpatient and outpatient facilities.*

An initiative on health facility infection control should examine at least the following:

- Inclusion and physical layout of space and infection control features including isolation spaces, hand washing, and sink locations;
- Mechanical and natural ventilation systems design; and
- Materials, surfaces, finishes, fixtures, and details such as sinks, faucets, door handles, and hands-free apparatus.

The committee recommends looking into current concepts that have been developed and employed in Europe including air handling, indoor environmental quality, and, specifically, displacement ventilation. Infection control under epidemic conditions, as well as normal operating conditions, should be included.

[11] Mercury, cadmium, dioxin, and lead are the most common PBT sources in building materials.

CHAPTER 3 Satisfaction

Satisfaction Committee Principal Recommendation: ***Provide building environments that respond to veteran, family, and staff needs and provide a more satisfying healthcare experience for these populations.***

The Satisfaction Committee considered three components critical to the establishment of optimal healing environments: healing relationships, healing organizations, and healing spaces. For healing relationships the committee addressed veteran-centered and family-centered care and satisfaction. For healing organizations it addressed staff satisfaction and enhanced team development and team care. For healing spaces it considered nature, color, light, artwork, architecture, aroma, music, and technology. The committee developed recommendations for these environments in both new and existing buildings.

The Satisfaction Committee recommendation consists of four specific subordinate recommendations for VA to consider.

- Veteran- and family-centered care: explore how design of all VA healthcare, mental health, rehabilitative, residential, and long-term care facilities can influence veteran and family satisfaction and the patient/resident and family experience of care delivery.
- Provider- and staff-centered care: explore how design of all VA healthcare, mental health, rehabilitative, residential, and long-term care facilities can influence staff satisfaction, caregiver burnout, and the staff experience of care delivery.
- Survey veterans, families, and staff to find out what components facilitate quality care and satisfaction in each population. Then, develop valid and system-wide metrics to measure veteran, family, and staff satisfaction.
- Develop design recommendations/guidelines for new and existing healthcare, mental health, rehabilitative, residential, and long-term care facilities to improve veteran, family, and staff satisfaction with VA care delivery and their overall VA healthcare experience.

In addition, the committee recommends that each organizational element involved in evaluation of facility satisfaction decision-making identify and describe specific performance metrics and data requirements.

Recommendation A, ***Veteran- and Family-Centered Care: Explore how design of all VA healthcare, mental health, rehabilitative, residential, and long-term care facilities can influence veteran and family satisfaction and the patient/resident and family experience of care delivery.***

Consider investigating current veteran and family demographics for various categories of veterans which have shifted recently, for instance in age, gender, or

type of disability. Then define veteran- and family-centered needs for these various demographics and identify specific spatial, environmental, technological, and other conditions for meeting these needs. Examples include:

- Higher natural light levels in patient/resident rooms to help decrease depression, improve sleep and circadian rhythms, and ease pain among amputees returning from war, in combination with ample room space for families and friends to gather and healthcare teams to conduct rounds.
- Walking paths and exercise rooms to promote active behaviors for patients/residents and families.
- Use of information resources to improve veteran education and awareness with respect to their conditions and procedures/tests they are undergoing.
- Use of technology, such as real-time bedside video conferencing, MyHealtheVet (MHV), and Home-Telehealth to increase frequency of veteran-provider communication (between in-person visits) and veteran-family/provider-family communication while veteran is in residence, thereby strengthening the veteran-provider, veteran-family, and provider-family relationships.
- Use of technology to enable patients/residents to gain greater control over room environment (via bedside control terminal for light, heating, humidity, entertainment and communications systems) and to obviate the need to move patients out of room for testing (via portable medical imaging and diagnostic tools that can be brought into the patient room).
- Use of color, colorful fabrics, and artwork to create familiar surroundings for the veteran and family, combined with music and aromatherapy to induce relaxation.
- Rooms designed for private, sit-down conversations between providers, veterans, and families, facilitating provider presence and patient-provider trust-building.

Recommendation B, *Provider- and Staff-centered Care: Explore how design of all VA healthcare, mental health, rehabilitative, residential, and long-term care facilities can influence staff satisfaction, caregiver burnout, and the staff experience of care delivery.*

Consider establishing and defining segments that encompass different VA employee demographics and employee specialties, such as physical medicine and rehabilitation, orthopedics, primary/ambulatory care, mental health providers, case management clinicians, and chaplains. Special attention should be given to the fact that the average age of nurses and other staff in hospitals has been increasing in recent years. Consider providing continuous staff training in new forms of team care. Finally, consider defining and executing a plan to assess the needs for these various demographics and identify specific spatial, environmental, technological, and other conditions for meeting these needs. Examples include:

- Space designed to encourage staff teamwork and quality communication amongst staff, veterans, and families, such as including ample space in patient rooms for teams to conduct rounds with family members present.
- Space designed to facilitate staff training.
- Sacred or quiet rooms to which staff can retreat for respite and renewal.
- Units designed to decrease amount of time clinicians spend walking and increase time for direct care with patients.
- Lifts or provisions for lifts at each bed, as well as adequate lighting for both general illumination and task work.
- Use of technology for increasing real-time provider communication with patients, residents, and families (e.g., MHV and Home-Telehealth) and provider communication with other providers, including non-VA clinicians (e.g., Project HERO).

Recommendation C, *Veteran, Families, and Staff Surveys: Survey veterans, families, and staff to find out what components facilitate quality care and satisfaction in each population. Then, develop valid and system-wide metrics to measure veteran, family, and staff satisfaction. (These should build on and improve upon currently used measures.)*

To survey the above-mentioned populations, consider the use of quantitative and qualitative surveys, focus groups, observational research, cultural probes, and other means to assess key needs of these populations and how they are supported or frustrated by building design. This should be followed up by the application of conjoint tools to assess veteran, family, and staff priorities.

To develop system-wide metrics for measuring satisfaction, consider building on and improving currently used measures by VA, such as the Survey of Health Experiences of Patients (SHEP), as well as by others, such as the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) and National Institute for Occupational and Safety Health (NIOSH) Quality of Worklife Questionnaire.

Recommendation D, *Design Guidelines: Develop design recommendations/guidelines for new and existing healthcare, mental health, rehabilitative, residential, and long-term care facilities to improve veteran, family, and staff satisfaction with VA care delivery and their overall VA healthcare experience.*

Consider leveraging the findings in the foregoing recommendations to provide specific spatial, environmental, technological, and other recommendations and guidelines that, when implemented, will respond to veteran, family, and staff needs and provide for a more satisfied healthcare experience. Additionally, consider surveying existing facilities to determine their ability to meet these spatial and environmental conditions currently or by retrofit.

CHAPTER 4 Adaptability

Adaptability Committee Principal Recommendation: ***Provide transformable building environments that accommodate changing needs, functional programs, and care delivery practices over time.***

VA currently provides healthcare in a number of different physical settings: the acute care hospital, outpatient clinics, dedicated residential facilities, and through home- and community-based programs. Each must be adaptable to changing conditions and requirements, but the constraints to change vary widely among the four. The acute care hospital presents the most complex constraints on capacity to change, while the homecare setting may have the least demand for physical change once configured and equipped correctly.

