

HEALTHCARE STRATEGIC SUSTAINABILITY: KEY FACTORS AFFECTING
THE TRIPLE BOTTOM LINE IN CONVERTING INPATIENT TO
OUTPATIENT FACILITIES

A Thesis

Presented to the Faculty of the Graduate School
of Cornell University

In Partial Fulfillment of the Requirements for the Degree of
Master of Science

by

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January 2009

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ABSTRACT

Healthcare strategic sustainability seeks to integrate in a cost effective manner sustainable development and design practices with health care facilities that are holistic places of healing for patients; and a safe, efficient, and effective environment for staff. This study focused on six United States Army military healthcare facilities involving conversion from inpatient to outpatient facilities. Data was collected in an intensive interview process from twenty-nine participants representing three stakeholder categories: planners (design and construction), operators (facility management and information technology), and users (clinical staff). The specific research questions addressed what design/building changes were made to accommodate the change from an inpatient to an outpatient care business model; and which existing design/building elements generated significant constraints or benefits when implementing the desired new design concept? The research also explored whether any desired design/building changes were not made, and why; and the extent to which social (quality of care and/or quality of life), economic (cost), or environmental (adaptable and sustainable) factors were considered? The findings confirm the impact of certain design elements on the conversion and adaptability of hospitals; and suggest the need to educate organizations on which design elements to invest in that not only meet cost and environmental quality goals, but also contribute positively to staff quality of life.

BIOGRAPHICAL SKETCH

Major David J. Zajac originally hails from Dearborn, Michigan. He is a graduate of Edsel Ford High School. Upon receiving an Army ROTC scholarship he attended Norwich University in Northfield, Vermont (the birthplace of ROTC) where he graduated with a Bachelor of Science in Engineering Technology (Environmental). He was commissioned a Second Lieutenant in the U.S. Army Medical Service Corps in 1994. He has served in the U.S. Army for fourteen years within various leadership and staff positions from Treatment Platoon Leader in the 2nd Infantry Division, Fort Lewis, Washington; to Chief, Project Operations, Pacific Rim, Tripler Army Medical Center, Hawaii. For the past eight years he has specialized in health facility planning and has been gainfully employed under the U.S. Army Health Facility Planning Agency, working as a consultant for the U.S. Army Surgeon General's Office. He was deployed to Iraq in 2004 as a health facilities advisor to the Iraqi Ministry of Health, under the Coalition Provisional Authority. During which time he worked directly for a Cornell DEA Graduate, Lieutenant Colonel J. Michael Olson. Upon returning from Iraq he successfully served as the Chief of Logistics and Transition Officer at the historic Schofield Barracks Health Clinic, Schofield Barracks, Hawaii. After the successful completion of his assignment he competed for, and was subsequently awarded, a scholarship to attend his graduate school of choice. He chose to attend Cornell University due to his positive experience while serving under Lieutenant Colonel J.M. Olson in Iraq. Upon graduation Major David J. Zajac will be assigned as Program Manager for a comprehensive portfolio totaling \$273 million in medical construction at Fort Carson, Colorado.

ACKNOWLEDGMENTS

I would like to acknowledge Professor Franklin D. Becker for his mentorship and support while serving as my thesis committee chair. I would also like to acknowledge Professor Ying Hua for her unselfish guidance as an informal member of my thesis committee. I valued the time I spent with both members of my committee and matured from their direct interest and focused input. Finally, I would like to thank Prof. William D. White for his participation and support as my minor member of my thesis committee.

I would be remiss if I did not acknowledge the tremendous support and love provided by my immediate and extended family which supported me throughout my graduate school experience. We can all remember when our household baggage arrived from Hawaii on the very first day of graduate school! To my loving and beautiful wife Andrea, who has always been there for me – I offer you my sincere love and gratitude for standing by me and supporting the family during these past two years. To my wonderful children who had to sacrifice their quality time with Daddy in support of his graduate education: Paul Gregory and Mara Elizabeth. Plus, the new addition to our family: Luke Anthony, who was born on 29 May 2008 during a beautiful sunrise at the Cayuga Medical Center overlooking the waters of Cayuga Lake.

Finally, I would like to thank the United States Army Medical Command, the Health Facility Planning Agency, and Cornell University for their financial assistance in support of my professional and educational advancement and all those who voluntarily participated in this, my first, formal research endeavor.

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CHAPTER 1

LITERATURE REVIEW

Introduction

The rising cost of healthcare today and the second largest recorded hospital construction program in history have launched the importance of the health care facility and its ability to promote healing, steward resources, and adapt over time (Center for Health Design [CHD], 2006; Marberry, 2006). Healthcare organizations have realized their direct moral and ethical obligation to promote healing and become members of a growing trend toward sustainable design and construction (Brody, 2001). As part of the increasing recognition of the importance of healthcare facilities, and given the cost of new facilities, hospitals have increasingly been converted to outpatient facilities or ambulatory surgical centers as a cost reduction effort (Williams, 2004). This conversion is defined as adaptive reuse. Adaptive reuse is the process of adapting old structures for new purposes.

Adaptive reuse of hospitals is considered sustainable since it has been shown to reduce between 50-75% of the debris burden to landfills, and lowers material, transportation, and energy consumption and pollution (Douglas, 2002; Gregory, 2004; Kats, 2003). There is, however, little research specifically regarding the adaptive reuse of health facilities (Kendall, 2008; Pati et al, 2008). In order to better guide current and future health facilities decisions more research is required to decrease the risk and potential cost burdens for organizations. Knowledge regarding which design elements constrain and/or benefit the

adaptive reuse of health facilities and the overall impact of the conversion on service delivery is necessary due to the rising cost burden associated with the deliverance of health care services to military and civilian communities alike. All efforts must be made to ensure converting military and civilian health facilities are guided through the use of evidenced-based design (EBD) that seeks to use the best possible available research information to help make more informed facility decisions (Hamilton, 2008).

1.1 Evidenced Based Design

There is a growing field of research that examines the role of the built environment in patient and staff outcomes, known as evidenced based design (EBD). EBD involves architects and engineers using credible research evidence to improve the quality of their designs (Hamilton, 2004). It can be described as applying the findings of credible research, conducted by academics and practitioners, to develop design concepts that, when implemented, can be assessed to determine the extent to which they achieve expected patient-centered and staff outcomes (Nelson et al, 2005; Stichler, 2007). It is most important to health care since the risks and costs associated with healthcare construction are higher than any other industry (RSMMeans 2008). Hospitals are among the most expensive facilities to design and build due to complexity of code compliance and technical requirements (Carpenter, 2006). With EBD there is solid evidence that these process outcomes will have positive impacts on an organization and its bottom-line (Hamilton, 2004). Therefore, hospital administrators are increasingly recognizing and requesting

evidenced-based designs that have the potential to reduce costs through risk avoidance while improving patient and staff safety and satisfaction.

Several organizations have raised awareness about the impacts of healthcare and environmental issues: The Center for Health Design, Health Care without Harm, American Society of Healthcare Engineers, and the Robert Wood Johnson Foundation; and increased understanding of health care facilities and sustainability initiatives will only increase in the future (Marberry, 2006). The increased awareness brought about by these organizations has stimulated MHS hospitals and civilian facilities. The MHS began the Epidaurus Project in 2002, a deliberate planning process within the MHS to incorporate patient centered and EBD principles to the maximum extent practicable as a result of on-going research by these organizations (Malone, Mann-Dooks & Strauss, 2007). There is an increased desire to produce more sustainable facilities since the argument that sustainable buildings cost more has been countered through research (Kats, 2003; Matthiessen & Morris, 2007). Building sustainable facilities also supports the TBL for health (Marberry, 2006). Renovating an existing building and making it Leadership in Energy and Environmental Design (LEED) certified is better than building a new facility (Bullen, 2007). The adaptive reuse of hospitals as outpatient clinics supports this logic and supports sustainable development, but up to now study regarding adaptive reuse has been focused on the industrial and residential building sectors (Bullen, 2007; Brand, 1998; Kincaid, 2000). The study of adaptive reuse within healthcare is new and its sustainable application is uncertain.

1.2 Current Conditions: Hospitals and the Healthcare Environment

The role of effectively reutilizing, designing, constructing, and managing capital assets is critical since they represent the second largest expense for most organizations (Becker, 2006; Advisory Board Company [ABC], 2007). Hospitals account for a substantial portion, as high as 50%, of health care budgets (McKee and Healy, 2002). This financial burden has the government targeting the hospital to achieve cost savings. This is exhibited by the most recent Burger Commission in New York State (2006) and the multiple rounds of the Base Realignment and Closure Committees (BRAC 1995 and 2005). Since the early 1980s, many organizations have sought to reduce their hospital capacity and shift care to alternate settings to reduce operating costs (Pollock et al, 1999; Saltman & Figueras, 1997; Street & Haycock 1999). Hospitals must adapt to these new circumstances. Especially considering the rate of change within the built environment, it is imperative to reuse, design, and construct health facilities that adapt to healthcare's changing needs over time (Arge, 2005; Becker and Steele, 1995; Brand 1994; Duffy, 1992; Slaughter, 2001; Worthington, 1997).

Healthcare's built environment plays a major part in decreasing costs and improving the health of patients and staff (Berry et al, 2004; Ulrich, 1991; Ulrich et al., 2006). Studies have shown that sustainability and its inherent building adaptability leads to reduced operating costs and lessens negative impacts within healthcare operations (Kats, 2003; Pitts, 2004; Slaughter, 2001). Within the government the need to reduce operating (utilities) costs and balance environmental impacts is evidenced by The U.S. Army Corps of Engineers

(USACE) adoption of the Sustainable Project Rating Tool (SPiRiT, 2002). The USACE has since mandated that all new construction beginning in 2008 must attain a Leadership in Energy and Environmental Design (LEED) Silver rating. A paradigm shift has occurred as a result of the United Nations World Commission on Environment and Development in 1987 which defined sustainable development as “development that meets the needs of present generations without compromising the ability of future generations to meet their own needs”. Also important, to a lesser degree, was the establishment of the later not-for-profit organization The Natural Step in 1989. Sustainable design builds upon sustainable development ethos. It is defined by the American Society of Healthcare Engineers (2001) as the art of designing physical facilities to comply with the triple bottom line (TBL); that is, consideration of the environmental, social, and financial consequences of building decisions. As important civic buildings hospitals should abide by the TBL – offering environmental, social, and quantifiable financial benefits that reduce and conserve utilities demand, protect the environment, and increase their inherent serviceability and adaptability to increase their lifespan (Bullen, 2007; Vanegas, DuBose, & Pearce, 1996). Further, as healing entities hospitals have a direct role in reducing staff stress and improving quality of care outcomes (Ulrich et al., 2004).

1.3 The Physical Environment and Quality of Care

The concept of quality of care (QOC) has always been important to healthcare executives, staff, and patients alike. The concept of QOC is an important part of healthcare strategic sustainability but not much is known about the impact of

the conversion of a health facility and its implications on QOC. It is interesting to point out that there has traditionally been a gap between how hospital administrators, physicians, staff, and patients define QOC (Laine et al. 1996). The Joint Commission defines the quality of patient care as, “the degree to which the patient care services increase the probability of desired patient outcomes and reduce the probability of undesired outcomes, given the current state of knowledge” (Joint Commission, 1990, p. 131). Koska (1989) conducted a survey of 663 hospital CEOs to determine what they felt were the most important factors in providing high quality care. Nursing care, clinical skills of medical staff, and employee attitudes were ranked the top three factors contributing to high quality care. In another study of 931 healthcare professionals, Arnetz (1999) found that the most important determinants of staff perceived quality of care were staff access to pertinent information concerning their daily work and organizational changes, participatory management, performance management, and job commitment. With more organizations shifting to a patient-centered care delivery model, the patient’s perception of quality of care and the staff’s quality of life has become of increasing interest to providers and researchers alike. According to Omachonu, “The patient perceives quality in the context of his or her own experience (Omanchonu, 1990, p. 45).” Omachonu points out the important difference between what is quality in fact and what is quality in perception. Similar to how patients evaluate satisfaction, they may not be able to assess their medical treatment, but they do assess the manner in which the treatment is provided in order to determine their overall quality of care. It is clear that the two key components of patients’ perceptions of quality of care are their perceptions of the physical environment, and their interactions with staff members (Powers & Bendall-Lyon 2003). In a

health care organization's pursuit of "first do no harm" (IOM, 2000) the built environment of care is often underestimated in its contribution to creating a healing environment. In order to compete healthcare organizations must design facilities which maximize their benefit to the organization.

1.4 The Current Military Health System (MHS)

The MHS is organized to support the United States Department of Defense and operates a substantial program by providing beneficial medical services to the active duty and retired members of the armed services, and their dependents. The MHS provides care to 9.2 million beneficiaries with approximately 130,000 staff in 70 hospitals, 411 primary care clinics, and 417 dental clinics around the world. Beneficiaries receive medical services through a managed care program known as TRICARE. Currently TRICARE handles on a weekly basis approximately 18,300 inpatient admissions, 1.8 million outpatient visits, 2,200 births, 2.1 million prescriptions and 104,000 dental visits. The total weekly tab is \$711 million. The TRICARE program was developed in response to the growing competition from the private sector and the health care needs of military personnel and retirees. It affords greater choice and different cost-share arrangements for its military beneficiaries.

The closing of military bases after the end of the Cold War through two rounds of Base Realignment and Closure Committee (BRAC I, 1995 and BRAC II, 2005) rulings and other right-sizing efforts much like those impacting civilian rural hospitals resulted in the closure of 35% of the military hospitals that existed in the U.S. in 1987 (Department of Defense, 1996). Under ever

increasing pressures to become leaner and more efficient, while still ensuring high quality of care, the MHS has had to deal with the same issues impacting its civilian counterparts. The MHS is not exempt from the challenges present in the civilian health care sector. The challenges are universal: managed care issues, changing technology, changing medical practice, environmental pressures, the replacement of Hill Burton era facilities due to obsolescence, and the adaptive reuse of inpatient to outpatient facilities. The MHS has and will continue to experience these challenges, and now has the opportunity to incorporate evidenced-based and sustainable design practices which have been shown to positively benefit the quality of care received by patients and balance the TBL for health maximizing corporate, environmental, and staff outcomes.

1.5 The Construction Boom an Impetus for Change

The American health care industry is in the midst of an impressive construction boom, the result of diminished capital investment, and building obsolescence due to the Hill Burton Era (Miller & Swenssen, 2002). The forecast for annual capital spending on health facilities from \$18 billion today to \$25 billion in the year 2010 has already been exceeded (CHD, 2006). It is now projected that the healthcare construction sector will grow to \$53.8B in 2008 and will continue to grow through 2011 (H. Jones, 2007). In the year 2011 the volume of construction is projected to reach \$71B (FMI, 2007). This boom is simultaneously affecting the MHS. With a \$6B portfolio of new healthcare facilities and projects planned over the next five years (2008 through 2013), the MHS finds itself with a once in a lifetime opportunity to transform its healthcare

infrastructure in order to improve patient, staff and resource outcomes, increase their sustainability and to contribute to the growing body of evidenced-based design (EBD). This construction boom presents a historic opportunity to learn from the past and prepare for the future.

1.6 Future Challenges for the Hospital in the Healthcare Environment

Twenty-first century healthcare organizations, both civilian and military, are operating within a dynamic environment and face enormous challenges in the future. Hospitals must continuously evolve and change in response to both social and political change, changes in medical knowledge and practice, and the rapid rate of technological advancement (Miller & Swensson, 2002).

Change is the only constant within the healthcare environment and to change is to challenge (Kendall, 2008). New challenges ranging from advancing technology to increased costs and environmental pressures are changing the face of health care, its utilization and practice, and in the process forcing health care organizations to shift their focus and change the way they operate.