Adaptability focuses on the capacity of the physical asset to accommodate change on at least four levels of intervention: the site and its infrastructure, the base building and its MEP infrastructure, the fit-out or spatial layout, and the equipment and furnishings specific to VA healthcare operations. Accommodation capacity requires careful design of structural systems, MEP systems pathways, and establishing a clear hierarchy of public and patient/care-giver circulation paths. The capacity for change at all levels of intervention is vital to all VA service venues—hospitals, clinics, residential facilities, storefronts, team facilities, and veterans' homes.

Adaptable facilities should accommodate changes in healthcare delivery strategies and changes in medical technologies. The change-ready facility adapts to changing healthcare staffing services, adapts as the building ages, adapts to alternate uses (such as office or residential services), and provides capacity for increased demand and casualties in disasters. VA facilities should be designed to anticipate and respond to trends that may be uncertain and unforeseen.

The Adaptability Committee addressed the following changes in healthcare delivery strategies, technology, and the healthcare marketplace.

- Changing patient population and their needs
- Changing healthcare staffing services including interdisciplinary teams
- Ambulatory care
- Chronic care
- Genomic-based research and patient care
- Tele-health medicine
- Robotics
- Translational medicine (clinical research integrated into patient care)
- Acceptance of the family/caregivers in the healing process
- Non-traditional modes of therapy (alternative medicine) such as acupuncture and massage therapy

- Digital/paperless communications, data storage, sensors
- Patient/family education
- New knowledge and designs derived from evidence-based research
- Specialized facilities (age- and disease-appropriate facilities for patient and caregiver population)

A further dimension of adaptability is the ability to respond to biological or other acts of terrorism, infectious pandemics, and other community needs in a time of natural disaster.

As presented in Part 1 of this report, VA may be entering into over-capacity in its acute care hospitals in some locations, given a projected decreasing, but migrating and aging, eligible-veteran population. This will have strong implications on the need for adaptability of VA healthcare facilities across the spectrum of facility types.

The Adaptability Committee recommendation regarding VA facilities adaptability encompasses six proposed supporting activities for VA to consider.

- Conduct a series of case studies of best practices in hospitals both inside and outside the VA system to determine actual experiences and lifecycle costs of flexible, change-ready healthcare facilities.
- Develop a plan to address how VA hospitals and ambulatory facilities can more effectively avoid premature obsolescence.
- Evaluate VA adoption of emerging adaptability innovations, including procurement methods congruent with the new requirements and realities.
- Assess institutional barriers within and external to VA that discourage or prevent increasing the adaptability of healthcare facilities.
- Develop a pilot project for facility replacement.
- Develop strategies for increased resilience and passive survivability in new facility design and existing facility and infrastructure upgrades.

Each supporting activity is detailed below. In addition, the committee recommends that each organizational element involved in evaluation of facility adaptability decision-making identify and describe specific performance metrics and data requirements for all its activities.

Recommendation A, *Change-Ready Best Practices: Conduct a series of case studies of "best practice" hospitals both inside and outside of the VA system to determine actual experiences and lifecycle costs of flexible, change-ready healthcare facilities.*

VA should design and conduct a series of case studies of "best practice" hospitals, congruent with VA hospital types, outside the VA system to assess the relation between planned change-readiness and actual experience of change at several levels of intervention (such as base-building, fit-out, equipment, and furnishings). A similar study should be conducted of a sample of VA facilities.

The case studies should explicitly link service-life, investment horizon, and degree of change readiness.

A modest investment would provide VA with a baseline of information on which to make decisions on investing in enhancing facility capacity to accommodate future change as it occurs. This could accomplish several things: reduce operating costs, down time, and disruption; extend the useful life of VA hospitals; and allow change to occur in a more efficient way so that optimum functional relationships could be preserved.

Along with establishing a baseline for change in VA facilities, VA should do an audit of facilities, both nationally and internationally that claim to be designed to accommodate change.[12] This should include not only new facilities, but also older facilities that have actually experienced a good deal of change. Both the consequences on operations and the cost should be well documented. VA would then have a state-of-the-art profile upon which judgments can be made as to future VA facility design. Then VA can decide whether to push the boundaries further in terms of designing facilities to accommodate change.

Recommendation B, *Avoiding Premature Obsolescence: Develop a plan for addressing how VA hospitals and ambulatory facilities can more effectively avoid premature obsolescence.*

Reducing premature but differential obsolescence is important to the future development of VA's building infrastructure.

"Obsolescence," the condition of being antiquated, old fashioned, or out of date, results when there is a change in the requirements or expectations regarding the shelter, comfort, profitability, or other dimensions of performance that a building or building subsystem is expected to provide. Obsolescence may occur because of functional, economic, technical, or social and cultural change.

"Design service life" is the period of time over which a building or a building subsystem or component (such as the roof, mechanical equipment, plumbing, or sheathing) is designed to provide at least an acceptable minimum level of shelter or service as defined by the owner. It typically depends on assumptions, sometimes implicit, regarding satisfactory completion of normal maintenance activities. A facility or subsystem may have an idealized service life based on expectations.

[12] The recently opened Martini Ziekenhuis in Groeningen, the Netherlands, is recommended as a best practice case study. It incorporates many strategies to accommodate change, including 100% movable walls. Also recommended is the Mayo Clinic's Gonda Building. Another is the INO Hospital in Bern, Switzerland, which used the Systems Separation approach in its procurement and design. The Open Building/System Separation procurement method is further discussed in Chapter 7 Building Acquisition, Recommendation A.

"Premature obsolescence" is the failure of a building, building subsystem, or the functional capacity to provide the anticipated design service life.

In the past 50 years, VA healthcare facilities have changed to accommodate new technologies, revised building codes, the shift from inpatient care to ambulatory care, changing social standards, and many other factors. VA has a unique additional challenge in its need to respond to changing legislative mandates and widely varying patient population and service needs.

In addition to internal change, the need to expand raises questions as to the site infrastructure and best building configurations to accommodate additions and incremental replacement of obsolete facilities. A facility that cannot efficiently expand may inevitably lead to premature obsolescence of the site.

In an era that emphasizes dispersing/integrating care within communities, it may be more effective to consider building very durable 100+ year buildings that are intrinsically habitable, so that they could be used for other functions, and highly flexible, so that they can accommodate changes in care delivery over time. Europeans have been accommodating the same essential care practices in intrinsically habitable buildings (such as those with daylighting and operable windows) for many decades.

Recommendation C, *Emerging Innovations: Consider continuous evaluation of VA adoption of adaptability innovations.*

Continuous evaluation of emerging adaptability innovations should encompass three distinct activities at VA.

> *1. Evaluate design of systems (especially systems that cannot be changed economically in the future) for a range of activities, not just the initial configuration and use.*
>
> There are some components of a building that are too large, too expensive, or too critical to be replaced in any subsequent renovation. At the same time, a great deal of change needs to occur in acute care facilities over their lifetime. To assure the ability to accommodate change is available and economical, building components that cannot be replaced easily should be sized for a range of activities, not just the opening configuration.
>
> Design calculations for such components might be made on the basis of probable use for the zone or space served by the component. For example, a large trunk air distribution duct might be sized for a variety of potential uses in the future: exam space at first, then a variety of diagnostic and treatment types of activities that might occur in subsequent

remodeling. While this does not assure total adaptability, it greatly enhances the ability to accommodate change.

2. Evaluate the planning of building systems so that increments of the building (modules) may be shut down for renovation without affecting other parts of the facility.