Some of these future challenges include the spiraling costs of healthcare (Fottler et al., 2000), technological advances (Carr & Dimitrakakis, 2003; Siminerio, 2005), shifting population demographics (Strunk et al, 2006), nursing shortages (Janiszewski-Goodin, 2003; McNeese-Smith, 1999), increased competition between organizations (Cuellar & Gertler 2005; Grimson, 2001; Guo, 2003; Watson, 2005). Hospitals are also facing competition from the growing number of physician-run specialty hospitals and their ability to attract and retain valued employees due to current workforce shortages. This shift in

the delivery of care is part of a larger movement across the country of treating patients in alternative settings. In the past decade there has been an increasing growth in the type and amount of outpatient and ambulatory care services that are provided. The need to compete with the private sector drove the MHS to initiate the 2002 OB Initiative which modernized facilities, increased access to care, and reduced manpower and capital costs (Shields, 2003). Also, the need to retain and attract nursing staff is critically important due to the current nursing shortage. Recent research has estimated that it costs between \$62,100 and \$67,100 to replace a lost RN (C.B. Jones, 2005).

These challenges, and the building construction boom (Carpenter D., 2004; Romano, 2007), are forcing healthcare institutions to rethink how they design facilities to better cope with change and a shift in focus from inpatient to outpatient care (Rebholz, 2007; Williams, 2004) as well as fierce competition making patient-centered care a priority (Gift, Arnould, & Brock, 2002). In response to these challenges health care organizations are rethinking and redesigning all aspects of their hospital system, including their facilities. Facilities are increasingly becoming recognized as vital components of business operations (Berry et al, 2004; Hutton & Richardson, 1995). New values based facilities are being designed for health care due to the acknowledgment of the role of the hospital as a healing environment for patients, staff, and the environment at large (Brody, 2001; Cohen, 2006; Schindler, 2006).

There is a growing acceptance of life-cycle costing in support of rationalizing green building and the role building adaptability plays within a sustainable building environment (Lawrence, 2000; Dowdeswell & Erskine, 2006).

Increasingly, these challenges are compelling healthcare executives, professionals, and patients to recognize the important role of the physical environment in the healthcare experience (Carpman & Grant, 1993; Marberry, 1995, 2006; Nelson, West, & Goodman, 2005; Nesmith, 1995).

These challenges are directly impacting the way health facilities are being designed and constructed in both civilian and military sectors of health care with a realization that the rate of change will only increase over time. It has become clear that it is more cost effective to incorporate sustainable measures and adaptable design elements at the front- end of the project than at the back-end (Roberts, 2002; Berry et al, 2004; Kendall, 2008; Valen & Larssen, 2006). The concept of Healthcare Strategic Sustainability (see Figure 1.1) is, therefore, a focused effort to integrate sustainable development and design practices with health care facilities that are holistic places of healing for patients, and a safe, efficient, and effective environment for staff, all accomplished in a cost effective manner with positive long-term economic benefits for organizations.

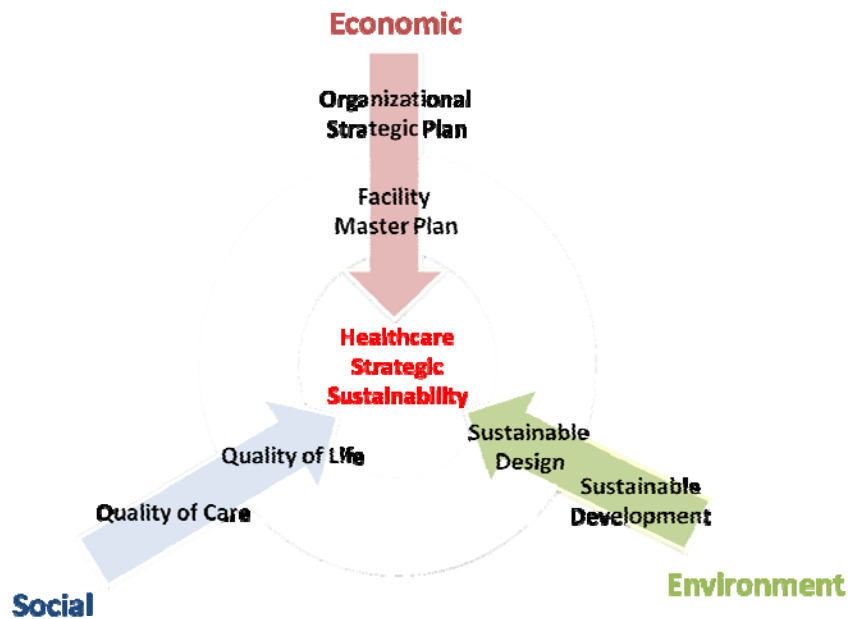


Figure 1.1 Healthcare Strategic Sustainability and the Triple Bottom Line for Health

1.7 Healthcare Strategic Sustainability

Sustainable buildings offer cost savings, reduce negative impacts on the environment, and improved working and living conditions. The advent of life-cycle costing and a whole buildings viewpoint or approach to estimate the worth of a facility and its impact on the environment has increased the credibility and justification for building sustainable buildings (Dowdeswell & Erskine, 2006; Roberts, 2002). The impact of the TBL for health has emphasized the notion that health care facilities must be places of healing not harm and in so doing be environmentally sustainable entities (Cohen, 2006; Guenther et al. 2006; Rossi & Lent, 2006; Schindler, 2006).

The reuse of hospitals as outpatient centers, or for purposes other than healthcare, is the subject of increasing discussion as well. Several factors have contributed to this debate including the over bedding of hospitals and unnecessary duplication of hospital facilities as health care organizations expand and consolidate service lines (Miller & Swenssen, 2002; Kobus et al., 2000; Williams, 2004). This becomes increasingly important as inpatient utilization declines and more procedures are done on an outpatient basis in clinics and doctor's offices. Stays have declined from 1000 days per 1000 population to 250 days per 1000 (Kobus et al., 2000). This has left older hospitals with 35-45% unused, nonproductive former inpatient bed space (Hayward, 2006). These issues have relevance for the MHS due to previous and future BRAC findings and the realignment toward a more Integrated Health System approach.

The study of building adaptation stems from the concern that too many buildings are being designed for obsolescence (Duffy 1992; Brand, 1994; Datta, 2000). Design adaptability leads to increased sustainability (Bullen, 2007; Kincaid 2000). Future health care facilities should be designed and constructed in a sustainable manner aligning with the TBL for health. They will therefore more easily adapt to different functions over time, have increased lifespan, and reduce operating costs (Slaughter, 2001). An adaptable building can better accommodate change and reduce negative impacts related to service delivery and cost (Datta, 2000; Kobus et al., 2000; Jonassen et al., 2001). A new focus on sustainability with its acceptance of lifecycle costing has provided the financial means to justify sustainable design (Dowdeswell & Erskine, 2006; Kats, 2003). Viewing buildings from a whole building

perspective has recently brought the study of building adaptability into the mainstream. It is still in its infancy however in the healthcare industry (Pati et al, 2008). The healthcare industry has been commonly viewed as a very specialized area which has prevented the influence of adaptable design. Due to recent trends and fiscal constraints on health care organizations this long held view is being shed. The recent construction boom and the increased emphasis on sustainable design necessitate the construction of adaptable health care facilities (Kendall, 2008; Roberts, 2002).

1.8 Buildings and Sustainable Development

Since the creation, operation, and disposal of the buildings dominate humanity's impact on the natural world a primary goal of sustainability is to reduce human environmental or ecological footprint on the planet (Kibert et al., 2000).

Especially in the last decade, a push toward the development of sustainable construction industry practices has given rise to the green building movement. Studies have shown that the average US employee spends as much as 90 percent of their time indoors (EPA, 1993). Currently, buildings demand 40 percent of U.S. energy assets and 16 percent of water resources, while building construction and demolition generates about 25 percent of municipal solid wastes (Cassidy, 2004). The aim of green buildings is to protect the earth's natural systems (Kibert et al., 2000). Green buildings offer the same quality or performance, if not better, but have a less negative impact on the environment. Most green building practices fall into seven basic categories: energy saving, water saving, land saving, storm water runoff-reducing, material conservation, and pollution reduction (ECONorthwest, 2001). A green building uses an

average of 30 percent less energy than a conventional building, the primary factor in decreasing operating costs (*Economist* 2004). This is important since one-third of the energy used by humans is related to buildings and their utilization. A considerable proportion of this energy could be avoided, and operating costs reduced for organizations, by incorporating sustainable design elements (Kats et al, 2003).

1.9 Buildings and Sustainable Design

These savings can be realized with minimal increases in upfront costs of about 2% to support green design and result in life cycle savings of 20% of total construction costs which is more than ten times the initial investment (Kats et al, 2003). For example, an initial upfront investment of up to \$100,000 to incorporate green building features into a \$5 million project would result in a savings of \$1 million in today's dollars over the life of the building (Kats et al, 2003). The USGBC, founded in 1993, has accelerated the introduction of green building practices through the introduction of the Leadership in Energy and Environmental Design (LEED) program. LEED works through a third party certification and is based on rating a building against benchmarked levels of sustainability in five categories: sustainable sites, water efficiency, energy and atmosphere, material sources, and indoor environmental quality and innovation. In addition to meeting a number of prerequisites, a building obtains a score in each category, the sum of which constitutes the overall LEED score. The scores are ranked as follows: platinum, gold, silver, and certified. A gold building is estimated to have reduced its environmental impact by 50 percent in

comparison to a conventional building of similar size; a platinum building, by more than 70 percent (*Economist*, 2004).

Many government agencies are aggressively adopting sustainable building strategies. Federal, state, and local governments have built 40 percent of the green buildings that are LEED certified (Gonchar, 2004). The perceived value of high performance buildings is increasing, while financial costs are going down. For instance, green schools and offices can cost an average of 0.5 to 6.5 percent more to build; however, owner costs decrease for energy, water, operations, and maintenance (Cassidy, 2004). These facts are supported by the USACE directive that all new construction beginning in fiscal year 2008 will achieve LEED Silver ratings (Deputy Assistant Secretary of the Army for Installations and Environment, 2006). Government buildings are typically owned, operated, financed, and occupied by a government agency. The average lifespan of a public building is long. Wearing multiple hats makes it easier for the governmental to design buildings to maximize their performance and occupant health on a long-term perspective (Gottfried, 2003). Recent research on buildings built by owner-occupiers supports this argument (Arge, 2005). The USGBC advocates that green building results in a TBL; offering environmental, social, and quantifiable financial benefits. Using less energy and water lessens both operating costs and a building's environmental impact. From a people perspective, occupant health and productivity improve as a result of green buildings. Evidence shows that productivity rises and absenteeism falls in well-designed, sustainable buildings (Pitts, 2004). Therefore sustainable design principles have positive and direct applications for the healthcare industry.

1.10 Healthcare Facilities and Sustainability

Sustainable building and development continue to infiltrate healthcare organizations as more people begin to understand the tremendous impact the built environment has on the environment, staff, and patients. The “triple bottom line for health” (Marberry, 2006) defines the health industry approach to sustainable building and operations and integrates quality of care outcomes while balancing the need for environmental stewardship and long-term profitability (Lawrence, 2000). The healthcare industry represents 3.9% of all U.S Construction and is projected to remain strong through 2010 (FMI, 2007). While healthcare facilities represent a small portion of the overall construction market, and a small portion of existing buildings, they have the second highest intensity of energy use (per square foot cost), second only to the food service industry (DOE, 2003). Healthcare facilities also have the fourth highest energy consumption behind office, retail, and education buildings. According to the USGBC, only two percent of LEED registered projects are healthcare related (CHD, 2006). Hospitals and other healthcare facilities have unique operational requirements such as around the clock operations, increased energy and water use, etc. all of which pose a challenge in implementation of LEED. At present, the USGBC is developing an alternative to LEED certification for health facilities titled LEED for Healthcare in order to increase adaptation of sustainable design practices within the HC industry. But more needs to be done to increase the sustainability of health care facilities.

1.11 Healthcare Strategic Planning and Life Cycle Costing

To ensure long-term profitability, and in-line with the TBL for health, measures are being taken to make health facilities more sustainable. These measures rely increasingly on life-cycle costing (LCC) approaches for justification. Life-cycle thinking in the construction sector takes account of every stage – from a structure’s conception to the end of its service life, and the raw material extraction to a buildings demolition or dismantling (UNEP, 2003). This new LCC methodology can provide the means of identifying and valuing sustainable elements of capital investment strategies that improve whole life building effectiveness (Dowdeswell & Erskine, 2006; Kats et al, 2003). The whole life building costs of a facility are: the cost of acquiring, operating, maintaining, and ultimately its ultimate disposal it. The average lifespan of hospitals and other health facilities tends to fall between 25 and 35 years. Sustainable priorities need to reflect longer-term operational and environmental objectives for buildings. The traditional notion of fixed point periodic renovation of a building within its lifetime is no longer viable (Dowdeswell & Erskine, 2006). Healthcare progress does not move in a linear fashion. Change is endemic in the healthcare operating environment and unpredictable in nature (Kendall, 2008). This new principle should therefore be buildings which are designed to adapt to meet changing needs, rather than the service learning to adapt to the built environment until major or periodic renovation is possible (Jonassen et al., 2001). There needs to be greater clarity in the long-term strategic aims of the health care organization concerned (Hayward, 2006). Because change is a constant force in design, today’s designs must acknowledge that what is built for today is not permanent and will at some point become a candidate for reuse,

retrofit, or removal. Therefore, the need for a comprehensive master plan, in support of a strategic business plan, that provides an arrow into the future is necessary (Hayward, 2006; Kobus et al., 2000). The cost of construction is but a small part of the cost of the daily operation of a hospital. Over the lifetime of a building, construction costs have averaged only 6 percent of organizational operating expenditures (Kobus et al., 2000; Slaughter, 2001). The net result of healthcare planning and construction through LCC and the TBL for health will provide buildings that ensure occupant health and are more resource and cost efficient in the long-term (Becker & Parsons, 2007).

1.12 Studying Healthcare Facility Adaptability

The study of building adaptability traces its roots to the early historical preservation and reuse movements (Bullen, 2007). Historical buildings by law could not be torn down so the challenge was to find a suitable functional use for the space while still maintaining its original character for future generations (Fitch, 1982). Building adaptability has always been of interest to designers but has been difficult to study due to its sheer size and complexity, this is especially so in the healthcare industry (McKee and Healy, 2002). There is an absence of a tradition of studying how hospitals change (Kendall, 2008; Pati et al, 2008). It has been noted that until recently most buildings have been built for obsolescence (Brand 1994; Duffy, 1992). With the advent of an increased awareness of the negative impact buildings and construction in general have on the environment, and the elevated importance of corporate and healthcare workplaces to the corporate bottom line, new buildings should be designed to

better adapt to changes over time and thus reduce operating costs (Becker, 2006; Roberts, 2002).

Studies exploring the adaptability of the healthcare environment are sparse. Studies on healthcare adaptive reuse are almost non-existent. It has been theorized through publication that incorporating certain design elements in health care facilities will increase their adaptability (ABC, 2007; Chefurka et al, 2005; Datta, 2000; Jonassen et al., 2001; Kendall, 2004; Varawalla, 2004). Recent research has found there are common design elements benefiting building adaptability (Valen & Larssen, 2006) and that building adaptability plays a crucial role in benefiting or constraining service delivery over both the short and long-term lifespan of the facility (Pati et al, 2008). A recent article relating to adaptive reuse of historic health care facilities has identified constraining design elements found within existing healthcare facilities relating to building services, column placement, and enclosure (Henrichs, 2004). However, more research to expand EBD is required to support effective decision making and increase the knowledge base of healthcare strategic sustainability relating to adaptive reuse of existing healthcare facilities.

To fill the void left by the deficit of scientific research there have been many articles written regarding the importance of building future facilities with design elements that are quasi-adaptable (ABC, 2007; Chefurka et al, 2005; Datta, 2000; Jonassen et al., 2001; Kendall, 2004;; Varawalla, 2004). This has been important since the building construction boom will impact the way healthcare is delivered for the next half century. These adaptable design features comprise the following design elements: floor to floor heights, longer spans for structural

grids, vertical chases, corridor space and circulation patterns, HVAC modularity and surplus capacity, electrical capacity, information technology capabilities, and modularity and standardization in room design. These articles have been written and guided through first-hand knowledge and generalized findings, but have not been scientifically studied so they can be exported and effectively used as EBD principles.