There are many reasons to plan building MEP systems in acute care facilities that can be shut down in increments. The nature of a hospital is such that it operates on a 24-hour basis with services for patients that are critical and cannot be discontinued. However, the need to change the function of certain parts of the hospital over time is inevitable. HVAC, piping, and electrical systems that can be shut down in small increments will facilitate renovation, while allowing the rest of the hospital to function in a normal fashion. In many cases where renovation is necessary, these systems need to be upgraded or significantly altered. Clear pathways disentangled from structure and walls enable these building infrastructure elements to be accessed and replaced with minimal perturbations. A modular approach to the design of these systems will greatly facilitate future change.

In addition, with today's biohazard threats and the prevalence of new mutations of harmful organisms, such as SARS and bird flu, the ability to isolate components of the hospital can be facilitated by having air systems designed in small increments or modules. This would allow certain portions of the hospital to be isolated and would also facilitate subsequent cleaning and decontamination.

3. Investigate the potential effectiveness of the wide use of movable/demountable (M/D) wall systems (as a prototypical example of a product innovation).

Space configuration changes are inevitable in healthcare, but are normally expensive and disruptive. With wide use of M/D wall systems in outpatient diagnostic and treatment, inpatient unit support, research, and administration areas, configuration change can occur as a series of frequent incremental adjustments, avoiding large area reconfigurations requiring programmatic downtime. The ability to maintain a close fit between spatial configuration and program by the use of M/D walls will significantly reduce horizontal travel time, programmatic fragmentation, inefficient space utilization, interim moves and departmental relocations, and increase space use efficiency over time.

Infection control professionals have identified a significant risk to immune compromised patients presented by construction dust and mold spores released by common building material demolition. When renovations take

place, the implementation of infection control measures has been estimated to add 5-10 percent to both the cost and schedule for a typical renovation.

While there are no movable/demountable wall systems available in North America that are full-purposed designed for use in healthcare, interest by VA in the use of M/D wall systems would likely inspire M/D wall and associated system research and development.

Recommendation D, *Institutional Barriers: Assess institutional barriers within and external to VA that discourage or prevent increasing the adaptability of healthcare facilities.*

The study of best practices in hospitals (*see* Recommendation A above) should make clear to VA the institutional barriers to increasing the adaptability of healthcare facilities.

Adaptability must be considered on at least two different levels: first, the ability to reconfigure the VA delivery system, facilities, and workforce to reduce dependency on large acute-care hospitals and long travel distances for veterans and their families; second, to be able to reconfigure and re-equip all the settings in which healthcare is delivered to respond to changing needs.

Assuming that projections are correct, the veteran population will shrink over time, while the average age and the number of women veterans increases. One aspect of adaptability is to be able to reconfigure existing health facilities to accommodate a smaller total workload, more chronic and home-based care, and the special needs of a female population.

In order to account for continuous adaptation, something measurable must first be in place. Reference to the design of updated or renovated infrastructure can be instructive, such as IT infrastructure. Perhaps more pertinent, some of the similarities of VA to smaller but relatively large private healthcare systems (such as Ascension or Sutter) are that each has many facilities in widely dispersed geographic settings, each designed by a different firm, and built by a different construction company. Individual organizations (Ascension, for example) are now trying to streamline and standardize procurement by establishing relationships with firms that can design many of their facilities. However, many organizations may not necessarily want to go the route of a template approach (Kaiser) or pursue a new version of the VA Hospital Building System (VAHBS). VA will benefit from studies of how these organizations are striving to get the facilities they want.

Recommendation E, *Pilot Project for Facility Replacement: VA has a substantial inventory of existing facilities in all stages of suitability for providing healthcare consistent with current and future standards.*

Many VA facilities may be heading for premature obsolescence. That is, they may not be appropriate for the VA's mission of delivering healthcare long before some of the building components reach the end of their functional life. For example, the structure may be functional for the next 100 years, but other elements such as the mechanical or electrical systems may be nearing the end of their useful life.

The challenge of upgrading selective components of existing buildings is compounded when the original building was not designed for change. VA has some of its hospitals that were designed using the VA Hospital Building System (VAHBS) with a highly organized system of utilities and high floor-to-floor heights. VA should determine whether or not VAHBS buildings can be upgraded more cost effectively than other building systems, which may not lend themselves to any cost effective approach to upgrading.

It is recommended that VA select a pilot project from each distinct building type in its inventory. These pilot projects would be used to track the initial cost of upgrading against the long-term savings in operational cost.

Initially, the upgrades might focus on energy savings consistent with Federal guidelines for energy efficiency. Upgrades might include replacing the skin of a building to gain better thermal transfer performance. Or, a second skin might be placed outboard of an existing skin for more efficiency. Early discussions indicate that it might be possible to get a seven-year payback in energy savings from such an approach. This, of course, depends on many variables such as climate and energy cost.

Another approach would be to undergo a comprehensive retrocommissioning[13] of mechanical systems with the objective of achieving energy efficiency. It might also be possible to install reliability maintenance devices in existing systems, particularly critical systems. The benefits of such an approach occur not only in the ability to schedule maintenance more efficiently, but also in preventing disruption in the normal functioning of the hospital. To a lesser extent, other building types such as ambulatory clinics could also benefit from such a program. This is particularly true for older buildings in the inventory. *See* Chapter 3

Water conservation is a critical issue, especially so in certain locations. A retrocommissioning program might well include water systems where conservation is a factor.

There are many other areas where a "tune-up" could result in enhanced operations or long-term cost savings. The pilot program would be geared to tracking first cost and long-term cost savings plus documenting any operational enhancements.

[13] *See* Chapter 6 Building Operations and Maintenance, Recommendation E for definition.

Recommendation F, *Passive Survivability for Emergency Management: Develop strategies for increased resilience and passive survivability in new facility design and existing facility and infrastructure upgrades.*

"Passive survivability," the ability of our healthcare infrastructure to continue to function in times of emergency without massive inputs of grid-source energy and potable water, has important relationships to energy and water conservation, on-site sewage treatment, renewable energy, adaptability, daylighting, and other building attributes. Recent weather events and wide-area power outages have indicated that current healthcare infrastructure, despite multiple backup systems, may be less resilient than it needs to be.

CHAPTER 5 Sustainability

Sustainability Committee Principal Recommendation: ***Provide sustainable building environments that meet the needs of the present without compromising the ability of future generations to meet their own needs.***

The Sustainability Committee recommendations VA consider developing approaches to provide the adequate support and oversight necessary to ensure that sustainable strategies are successfully incorporated into VA projects. A review of appropriate green/sustainable certification systems would assist VA in identifying strategies that complement and support existing VA goals and objectives. VA should identify and require best practices that facilitate the development and delivery of high-performance, adaptable, and sustainable healthcare facilities. Continuous commissioning[14] and energy modeling should be included in best practices.

Central to the selection and implementation of sustainable strategies and best practices should be a commitment to whole lifecycle value in lieu of initial cost. Cost-benefit analyses and return-on-investment (ROI) calculations should be used to evaluate both quantifiable benefits (such as energy-saving features) and qualitative benefits (such as error reductions, productivity, and retention of care-delivery professionals).

The Committee developed six supporting recommendations for sustainability initiatives for VA to consider.

- Create initiatives to take advantage of the relationship between sustainable building practices and their effect on patient healing.
- Adopt policies and procedures to achieve carbon-neutral buildings by 2030, include whole lifecycle cost models.
- Prioritize water conservation strategies in all construction and retrofits, particularly in areas of the U.S. with current or projected potable water scarcity.
- Consider the lifecycle impacts of materials used in construction with a focus on reducing the environmental footprint (i.e., embodied energy) of material selection and use.
- Develop tools to measure the facility's environmental footprint, including the effects of energy use, transportation, sourcing of products (including food), and waste, as a means to develop facility and procurement solutions that include consideration of environmental factors.