Other countries are experimenting with new building designs in the hopes that it will increase their inherent sustainability. This has occurred in Canada, the Netherlands, and Switzerland. In Canada the near historic McMasters Health Science Center was declared by its main designer that “it will never be finished” (Pilosof, 2005). The MHSC adaptability lied with its master plan, horizontal and vertical expansion methods, and its interior design for flexibility. This was accomplished through structurally reinforcing the facility, allowing for increased site development in the future, and providing circulation and interstitial spaces throughout the facility. It was a new concept design in 1972 and much was learned from it. The primary lesson learned was the importance of the relationship between an on-going master planning effort in line with existing organizational strategic planning process. They must be conducted in concert with on another. Over time the impact of changing medical practice and technology had their impact on the facility. The facility was never expanded upon as originally master planned. The exterior spaces meant to provide restoration to staff were left vacant and became eye sores. The organization strategic plan had changed and much of the efforts associated with the original master plan were never realized. It is a testament to the fact that a master plan is only as good as its supporting organizational strategic plan.

In the Netherlands and Switzerland they are aligning strategic planning and master planning efforts once again. They have specifically designed and constructed new healthcare facilities with adaptive reuse in mind. They are testing new facilities which are comprised of adaptable design elements to maximize their inherent sustainability (Martini Hospital, 2005). In the Netherlands the Martini Teaching Hospital in Groningen follows a new adaptable concept named Industrial, Flexible, and Demountable (IFD). It is Industrial since it is based on standardization. It is flexible since it can increase its floor space by hanging structurally supported extensions on the exterior façade of the building and possesses a flexible layout that can respond to the demands made on it by the patients and staff, plus changing technology. It is demountable due to its incorporation of demountable walls and fixtures throughout the facility. This facility is master planned and has multiple lifecycles each with its own functional use: hospital, clinic, and office. In Bern, Switzerland, the Insel Teaching Hospital is designed and constructed following an Open Plan Building Concept called INO by its developers (Kendall, 2004). Since healthcare facilities are complex, costly, and are composed of several different systems that all have varying rates of change the project diverges from the traditional idea of delivering health facilities in a linear format. Therefore INO is meant to adapt to change over time by addressing the varying rates of change in technology with the long duration required to design and construct a health facility. The INO is composed of three systems: primary, secondary, and tertiary. All three have varying replacement rates (100, 20, and 5 years) respectively. The facility is designed in three layers and three differing times throughout the project lifecycle to optimize the tertiary, or more technologically sensitive, system to the last in order to capitalize on the most recent

technologies since design and construction timelines last up to 6 years for large projects. The INO is meant to be more sustainable since it is designed to adapt over time encompassing “punch-through” systems where by allowing ease of vertical circulation, mechanical systems, and light shafts. Both these hospitals are well designed and are aligned with a dynamic functional environment. The buildings operate at varying timescales and at varying levels (Kendall, 2004). The INO project in Bern, and the Martini Hospital in Groningen are examples of healthcare strategically sustainable facilities. These two facilities exemplify sustainable health facilities. However, with the knowledge that the rate of change will not decrease but increase in the future more EBD is needed to maximize benefits and minimize constraints on the organization as a whole. More research into hospital adaptability and adaptive reuse is necessary to increase understanding of health facility design and determine the most adaptable design elements to incorporate in the next era of health care reconstruction to ensure hospitals follow the TBL for health: sustainable, decrease negative economic impacts on the organization, and assist with high quality service delivery.

The most current scientific research on hospital adaptability has been conducted in Norway and the United States. In the Norwegian study six hospitals were studied to determine which design elements contribute to the adaptability of hospitals and how often and for what reason change occurred within each facility over its lifespan (Valen & Larrsen, 2006). The overall goal was to identify design elements, based upon the frequency of change, which prove to be cost beneficial investments. The study found that effective master planning is critical to reducing costs over the long-term. The design elements

which identified as cost beneficial were: modularity of room types, sufficient load capacity, and floor to floor heights, and interstitial spaces, flexible interior wall systems, and surplus utilities (HVAC, ELEC, and IT) capacity. One of the major challenges of hospitals is to adjust existing buildings to new demands. The Valen and Larson (2006) study found that the frequency of change drastically increased in the last three to four decades. One of the newer facilities registered 30 significant changes in the first five years since its opening (Valen & Larssen, 2006). In a U.S. study of six inpatient hospital medical-surgical unit design characteristics it was found that building adaptability had the most impact on service delivery (Pati et al, 2008). The study focused on elements of the physical environment that constrained or benefited staff operating requirements. Over time it was identified that operational changes related to changing medical practices encroach and devour support space. It was also found that inpatient unit design consideration should be accorded higher consideration regarding operational efficiencies over time since seven of nine indicators were identified to relate to unit adaptability. The study found the following design elements within the built environment to be beneficial: modular/standardized rooms, modular furniture, internal adjacencies dealing with circulation and use patterns, and the adjacency of soft space to expand and contract as changes in medical technology and practice dictate. Overall there is very limited study to guide decision making and reduce the many risks inherent within the healthcare sector.

1.13 Summary of the Literature

In summary, the healthcare construction boom presents a rare opportunity to reassess the validity of pending capital investments for their inherent healthcare strategic sustainability. Currently there is a deficit of study regarding the adaptability of health care facilities in general (Kendall, 2008; Pati et al, 2008). This exploratory study's goal is to contribute to the literature on health care facility adaptive reuse. This study builds on previous health facility studies by looking at the adaptability of the built environment and which design elements lend themselves to be more adaptable than others (ABC, 2007; Kendall, 2008; Pati et al, 2008; Slaughter, 2001; Valen & Larssen, 2006). Specifically, this study focuses on the role of the physical environment within converted and existing hospitals and how the physical environment either positively or negatively impacted the conversion effort from the design and construction and the operator's (FM) perspective; and from the medical staff's perspective, how the conversion affected staff quality of life and the quality of care they provide to their patients. Its goal is to identify physical factors that need to be considered to achieve a triple-bottom line benefit over time; that is, what are factors that can contribute to strategically sustainable hospital facilities.

1.14 Research Questions

The specific research questions this pilot project addresses are:

1. What design/building changes were made to accommodate the change from an in-patient to an outpatient care business model?

1.1 What areas within the facility were most affected by the conversion?

1.2 Which existing design/building elements generated significant constraints when implementing the desired new design concept?

1.3 Which design/building elements made it easy to implement new design concepts?

1.4 What, if any, desired design/building changes were not made, and why?

2. What factors were considered and/ or emphasized during the conversion of the facility: social (quality of care and/or quality of life), economic (cost), or environmental (adaptable and sustainable)?

CHAPTER 2

METHODS

2.1 Methodology Overview

The research questions identified above were examined as a comparative case study design in which six former or current hospital sites with three varying scopes of conversion from inpatient to outpatient services were surveyed. Inpatient services were defined as those requiring greater than twenty four hour stays. Outpatient services are defined as those requiring less than twenty four hour hospital stays. Data collection efforts were focused on gathering information regarding the adaptability of design and its impact on facility operations (facilities management) and facility use (patient quality of care and staff quality of life). Focused interviews were conducted within three targeted groups: planners, for initial design and construction issues; operators, for efficiency and effectiveness of facility operations; and key medical staff, to understand how the renovated space works in terms of delivering services at the desired level of quality. Data collection comprised three phases with planners, operators, and users being involved in each phase. The interviews in Phases II and III focused on the issues of each key stakeholder group: planners, operators, and user. The follow-up interview phase (Phase III) provided the opportunity for more detailed information and to clarify issues relating that have arisen subsequent to the first interview. Data analysis also helped to gauge perspectives within the MHS of importance attached to the TBL for health during the conversion process (Marberry, 2006).

2.2 Site Selection

A request for information was sent to the U.S. Army Health Facility Planning Agency and the Air Force Health Facilities Office for potentially viable sites for inclusion in the study. Over 35 hospitals were identified as potential research sites in which some level of conversion from inpatient to outpatient facility had occurred as a direct result of the MHS taking measures to provide more cost efficient services to its beneficiaries. These conversions have been on-going for the last fifteen years.

Table 2.1 Criteria for Site Selection

Criteria	Definition
Access to key historic personnel	Easy access to original project personnel within the three stakeholder categories.
Access to historic master plans and drawings	Easy access to original project drawings, master plans, and background information relevant for each site.
Recent outpatient conversion	The site had to have been converted within the last 12 years to ensure ready access to historic personnel and drawings, etc.
Common Design Template	The sites had to be comprised of near similar designs to maximize research outcomes.
Proximity to Cornell University	Due to funding limitations and on-going graduate degree commitments required sites had to be within a 500 mile radial distance from school.

The original 35 sites were eventually reduced to six by applying selection criteria (Table 2.1): 1) access to key personnel familiar with the conversion representing planner, operator, and user; 2) access to historic master plans and drawings; 3) conversion to outpatient facilities within the last 10-12 years; 4) common design template, represented by the York and Sawyer design and 5) proximity to Cornell University.

Table 2.2 Sites Selected for Exploratory Case Study into Healthcare Strategic Sustainability

Facility Location (Post)	Facility Name	Facility Location (City, State)	Year Built	Population Served	Scope Level	Size of Facility (GSF)	Facility Height (# storeys)	Date of Conversion	Facility Ownership	"York and Sawyer" Design Type (Yes/No)
Fort Eustis	McDonald Army Health Center	Norfolk, Virginia	1962	23,400	High	130,000	3	2006	Army	Yes
Fort Meade	Kimbrough Ambulatory Care Center	Baltimore, Maryland	1961	24,000	High	180,000	3	1995	Army	Yes
Fort Lee	Kenner Army Health Clinic	Petersburg, Virginia	1962	16,000	Medium	146,000	3	1995	Army	Yes
Fort Rucker	Lyster Army Health Clinic	Dodson, Alabama	1967	17,000	Medium	230,000	2	2004	Army	Yes
Fort Belvoir	DeWitt Army Community Hospital	Springfield, Virginia	1957	70,000	Low	260,000	5	2002	Army	Yes
Fort Jackson	Moncrief Army Community Hospital	Columbia, South Carolina	1972	27,000	Low	323,000	12	2003	Army	No

After applying the selection criteria the following six sites were selected (see Table 2.2): Ft Eustis, Virginia; Ft Belvoir, Virginia; Ft Lee, Virginia; Ft Rucker, Alabama; Ft Meade, Maryland; and Ft Jackson, South Carolina.

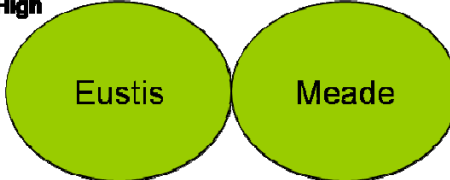
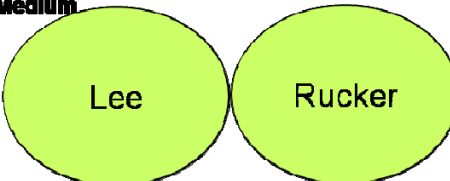
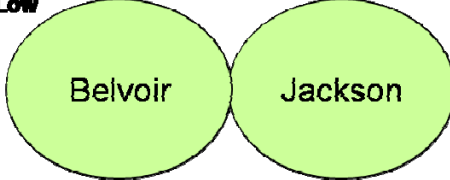
2.3 The Common Design Template: The York and Sawyer Designed Hospital

The common design template selected was the York and Sawyer Hospital Design. It has endured significant adaptations over the years within the MHS. It was widely constructed during the late 1950s and into the 1960s within the Army and Air Force health care delivery systems and is indicative of a typical Hill Burton Era designed hospital. The York and Sawyer design was based upon a common hub comprising a pharmacy, laboratory, x-ray, dining facility, and administrative area. This hub was then tailored to fit with an appropriately sized patient tower. The tower height, or number of floors, was based upon the troop population it would serve. A significant number of hospitals planning to undergo conversions or replacements within the United States were built during the same timeframe so there is relevance between the military and civilian sectors of health care delivery. This relevance is primarily due to the massive building boom as a result of the Hill-Burton Act. These specific facilities were selected since they would be representative of the designs built within the Hill-Burton era. One site (Fort Jackson) was not representative of a York and Sawyer design but still reflected similarities found within Hill-Burton Era facilities. It did not negatively impact the study since it was a low scope site and its conversion was in-line with the scope of interest of the research into healthcare strategic sustainability.

2.4 Site Scopes and Descriptions

This study focused on the conversion of outpatient to inpatient facilities driven by changing medical practices, the impact of technology, particularly non-invasive surgery; and major shifts in the military patient population brought about by BRAC I (1995) and II (2005). These facility conversions took place within three distinct scopes of change: High, Medium, and Low (see Table 2.3). These scopes were selected because they are indicative of the changes occurring in both the civilian and military healthcare sectors today, and thus could be relevant to both sectors. Also, during early exploratory research it was deemed useful to include varying hospital sizes to see whether any significant differences surfaced as a function of different scope of change.

Table 2.3 Scope Definitions for each site studied

Scope	Definition
<p>High</p> 	<p>Sites in which the <i>whole facility</i> changed, with no inpatient services or non-ambulatory surgery any longer available. Size of hospital varied from 25 beds to 100 beds, and was not a distinguishing factors in scope.</p>
<p>Medium</p> 	<p>Sites in which the <i>whole facility</i> changed, with no inpatient services but ambulatory surgery still occurring in ORs.</p>
<p>Low</p> 	<p>Sites in which only a <i>floor</i> was converted from inpatient to outpatient, or clinical services. This is in contrast to the high and medium scope, where an entire <i>facility</i> was converted.</p>

Below is a brief history and description of the six sites participating in this study:

2.4.1 Fort Lee (HIGH SCOPE), Kenner Army Health Clinic



Figure 2.1 Kenner Army Health Clinic, Fort Lee, Virginia

Kenner Army Health Clinic is a high scope site since its operating theaters have closed and it functions now as an outpatient primary health clinic. It is located in Petersburg, Virginia (see Figure 2.1).

- On 16 April 1962, Kenner Army Hospital was dedicated in memory of Major General Albert W. Kenner, Medical Corps, a veteran of World Wars I and II. The final plans called for a three-story structure with a 100-bed capacity on a 200-bed framework.

- The outpatient wing was added in 1975, effectively tripling the square footage available for patient care. Completion of this project was followed by the renovation of the original building in 1977.
- A second renovation began in June 1996 in order to bring the facility in compliance with the current Life Safety codes for an inpatient facility.
- In July 1995, the BRAC I Commission selected Kenner Army Community Hospital as a potential candidate to downsize its operations.
- On 1 August 1996, Inpatient and Emergency Department capabilities were eliminated. The clinic's mission from 1996 to the present is that of an outpatient primary care clinic. All inpatient services are supported by contracts with local civilian health network hospitals.

2.4.2 Fort Rucker (HIGH SCOPE), Lyster Army Health Clinic



Figure 2.2 Lyster Army Health Clinic, Fort Rucker, Alabama

Lyster Army Health Clinic is a high scope site since its operating theaters have closed and it functions now as an outpatient primary care clinic. It is located in Dotham, Alabama and is responsible for all medically related activities on the post which specializes on Army Aviation (see Figure 2.2).

- On 5 March 1964, the Surgeon General officially named the hospital in honor of Brigadier General Theodore C. Lyster, "The Father of Army Aviation Medicine." Originally the medical facility was constructed as a 25 bed community hospital with limited clinical facilities.
- In 1975 a major addition to the facility was constructed which primarily expanded the outpatient functions of the medical facility.
- In 2004 Lyster Army Community Hospital was downgraded to an Army Health Clinic and all inpatient functions were terminated. The downgrade was a result of a change in the MHS Strategy which supported a network related model of health delivery in order to recapture significant cost savings. Since the local civilian health network had excess capacity the decision was made to shift all inpatient functions and services to the civilian health network.