Recommendation A, ***Sustainability and Patient Healing: Create initiatives to take advantage of the relationship between sustainable building practices and their effect on patient healing.***

[14] *See* Chapter 6 Building Operations and Maintenance, Recommendation E for definition.

Patient healing can be enhanced through sustainable design practices. VA should investigate integrating such practices into the design of all healthcare, mental health, rehabilitative, residential, and long-term care facilities. For example, access to natural lighting has shown remarkable healing results. Outdoor places of respite and other natural and environmental factors such as vegetation, healing gardens, labyrinths, walking trails, and related outdoor amenities should be considered for incorporation into VA facilities. Resident or patient controls for light, heating, humidity, entertainment, and communications systems for individual use are desirable features. *See also* Chapters 1 and 2

Recommendation B, *Carbon-Neutral Buildings: Adopt policies and procedures to achieve carbon-neutral buildings by 2030, including considerations of cost models.*

The Federal mandate on VA, EISA, calls for a 60 percent reduction in energy demand in new buildings coming on line by 2015, with the goal of achieving carbon neutrality by 2030.[15] Similar targets are set for renovated facilities. The Cascadia Green Building Council Living Building Challenge[16] postulates zero net energy buildings that require no more energy than they produce on-site. In order to effectively reach these aggressive targets, a climate-responsive approach is required. Energy conservation and renewable solutions differ in cold and hot climates, as well as in dry-versus-wet areas. VA should develop specific system strategies for each U.S. climate zone that provide effective guidance to design teams and infrastructure upgrade teams undertaking capital improvements for each of the following components: building siting and envelope considerations, mechanical system selection, and implementation of on-site renewable energy.

Energy sourcing both in terms of clean energy sourcing and source efficiency is critical. The quantity of energy used in buildings is extremely important, and the quality of the energy used needs to be considered during the design process. As a general rule, low-grade energy, such as passive solar, waste, geothermal/geo-exchange energy should be used before considering using fossil fuel or electrical power.

[15] *Energy Independence and Security Act of 2007* (EISA) establishes a new and aggressive plan for achieving energy independence in our nation's building stock by the year 2030. The act requires that Federal buildings (both new construction and renovations) achieve fossil fuel-generated energy consumption reductions on the order of 55 percent in the year 2010 to 100 percent in 2030. The act also requires that sustainable design principles be applied to siting, design, and construction. In addition, EISA defines high performance buildings as the integration and optimization on a lifecycle basis all major high performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.

[16] http://www.cascadiagbc.org/resources/living-buildings/living-building-challenge/

Recommendation C, *Water Conservation Strategies: Prioritize water conservation strategies in all construction and retrofits, particularly in areas of the U.S. with current or projected potable water scarcity.*

VA should consider strategies that include the productive and safe use of captured rainwater and recycled water to displace the need for and use of potable water for process uses. Potable water reduction strategies should also be considered. Through innovative and strong measures, VA can lead the healthcare industry in water conservation efforts.

Recommendation D, *Materials Lifecycle: Consider the lifecycle impacts of materials used in construction with a focus on reducing the environmental footprint (i.e., embodied energy) of material selection and use.*

Material lifecycle begins with extraction/recovery and includes all stages of production, use, and disposal. Broadly speaking, it includes considerations of material sourcing (distance from extraction or production and environmental outcomes associated with manufacture), transportation, durability, salvage, recycling, and demolition.

Recommendation E, *Measure Environmental Footprint*: *Develop tools to measure the facility's environmental footprint, including the impacts of energy use, transportation, sourcing of products (including food), and waste, as a means to develop facility and procurement solutions that include consideration of environmental factors.*

As a system, VA is in a unique position to gather comprehensive data on energy use, transportation requirements for access by patients and staff, and sourcing of medical and non-medical products and food (product-miles).[17] As part of the environmental footprint measurement initiative, VA should develop or adapt a methodology to assess the locational energy[18] demand imposed by the distribution of its services, the location of its facilities, and confirm the assumption made by many that lower overall locational energy demand equates to greater ease of access for patients and staff, as well as increased community integration. The more dispersed the care provided, the less energy consumed. Facilities served by public transport in dense urban areas, for example, consume less locational energy.

[17] For comparison, The National Health Service in the United Kingdom, after determining that 22 percent of its environmental footprint was attributable to transportation, moved from large, centralized ambulatory care centers to decentralized models.

[18] Locational energy is defined as the total energy consumed to access a facility or a system of facilities by all categories of users.

CHAPTER 6 Building Operations and Maintenance

Building Operations and Maintenance Committee Principal Recommendation: ***Provide more effective and efficient building environments through innovative monitoring, operations, and maintenance.***

This chapter addresses building operations and maintenance from the perspective of building systems and infrastructure to achieve effective and efficient facilities.

The effective performance of building environments results from the proper design, procurement, installation, operation, and maintenance of building systems. Building systems consist of several subsystems: structure, exterior envelope, interior partitions and finishes, mechanical and electrical networks and equipment, and equipment and furnishings. These subsystems provide the performance to support occupant functions, health, safety, comfort, environmental sustainability, and satisfaction.

The Committee recommends that VA consider developing effective mechanisms to realize improved performance both in new buildings and in the large existing portfolio of VA facilities: hospitals, Community-Based Outpatient Clinics (CBOCs), Community Living Centers (CLCs), storefront Vet Centers, and the new Mental Health Residential Rehabilitation and Treatment Programs (MHRRTP) domiciliary, as well as veterans' homes.

Considerations for all building elements and systems include:

- Accommodation of future change
- Support of a healing environment
- Reduction of infectious organisms
- Improving disaster resilience
- Allowance for routine maintenance of all systems with minimum disruption to patient care

Considerations for MEP systems include:

- Reliably manufactured equipment and materials
- Well-tuned systems
- Appropriate spaces
- Effective distribution

The Building Operations and Maintenance Committee recommendation regarding VA facilities building operation and maintenance encompasses six proposed supporting activities for VA to consider.

- Incorporate opportunities for assuring a higher degree of building system performance in the design, construction, and operation of new VA facilities.
- Analyze opportunities for retrofitting existing VA facilities with high performance building systems.
- Specifically consider systematic approaches to the renovation of specialized areas in VA hospitals.
- Implement and test reliability-centered maintenance (RCM) pilot programs for selected VA healthcare facility types and operations.
- Develop, test, and assess operational commissioning programs for optimizing operations at a range of VA healthcare delivery and facility types.
- Develop, test, and assess recommissioning and retrocommissioning programs for the existing VA portfolio of healthcare facilities.

Each supporting activity is detailed below. In addition, the committee recommends that each organizational element involved in evaluation of facility operation and maintenance decision-making identify and describe specific performance metrics and data requirements for all its activities.

Recommendation A, *New Building System Performance: Incorporate opportunities for assuring a higher level of building system performance in the design, construction, adaptation, and operation of new VA facilities.*

This recommendation applies to all facilities serving all levels of patient care and acuity in the VA system. The following are recommended as considerations in upgrading VA standards to achieve this goal.