2.4.3 Ft Meade (MEDIUM SCOPE), Kimbrough Ambulatory Care Center



Figure 2.3 Kimbrough Ambulatory Care Center, Fort Meade, Maryland

Kimbrough Ambulatory Care Center is a medium scope site since its ORs are still in use performing ambulatory surgery procedures and holding capabilities are present for patients not to exceed 24 hours. It is located in Baltimore, Maryland and is part of the National Capital Health Network (see Figure 2.3).

- During June, 1961, U.S. Kimbrough Army Hospital, a 145-bed acute care community hospital, was dedicated in honor of Colonel James Claude Kimbrough, the “Father of U.S. Army Urology,” and a veteran of both world wars. In 1971, a 9-bed Intensive Care/Coronary Care Unit was added.
- In 1972, 44,000 square feet of outpatient clinical areas were added. During 1978, the hospital was reorganized and its authorized strength was dramatically increased from 550 to 982 beds?
The Base Realignment and Closure Commission (BRAC) of 1995;
subsequently referred to as BRAC I, was responsible for several major

changes in the hospital structure: U.S. Kimbrough Army Hospital was downgraded to an outpatient clinic. This change occurred on July, 1996. As a direct result of BRAC Kimbrough closed its emergency room and became Kimbrough Ambulatory Care Center. U.S. Kimbrough Army Hospital was officially discontinued as an organization in October, 1996.

2.4.4 Ft Eustis (MEDIUM SCOPE), McDonald Army Health Center



Figure 2.4 McDonald Army Health Center, Fort Eustis, Virginia

McDonald Army Health Center is a medium scope site since its ORs are still in use performing ambulatory surgery procedures and holding capabilities are present for patients not to exceed 24 hours. It is located in Norfolk, Virginia and primary care and ambulatory surgical services in the Tidewater Community (see Figure 2.4).

- In March 1941 McDonald Army Community Hospital was established at Fort Eustis in the heart of Hampton Roads. After serving during World War II, the hospital served briefly as a Naval Hospital and in February 1946 the army reactivated it as an Army Hospital. The hospital at that time was known as US Army Hospital, Fort Eustis. In March of 1961 a new hospital was dedicated to Brigadier General, Robert McDonald who was a pioneer in intra theater medical transfer and evacuation.
- The main facility was constructed in 1964 with a major outpatient clinic added in 1976.
- Orthopedic and Women's health clinics were added in 1993 and the administrative building and business offices were completed in 1999.
- Under the BRAC II round of closures it was determined that its best use to the MHS, and the military health network of Hampton Roads was to serve as an ambulatory care center focusing on Orthopedic and GI outpatient surgery.

2.4.5 Ft Belvoir (LOW SCOPE), Dewitt Army Community Hospital



Figure 2.5 DeWitt Hospital, Fort Belvoir, Virginia

DeWitt Army Community Hospital is a low scope site since it is an existing hospital with inpatient capacity within which an entire floor has been converted from inpatient ward space to an outpatient, or clinical, model of health delivery a functioning hospital. This conversion of ward to clinical space pertained to a Women's Health Clinic on the third floor of the facility. It is located in Springfield, Virginia and is part of the National Capital Health Network (see Figure 2.5).

- DeWitt Army Community Hospital was named in honor of BG Wallace DeWitt, a surgeon who served in WW I and WWII. It was the second of nine hospitals planned by the Army during the building program following the Korean War.

- The hospital today is a 46-bed JCAHO accredited facility, and is the only military inpatient facility in northern Virginia. Major services include general medical and surgical care, neurology, pediatric medical and surgical care, obstetrics, orthopedics, and emergency department.
- It is the center of the DeWitt Health Care Network, which features the Rader Army Health Clinic at Fort Myer, and the Family Health Centers of Woodbridge and Fairfax.
- The network joined the Walter Reed Health Care System in 1996.
- A new replacement hospital is slated for construction under BRAC II, and is expected to open in 2009.

2.4.6 Ft Jackson (LOW SCOPE), Moncrief Army Community Hospital



Figure 2.6 Moncrief Hospital, Fort Jackson, South Carolina

Moncrief Army Community Hospital is a low scope site since it is an existing hospital with inpatient capacity within which an entire floor has been converted

from inpatient ward space to an outpatient, or clinical, model of health delivery a functioning hospital. This conversion of ward to clinical space pertained to a temporary (one year) transition of the Family Health Clinic to the tenth floor of the facility which was later occupied by administrative services. It is located in Columbia, South Carolina and primarily supports the Fort Jackson military community (see Figure 2.6).

- Moncrief Hospital is named in honor of Colonel William Henry Moncrief, Sr., a former Army Medical Corps surgeon whose career spanned over 41 years of dedicated service. Following his retirement from active duty in 1939, Colonel Moncrief moved to Columbia where he served as Administrator of the South Carolina Sanatorium at State Park until 1954.
- Dedicated in 1972, Moncrief Army Community Hospital is a modern medical complex covering 323,000 square feet. Within the 12-story hospital and its related clinics, a wide range of medical services are available, ensuring quality and comprehensive medical care with a capacity for 81 inpatient beds. Surgical specialties include: Audiology, Ophthalmology, Optometry, Orthopedic Surgery, Otolaryngology, Podiatry, Gynecology, and Radiology.

2.5 Stakeholder Selection

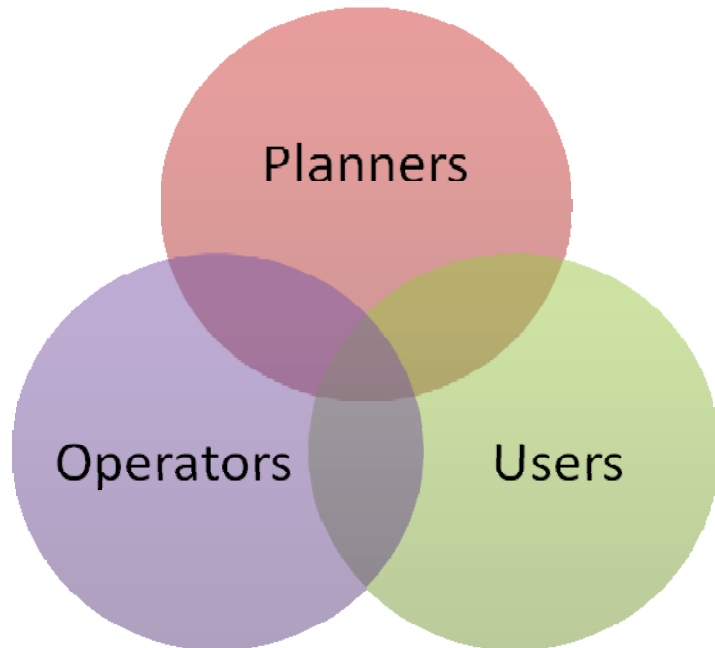


Figure 2.7 Visual Representation of Varying Stakeholder Perspectives

The three stakeholder groups (see Figure 2.7) were selected for this study to gain a perspective on what factors made the conversion from inpatient to outpatient easier or more difficult (planners), and how the specific factors converted affected the ongoing operations of the facility (facility management) and those providing care (users). Therefore, planners were selected for initial design and construction issues; operators, for efficiency and effectiveness of facility operations; and key medical staff, to understand how the renovated space works in terms of delivering services at the desired level of quality. The planners were comprised of one U.S. Army healthcare planner and one government contracted architectural design and engineering firm representative per site. The operators comprised facilities manager and information

technology manager employed at each site. The key medical staff was either a physician or nurse at the clinic or hospital selected for the study.

2.6 Data Collection

Focused interviews were conducted within three targeted groups: planners, for programming, planning, and design issues; operators, for efficiency and effectiveness of facility operations; and key medical staff, to understand how the renovated space works in terms of delivering services at the desired level of quality and the physical environments impact of staff quality of life. In total, twenty-eight focused interviews were conducted: nine planners, thirteen operators, and six users. There was some overlap between sites within the planner category since the government and AE planner tend to perform services at multiple sites. Also, during Phase II a primary and a second facility manager were interviewed at the Ft Belvoir site to receive more detailed background information pertaining to the scope of conversion.