- Incorporating the performance goal of accommodating future alterations with minimum disruption and cost. For example, components of the mechanical or electrical system that cannot be economically or physically changed should be sized for a range of activities, a previously agreed to set of performance criteria that would accommodate more than the initial spatial configuration.
- Add a level of performance specificity to current VA standards for all building systems, including their maintenance. For example, current VA standards say, “steam traps shall be readily available for ease of maintenance.” This language seems self-explanatory but does not offer any specifics for what ease of maintenance means or what readily available means. Such instructions should be tied to a specific test procedure or a specific set of design requirements that define availability and ease of maintenance.
- In the selection of materials, specifically consider their maintenance and cleaning requirements.

- Consider requiring a rigorous, independent post-occupancy evaluation process for all new VA facilities.[19] This should include a one-year and five-year evaluation.
- Enhance the current commissioning process by applying total building commissioning for all building systems.

Recommendation B, *Retrofit Systems*: *Analyze opportunities for retrofitting existing VA facilities with high-performance building systems.*

Retrofitting needs and opportunities to support occupant functions, health, safety, comfort, satisfaction, and disaster mitigation vary for each type of facility; each requires its own analysis. High-performance building systems that are becoming common in other building types (hospitality, office, retail) may be applicable in selected areas of hospitals and clinics. Needs and opportunities for adapting residential environments to accommodate aging veterans with reduced acuity, mobility, and other capacities by the provision of materials, finishes, and systems pose a distinct area of research and analysis.

Opportunities identified should be practical and acceptable to the operations staff.

Recommendation C, *Specialized Renovation: Specifically consider systematic approaches to the renovation of specialized areas in VA hospitals.*

The Committee used the renovation of VA clinical laboratory spaces as a prototypical example of the recommended approach to renovate specialized areas within a healthcare facility. In this example, the laboratory space should be adaptable to changing equipment and emerging diagnostic technologies, which will have varying footprint and utility requirements.

- The space should be configured for maximum efficiency of workflow and reduced number of workstations required for operation in the face of limited staffing.
- Consideration should be given to logistics of rapid specimen transport to the laboratory. Improved turn-around time may reduce or eliminate the need for STAT orders, shorten patient wait time, and improve throughput in ER and other urgent care situations. This results in better quality of care and improved patient satisfaction.
- Blood-drawing facilities should be accessible and convenient for patients.
- Level of service should be appropriate to the level of care provided at the facility.

[19] Building-in-use post-occupancy evaluation survey methods, instead of more conventional models, may benefit VA. For additional information see Jacqueline Vischer, *Space Meets Status: Designing Workplace Performance* (New York: Routledge, 2005) and Chris Watson, *Green Buildings in Use: Post Occupancy Evaluations* (ISSN 1609-7548, PEB Exchange 2007/12 © OECD 2007, http://www.oecd.org/dataoecd/16/59/39344715.pdf).

Consider developing similar types of specifications for renovations of other types of specialized areas and functions.

Recommendation D, *Reliability-Centered Maintenance Pilots: Implement and test reliability-centered maintenance (RCM) pilot programs for selected VA healthcare facility types and operations.*

Since 1950, the U.S. airline industry has developed and fine-tuned the maintenance of aircraft under the paradigm called reliability-centered maintenance (RCM). The new Boeing 787 will have no preventive or predictive maintenance program, only reliability checks during its lifetime. By the 1990s, many large industries had increasingly followed the lead of the U.S. airline industry and adopted RCM to gain the advantages afforded by this technique.

Two key advantages of RCM are fewer unscheduled shutdowns of systems and a higher, more accurate predictability of failure. This allows for corrective maintenance to be scheduled at convenient times, instead of responding to catastrophic failures. RCM shifts the concept of maintenance from performing prescribed routines on many items to providing instrumented monitoring (under the concept of condition monitoring) for the critical elements of fewer pieces of equipment, with less invasive maintenance for the rest. It also redefines the terms used for failures from those related to equipment malfunction to terms of the effects on the equipment's customers, such as patients and staff.

Recommendation E, *Operational Commissioning: Develop, test, and assess operational commissioning programs for optimizing operations at a range of VA healthcare delivery and facility types.*

The ability to provide an optimally run plant starts with its initial commissioning. The concept of commissioning, however, is not well defined and can be applied to an item of equipment, an individual system, or an entire plant. Operational commissioning fits the purpose of operating the total plant in a manner that adjusts to the organization's operational preferences and provides the best running parameters for customer satisfaction and energy efficiency.

Energy Independence and Security Act of 2007 (EISA)[20] Subtitle C—High-Performance Federal Buildings requires all Federal agencies to implement commissioning[21] programs in their new and existing facilities. The provisions

[20] *See also* Chapter 5 Sustainability, Recommendation B

[21] Commissioning: A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements. Defined in Guideline 0-2005, *The Commissioning Process*, from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), page 4.

also cover recommissioning[22] and retrocommissioning[23] and encompass both energy and water systems.

Consider the establishment of operational commissioning programs that encompass as many building and operational systems as possible. A first step might consist of a survey of the portfolio of facilities to determine the current status and effectiveness of ongoing commissioning programs and solicit recommendations for expanded programs.

Recommendation F, *Recommissioning and Retrocommissioning: Develop, test, and assess recommissioning and retrocommissioning programs for the existing VA portfolio of healthcare facilities.*

For facilities that have been in service a number of years, recommissioning or retrocommissioning are being shown to have significant merit. Most of these programs focus on the concept of providing energy savings. *See* Recommendation E above

[22] Recommissioning: A process of (i) commissioning a facility or system beyond the project development and warranty phases of the facility or system; and (ii) the primary goal of which is to ensure optimum performance of a facility, in accordance with design or current operating needs, over the useful life of the facility, while meeting building occupancy requirements. Defined in the *National Energy Conservation Policy Act* (42 USC 8253 Section 543(a)(1)) as amended by EISA Section 431.

[23] Retrocommissioning: A process of commissioning a facility or system that was not commissioned at the time of construction of the facility or system. *Ibid.*

CHAPTER 7 Building Acquisition

Building Acquisition Committee Principal Recommendation: ***Provide more effective and efficient strategies for the acquisition and delivery of new healthcare buildings and for their ongoing adaptation and expansion.***

The Building Acquisition Committee explored the acquisition and delivery of VA healthcare facilities. Building acquisition includes work at all levels of intervention, initially and over time. That is, in a base building that remains stable and constant, a new fit-out configuration may be designed and constructed, or in a stable environment with ongoing patient treatment, such as an emergency department or surgery suite, new equipment may be acquired and installed. This suggests attention to construction processes and management as well as to building programming and design. Particular attention needs to be paid to ongoing operations and any disruption during facility alterations.

VA facilities are never finished. A new building immediately becomes an existing building, and, once it is handed over to the client, it immediately changes places in the organizational chart, moving from the capital asset to the facilities management category. New is temporary, while existing is for the long haul. Thus, building acquisition is broadly interpreted to include not only the initial building construction process but subsequent acquisition activities such as renovation and expansion, and also facility operations and maintenance (O&M).

Attention to building acquisition should consider healthcare service delivery in cases where design and construction may not be needed or is minor, such as in home-based care. Metrics for acquisition should include time from inception to occupancy, budget reliability, acquisition within established cost parameters, surprise-free acquisition process, and provisions for long-term use and capacity to adapt to new requirements as medical practice changes.

One concept currently undergoing evaluation and implementation in the building industry is lean[24] design and construction. At its simplest, lean facility design and construction is focused on reduction of work-in-progress delays that add no value. Lean emphasizes concurrent actions/activities wherever and whenever possible. The intent is to shorten overall acquisition time, increase throughput, and maximize utilization of resources and assets. Hence, for example, just-in-time concepts may be valuable in construction. It should be noted however, that

[24] Lean construction is a translation and adaptation of lean manufacturing principles and practices to the end-to-end design and construction process. Unlike manufacturing, construction is a project based-production process. Lean construction is concerned with the holistic pursuit of concurrent and continuous improvements in all dimensions of the built and natural environment: design, construction, activation, maintenance, salvaging, and recycling. This approach tries to manage and improve construction processes with minimum cost and maximum value by considering customer needs.

design and construction processes and the firms that provide them tend to be one-off and quite dissimilar to an automobile assembly plant, the original model for lean process. In the building industry, diverse firms are assembled for each project design; those constructing a building may never have worked with the designer or with each other before.

The Building Acquisition Committee recommendation consists of four specific subordinate recommendations for VA to consider.

- Conduct a detailed and wide-ranging assessment of alternative procurement models including lean business process management concepts, lease, lease-to-buy, public/private joint ventures, and other models of obtaining and operating facilities.
- Establish a means of investing in research and innovations beyond budgetary norms where these are likely to produce improved facility acquisition methods or long-term operational savings. Establish a system of tracking long-term savings and/or cost of these investments as a return on investment (ROI).
- Conduct a limited (10-year) experiment to investigate potential and actual design impacts of merging the budget authority for capital asset acquisition with the budget for O&M and VA facility upgrade work.
- Adopt current practices of integrated design and construction.

In addition, the committee recommends that each organizational element involved in evaluation of facilities building acquisition decision-making identify and describe specific performance metrics and data requirements.

Recommendation A, *Alternative Procurement Models*: *Conduct a detailed and wide-ranging assessment of alternative procurement models including lean business process management concepts, lease, lease-to-buy, public/private joint ventures, and other models of obtaining and operating facilities.*

Such an assessment should be open to models that call into question existing procedures at VA. Assessments should include: ability to assure desired short- and long-term operational performance, time from inception to occupancy, legal barriers to the procurement method, budget reliability and predictability, incidence of cost overruns or other unanticipated events, user satisfaction with the end product, and whole lifecycle value. Current VA procurement methods should be used as a baseline for comparative purposes.

Private healthcare systems such as Kaiser, Sutter, St. Vincent's, Ascension, and others share some characteristics with VA: they have many facilities of various kinds spread over large geographic regions; each facility is situated in a particular climate, demographic and service provider context; and all are designed, built, adapted, and managed by unique teams organized for each new construction or renovation or expansion project. VA could benefit from the

conduct of a careful study of how private sector entities procure facilities and how the facilities perform as investments over time.[25]

There are also international models, such as Open Building/System Separation, that VA could assess. Open Building/Systems Separation is a procurement and design method that distinguishes technically and contractually between a base building (core MEP pathways, shell, and primary circulation pathways); a fit-out (spatial layout and secondary MEP systems installations); and equipment and finishes (movable equipment defining functions). Since the base building is designed to accommodate a variety of functional configurations, it can be designed and built before the detailed functional space programming is undertaken with input from all levels of the organization. Programming assumes a fixed base building as the site. This compresses the time needed to deliver the project and assures that the base building investment is change-ready, both during initial provisioning and over the long term.[26]

Recommendation B, *Investment in Research and Innovations: Establish a means of investing in research and innovations beyond budgetary norms[27] where these are likely to produce improved facility acquisition methods or long-term operational savings. Establish a system of tracking long-term savings and/or cost of these investments as a return on investment (ROI) over time.*

Because assessments of experience in non-VA settings require resources and because innovation is often untested or requires funding beyond budgetary norms, VA is encouraged to develop an investment research fund (looking at investment in the future rather than first costs only) to support these recommendations and other forward-looking ideas that require multiple year tracking and study.

VA should investigate ways to test the concept of establishing two categories for budgeting. The first would be a conventional fixed cost budget. The second would be an investment account. The latter would be a special account for money that would have a long-term repayment period; it would be considered an investment, say in new technology, and the pay off would be tracked once the facility is in operation over a period of years. The amount of this fund could be a small percent of the budgeted construction cost of the project. A report on the long-term savings achieved would be an argument for expanding the program.

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[25] Ascension, for example, is presently exploring the concept of securing the services of single design/build entity for a large number of facilities. Others, such as Kaiser, are already doing similar programs of acquisition using a template approach to streamline regulatory review.

[26] Kendall, Stephen, ed., 2008. *Systems Separation, Open Building in the Inselspital Bern INO Project*. Bern: Stämpfli Verlag AG, SIMOWA. 88-93. (ISBN 978-3-908152-27-9)

[27] These budgetary norms statutorily require facility funds to be authorized, appropriated, allocated, and spent through separate fiscal mechanisms, which currently may not be mixed for lifecycle management.

There is ample evidence that obsolete organizational structures and habits can undermine the implementation and survival of new ways of working. Resistance to new procedures and methods is natural and creates both a stabilizing effect as well as lack of organization agility in the face of new realities. But, reality always has a way of forcing itself on organizations. The best adapt; the rest fall to the wayside.[28] In addition, the new ways of working threatened entrenched interests and associations and called into question the familiar landscape of practices and methods. In any innovative acquisition method, this might be the biggest challenge for VA to overcome.

Recommendation C, *Merged Budget Authority Experiment: Conduct a limited (10-year) experiment to investigate potential and actual design impacts of merging the budget authority for capital asset acquisition with the budgets for operations and maintenance (O&M) and VA facility upgrade work.*

VA should obtain the authority to conduct a limited experiment over the next ten years in several facilities (both existing facilities and facilities in the pipeline but not yet in the design phase) where the budget authority for capital asset acquisition is merged with the budget for O&M and facility upgrade work.

One of the major impediments to innovation in large organizations is the separation of financial accounting for acquisition and operations. That is, there is a budget for acquisition and a totally separate budget for yearly operations. Often the responsibilities for these budgets are in two separate organizational elements with different leadership and reporting responsibilities. This means that any investment in innovation that increases first (acquisition) cost while substantially reducing long-term cost cannot be considered. Savings in operations do not link to any increase in first cost. Likewise, any reduction of first cost (value engineering) does not link to increased operating cost.

Joining budgets for acquisition and long-term operation and renovation, once accomplished, would push the facility management and those responsible in the VISNs and the Central Office level to insist that the design and construction teams design long-lived, change-ready buildings. The English have experimented with their private finance initiative (PFI)[29] program which totally changed the relationship between the design/construction team and the provider

[28] For example, when GSA embarked on a new way of acquiring office buildings (a process that came to be called the "Peach Book"), the innovative practices that were implemented in three pilot projects were eventually killed largely because the champion of the effort left the organization and the intellectual and methodological infrastructure was not in place to help the changed way of working take root and endure.

[29] PFI uses private investor financing in 25- to 30-year loans to the public. Debt is paid down annually. The agreement includes long-term maintenance of the facility and sometimes cleaning, transport, and food service. While the program is controversial in England, over 50 projects have used this scheme and another 30 are under construction. There are problems, but it would be worth VA taking a closer look to see if a modified PFI could become a useful program here.

of health services. There may be ways of linking design and construction to long-term performance of a building that does not require that degree of commitment but can achieve substantial improvement in performance.

Recommendation D, *Integrated Design: Adopt current practices of integrated design.*

Integrated design is a process in which the design and construction team works together with user representation on seemingly unrelated aspects of design in a manner that permits synergistic benefits to be realized. The goal is to achieve high performance and multiple benefits at lower cost. The process often includes integrating sustainable design strategies into conventional design criteria. A key to successful integrated building design is the participation of people from different specialties of design: architecture, engineering, interior design, and landscape design, as well as from construction, building operations, and various aspects of the user community. By working together at key points in the design process, participants can often identify highly attractive solutions to building needs that would otherwise not be found.

CHAPTER 8 Data Acquisition

Data Acquisition Committee Principal Recommendation: *Provide self-monitoring facility environments that become a source of research data and information.*

The Data Acquisition Committee defines "self-monitoring" as the creation of an evaluation culture at VA applicable to all facility types. In addition to self-monitoring, this evaluation culture should include program evaluation, creation of living laboratories[30] for innovative building projects, and three-way knowledge translation activities where innovations and information are exchanged both vertically and laterally. Monitoring may also include embedded sensors to capture certain kinds of data continuously and unobtrusively. VA may choose to identify other potential sources of research data and information (such as post-occupancy evaluations, occupant surveys, and inspections) and develop applicable evaluations. Data should cover clinical outcomes and facility attributes and draw correlations between them, making effective use of performance metrics and standard benchmarks. *See also* Chapter 4 Adaptability, Recommendation A

The Data Acquisition Committee recommendation consists of four specific subordinate recommendations for VA to consider.

- Support the establishment of an evaluation culture in VA by making evaluation a separate, funded mandate.
- Develop clinical services and outcomes measures.
- Develop facility measurements for measuring cost/value offset (the business case) of design features within VA sites.
- Facilities must facilitate both research and training of staff.
- Create “living laboratories” within VA to gather clinical, financial, and facility information that is useful to local sites as well as VA- and industry-wide.

Each subordinate recommendation is detailed below. In addition, the committee recommends that each organizational element involved in data acquisition decision-making identify and describe specific performance metrics and data requirements.

Recommendation A, *Evaluation Culture*: *Support the establishment of an evaluation culture in VA by making evaluation a separate, funded mandate.*

The logical source of data is the building itself and its occupants. The committee heard anecdotes of multiple data acquisition activities, the results of which are

[30] http://www.siib.org/research/research-home/optimal-healing.html

not always reported back to staff. VA staff should be made partners in the data collection and routinely informed of the results.

Recommendation B, *Clinical Outcome Measurements*: *Develop clinical services and outcome measures.*

Data acquisition, communication, and use are critical to clinical outcomes, cost of care, and effective operational evaluation of VA facilities. Ensure that facilities and systems have methodologies and technologies for collecting varying sources of data needed to measure clinical outcomes, patient safety, and quality benchmarking metrics endorsed by, but not limited to, key organizations and government agencies,[31] as well as supporting professional and economic outcomes. These methodologies and technologies must support data acquisition in all VA care delivery environments (hospitals, CBOCs, nursing homes and CLCs, Vet Centers, HBPCs, and private homes). Due to the importance of patient privacy, the use of collected data must fully comply with all privacy laws and regulations.

Recommendation C, *Facility Measurements*: *Develop outcome standards for measuring cost/value offset (the business case) of design features within VA sites, to include indices of safety, quality, satisfaction, and cost.*

Make effective use of data by comparing performance metrics with standard benchmarks and by drawing correlations between these metrics and the clinical outcome data from Recommendation B above. Report all results; if correlations do not exist, then that is a valid conclusion as well.

While Recommendation B focuses on data representing the patient and the clinical process, Recommendation C focuses on data representing the facilities that support the clinical process. While these data should address all the physical attributes of the facilities, the following discussion addresses energy use as an example. There are many benchmark sources available for VA to use in comparisons with both new and existing facilities. Three generic types that are available and useful are recommended.

1. *Self benchmarking:* Each facility knows its own metrics with respect to the common measurements of performance, temperature, humidity, electricity, water, and fossil fuel use with respect to time. Self benchmarking simply compares a metric from one time period to another. While the practice is currently commonplace at each VA facility, this recommendation is to share information across all facilities.

[31] Such as the National Quality Forum (NQF) www.qualityforum.org, the National Committee for Quality Assurance (NCQA) www.ncqa.org, and the Agency for Healthcare Research and Quality (AHRQ) www.ahrq.gov.

2. Common building benchmarking: This is also a common method in that there are a number of similar facilities, both public and private, that share performance metrics for the purposes of comparison. The CBECS[32] has been the most famous example; however, it is often not used because the data set for healthcare is very small. VA has the ability to share information between facilities for comparison and similarities. The recommendation is to find methods to encourage this sharing in a way that is not threatening to the facility managers.

3. Simulation benchmarking: This method of benchmarking is the most powerful and the most useful for individual facilities. A facility is simulated using a powerful simulation engine, such as the DOE EnergyPlus[33], where the results are compared to actual performance. This will allow facility managers to model energy conservation proposals and to calculate accurate savings for justification of capital expenditures.

Recommendation D, *Staff Training:* Facilities must support both research and training of staff.

Include ongoing training of staff as IT systems and informatics play an increasingly prominent role in care delivery and shape facility design.

Recommendation E, *Living Laboratories: Create living laboratories[34] within VA to gather clinical, financial, and facility information that is useful to local sites as well as VA- and industry-wide.*

Evaluation should be a collaborative process between local sites and VA-wide initiatives. The nature of a living laboratory allows for effective data collection and three-way knowledge translation to create a centralized source of information for both local and VA-wide initiatives. Attention should be paid to the display and dissemination of both service data and facility data obtained in the living laboratories.

[32] Department of Energy, Commercial Building Energy Consumption Survey is a national sample survey that collects information on the stock of U.S. commercial buildings, their energy-related building characteristics, and their energy consumption and expenditures. http://www.eia.doe.gov/emeu/cbecs/
[33] http://www.wbdg.org/tools/eplus.php
[34] http://www.siib.org/research/research-home/optimal-healing.html

CHAPTER 9 Continuous Innovation

Continuous Innovation Committee Principal Recommendation: *Develop new solutions for optimum coordination of best practices in healthcare and in the design, adaptation, and operations for the transformation of healthcare facilities that will provide 21st-century care.*

Establishing an "Innovation Center," with a dedicated budget for the center's activities, within VA would provide the opportunity to develop concurrently new solutions for optimum coordination of best practices in the delivery of healthcare and the design, alterations, and operations of healthcare facilities.

Planning for future flexible and sustainable healthcare facilities will require an understanding of alternative futures in the healthcare system. Achieving dramatic gains in efficiency and quality to reduce costs requires fundamental reengineering of healthcare processes. The center should include a way to continuously monitor and advise VA.

An innovation center within VA is premised on the observation that future healthcare systems including facilities will be different than today. An innovation center could examine questions such as:

- What are veterans' healthcare, mental health, rehabilitative, residential, and long-term care needs now and in the future?
- What are the future characteristics of advanced systems of care and how can they be integrated?
- What are best practices?
- Where can innovations be tested within the VA system of care delivery?

As VA care delivery transforms for the 21st-century, an Innovation Center establishes the place to create transformation of the facilities where that care will be delivered.

VA should look at the SPARC (an acronym for *See, Plan, Act, Refine, and Communicate*)[35] lab at the Mayo Clinic that examines how healthcare is delivered to patients. The SPARC lab is designed to "identify, develop, test and measure innovative processes for healthcare delivery through real-time experimentation in a clinical setting." The lab examines healthcare delivery processes at the intersection of patients and caregivers.

An innovation center should also assure that three-way knowledge translation—a process whereby innovations and information are exchanged both vertically and laterally—is integrated into the center's operational functions. Historically, knowledge translation has referred to research results getting out into practice, a vertical "top-down" approach. Today, some of the most innovative and useful

[35] http://www.mayoclinic.org

discoveries are made out in the field requiring that that information be transferred "bottom-up," imparting practical information on relevance and value to the experts. In a similar way, community innovation and information transfer laterally across application sites through learning communities is a key aspect of any knowledge translation process or center.

In its deliberations, the Committee on Continuous Innovation examined opportunities for VA from the standpoint of future challenges facing the entire spectrum of veterans' care. Looking at potential changes in healthcare, it took a long-term view at how these changes could affect VA facilities planning. The committee found the distribution of facilities, information and medical technology, long-term care, and staff and caregiver education were overarching concerns. In this light, the four recommendations below are presented for VA to consider.

- Examine potential future systems of care that provide easy access to appropriate levels of health services in various venues from home self-care to distributed clinics and acute care facilities that effectively serve beneficiaries within a geographic region.
- Explore the influence of new information and medical technologies on healthcare services and the building environments in which such services take place.
- Extend VA's continuous and seamless coordination among its various types of healthcare facilities to the long-term care environment, in particular the home as a healthcare environment.
- Maintain and expand staff and caregiver continuing education, training, and outreach programs.

Recommendation A, *Dispersed Healthcare Facilities: Examine potential future systems of care that provide easy access to appropriate levels of health services in various venues from home self-care to distributed clinics and acute care facilities that effectively serve veterans within a geographic region.*

Dramatic advances in healthcare may require fewer, smaller, high-capacity hospitals that might be shared by government and civilian systems. VA should consider developing appropriate building environments that support a more dispersed, coordinated, and scalable range of healthcare services.

As medical advances enter practice, care will shift away from hospitals and other dedicated healthcare facilities to home self-care, virtual health delivery capabilities, care provided at convenient places such as retail clinics, and so on. Less care will need to be provided in hospitals, and so their purpose and distribution must change to be convenient and cost effective. Systems of care delivery must dramatically increase to provide effective, convenient care across a wider spectrum of venues. Therefore, the capacity and distribution of hospitals to meet new delivery systems must be considered when selecting locations,

determining capacities, and creating flexible designs for new and upgraded VA facilities.

VA should continue to examine the implications of having regional medical centers serve veteran, military, and civilian/Medicare beneficiaries through government, nonprofit, and for-profit delivery systems all working together in the same facility. Healing environments, eco-friendly facilities, and flexible designs for streamlined delivery are all important, but the underlying changing need must be part of initial planning and system design before thinking about the building.

Recommendation B, *New Information and Medical Technologies: Explore the influence of new information and medical technologies on healthcare services and the building environments in which such services take place.*

For example, VA should continue its use of telemedicine, to allow more patients to perform certain services from their homes, as well as the use of information technologies to locate business and support services away from the acute care facility.

VA should engage in forecasting and imagining what will be done in hospitals in the next 10 to 20 years. If advances in biotechnology allow prospective medicine (detection of risk and earliest changes leading to disease) and targeted therapies for pre-disease, and if therapies become less invasive, medicines replace surgery, dramatic streamlining of care processes and evidence plus incentives eliminate inappropriate and unnecessary diagnostic and therapeutic interventions, then we will see a dramatic decrease in clinical disease and of advanced diseases requiring hospitalization. Required healthcare delivery capabilities can be articulated, and VA can determine the need for and characteristics of flexible future facilities.

Advances in interactive information technology, simple bio-monitoring devices, robotics, digital coaching, new therapies, and minimally invasive procedures will cause a shift of services away from hospitals to ambulatory centers, retail venues, and the home.

VA can take the lead in demonstrating the trends which are currently reshaping its operations. The VA telemedicine program is one of the most effective programs in existence today, rating high in customer and staff satisfaction, while showing significant cost savings and better clinical outcomes for chronic disease management. The infrastructure of new care components should be planned around the lessons learned from this program.

Recommendation C, *Long-Term Care Environment*: *Extend continuous and seamless coordination among the various types of healthcare facilities to the long-term care environment, in particular the home as a healthcare environment.*

VA is committed to a seamless coordination among its healthcare facilities in order to meet its first priority—to care for veterans. Such coordination needs to extend into the long-term care environment including the home. Treating patients at home presents a number of unique challenges.

- Home as a healthcare environment is operated by its residents; patients at home are more like empowered partners than patients.
- Home healthcare is difficult to standardize in part because no two homes are identical.
- At-home patients are often in charge of their care, which can mean that care by outsiders takes more time than comparable institutional care.
- Patients at home seem to want to be active in self-care routines, especially those focused on wellness and quality of life issues.

Home modifications may be essential when veterans are faced with a decline in functional capacity. VA should consider universal design as the appropriate language for designing and building home modifications for veterans suffering permanent disabilities.

With VA transitioning veterans across the healthcare continuum, service coordination from one environment to the next is facilitated by VA's Computerized Patient Record System (CPRS), the veteran's electronic medical record. VA has addressed this significant information technology challenge. There will also be the challenge of extending care-giving employment to veterans' families, friends, and veterans' services organizations in the home environment.

The committee commends VA for establishing alternatives to the institutional models of long-term care. Community Living Centers offer both short and long stays and are organized along a new transformational model rather than the traditional medical model. VA should continue to examine lessons that can be learned from other Federal entities, such as Centers for Medicare and Medicaid Services (CMS), which have sought to rebalance the care needs of millions of the elderly among institutional facilities and home and community resources.

As with civilian disabled and/or elderly, it is unlikely that any one long-term care environment will serve the future needs of most veterans. VA should consider developing a pilot program for serving veterans wishing to remain at home or in similar residential environments. These initiatives might include home modifications based on universal design, Vet Centers with adult daycare centers, traveling clinical-care teams, telemedicine and telemonitoring, small homes for skilled care, and neighborhoods wired as first-responder healthcare networks. Comparing these kinds of unique care environments, VA will be able to model better the business case for extending service into veteran's home and community environments.

Continuous Innovation Recommendation D, *Education, Training, and Outreach: Maintain and expand staff and caregiver continuing education, training, and outreach programs.*

Transitional success within VA will require concerted efforts to coordinate all its transitional programs with the greater communities with which VA interacts. These include VA leadership and staff, veterans and families, community providers, and Veteran Service Organizations (VSO). This will require ongoing and continuous outreach and education on the part of VA leadership and staff.

Veterans and their families access a wide range of services required to achieve optimal health outcomes by using services within and outside VA. VA facilities are large and play a dominant role in the lives of the veterans living in the regions they serve. Because of their size and mission, these centers have a lot to offer their larger communities in terms of lessons learned and hopes for a more coordinated healthcare service sector. To accomplish this new strategic partnering, VA needs to commit to regular interactions with non-VA healthcare providers, especially at the community level.

Finally, to assure transitional success, VA should continue to maintain and expand staff and caregiver continuing education and training programs.

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