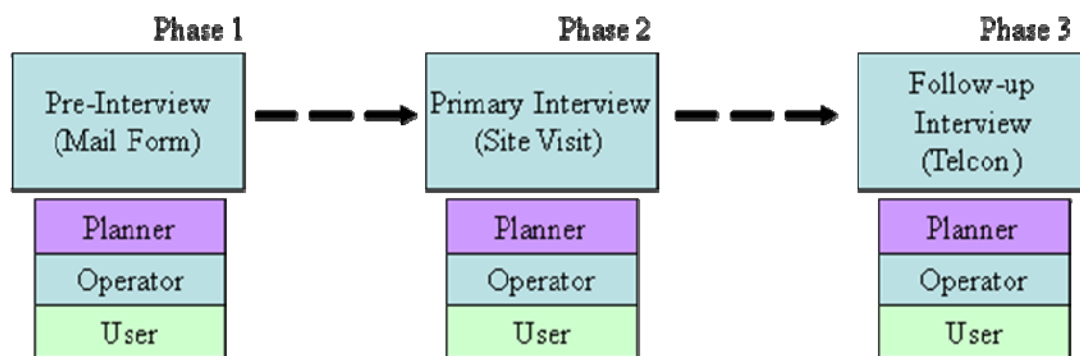


Figure 2.8 The Three Phased Research Design

Data collection comprised three phases (see Figure 2.8), with planners, operators, and users being involved in each phase. The purpose of the pre-interview phase was to gather relevant documentation about the specific facility (e.g., master plans, space plans, etc.) and also to send the key informants the interview tool which was composed of the types of questions that would be asked in Phases II and III (see Appendix B). Logistical factors such as time and funding limited the number of sites visited; therefore, teleconferences were utilized to interview stakeholders at two sites: Fort Rucker, Lyster Army Health Clinic and Fort Jackson, Moncrief Army Hospital, for Phases II and III of the data collection process.

2.6.1 Phase 1 Pre-Interview

After the sites were selected a request for historical information regarding each site was sent to the U.S. Army Health Facility Planning Agency (HFPA) and respective architectural and engineering firms. Data requested pertained to details regarding why the sites were converted and how the facilities adapted to the changing healthcare mission. The following documents were received in support of the research endeavor: facility master plans, stock site photos, facility condition assessments, and healthcare requirements analysis.

The specific participants were selected based upon their experience, or historical connection and knowledge of the conversion. This was easily accomplished for the planner and operator categories since there was a record of these persons and limited staff rotation meant most were still involved and could be contacted. There was one exception found within the operator

category. The operator category was split between the facility managers (FM) and the information technology (IT) managers. The IT manager category had to be augmented with an HFPA IT Consultant who was familiar with the research sites. The lack of a historically knowledgeable IT manager was due to the transient nature of hospital IT staff and the time span post-conversion at some sites. Obtaining historical user participants presented a challenge. Therefore each hospital's Managed Care division liaison was interviewed to determine whether staff was available who had experienced the conversion. All the users interviewed had a historic knowledge of the conversion so they could comment on what transpired and/or on the impact the physical environment had on the quality of care the patient received and on staff quality of life.

2.6.2 Pilot Study

The Guthrie Clinic at Ft Drum in Upstate New York was selected as a pilot study to test data collection and analysis tools and methods. It met a majority of the selection criteria and was in close proximity Cornell University. The lessons learned from the pilot were the following:

- Develop a simplified data collection tool with examples of possible answers to aid data collection (see Appendix A for initial and Phase 2 tool).
- Maintain continuous and frequent communication with participants to maximize the probability of holding the appointment, and the interviewee being prepared. This was accomplished by:
 - Initial Introduction. A telephone call upon acceptance into study.

- Calendar Marking. Contacting the participant over email 30 days out to establish a rapport with the participant.
- Reminder and Follow-up. Two weeks out following up with an email reminder, followed by telephone communications to answer any questions which may have occurred concerning the tool.
- Final Reminder. Sent via email and also followed with a telephone call to confirm the appointment 24 to 48 hours in advance.

2.6.3 Phase 2 Primary Interview and Site Visits

The interviews in Phase 2 focused on the issues of each key stakeholder group: planners, operators, and users. An interview protocol (see Appendix B) was developed as a result of the pilot study to aid data collection in Phase 2. The tool was sent at least two weeks in advance of the teleconference interview or site visit. The interview was conducted in association with the site visit at four of six sites. The site visits were conducted during Cornell University's winter break in January and spanned eight days. The eight days were broken into 4 segments of two days each: one designated for travel and one for the site visit. Four sites were visited in eight days. Participants were contacted 24 to 48 hours prior to their scheduled interviews. Photos were taken during the site visits to support and/or emphasize constraining or beneficial design elements. The duration of the interviews trended toward 60 minutes for the planner and operators and between 30 and 45 minutes for the users. An elongated moving box was utilized to organize all materials required to perform the site visits and interviews. Contents of the box included: extra batteries for the camera and the audio recorder, extra copies of the interview tools for each site visited, site

specific contact information, and general research support items (books, paper, clip-board, etc.).

After the site visits were completed the teleconferences with two remote sites were conducted. From beginning to end Phase 2 was planned to be completed in three to four weeks. In reality it took six weeks, from early January 2008 until mid-February 2008. This was due to scheduling issues between the availability of private teleconferencing capable areas at Cornell University and difficulty scheduling the interviews given respondents own busy schedules.

2.6.4 Adaptability Data Collection Tool

A data collection tool was developed to interview stakeholders regarding the changes made within the facility and the adaptability of design elements. The tool was tailored to each target category of stakeholders: planner, operator, and user. The study of the built environment within healthcare facilities is complex and difficult. Therefore, utilizing a simple framework was necessary and beneficial. A beneficial framework was found within previous studies of workplace design. The tool used was developed by merging previous frameworks describing different layers of building change and adaptability (Becker, 1990; Duffy, 1992; and Brand, 1994). The tool comprised a simple MS Word Table (see Appendix B) with detailed sample questions relating to six layers of change set forth by Steward Brand. The work of Duffy (1992) and Brand (1994) developed frameworks to study building adaptability. Duffy (1992) articulated four shearing layers of change: shell, service, scenery, and set. Brand (1994) built upon these shearing layers concept and developed a

framework comprised of six layers to study the workplace environment: site, structure, skin, services, space plan, and stuff. These frameworks can be adapted for use in the study of the healthcare physical environment to improve the overall sustainability of health facilities. The intent behind developing the tool was to help the participant prepare for the interview.

The tool was sent electronically as an attachment to the participant group two weeks in advance of the interview. The main purpose of the tool was to stimulate data gathering efforts on the part of the participant regarding the adaptability of their respective facility and aid in gathering data in preparation of the first interview.

2.6.5 Stakeholder Perspective Data Collection Tool

In order to appropriately gauge stakeholder perspectives on which factors were emphasized during the conversion a simple four part verbal questionnaire was used. After completing the interview tool the participant was asked to rank order the four factors relating to the triple bottom line for health: adaptability, cost, sustainability, and quality of care, from one to four. The number one was identified as the most important factor impacting decision making during the conversion of the facility and the number four was the least important.

2.6.6 Phase 2 Data Analysis

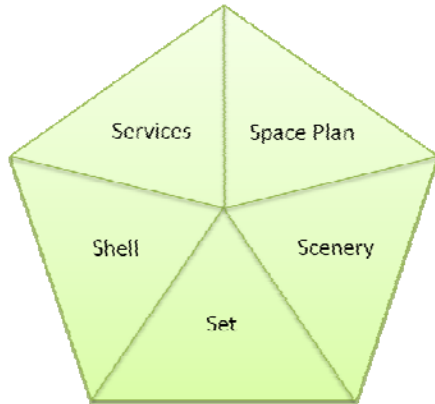


Figure 2.9 The Pentagon Analysis Framework

Between Phase 2 and 3 data was analyzed for patterns across scopes and categories of systems. Phase 2 data analysis occurred from late February to late April after which a second interview tool was developed to refine data collection efforts for Phase 3. The revised tool focused on specific issues raised during Phase 2, seeking deeper understanding of critical physical factors, and how they either constrained or benefited the conversion of the facility. Issues requiring additional detailed information were identified for Phase 3. To aid the data analysis a hybrid of Duffy's and Brand's layers of building change was developed. The hybrid format comprised five layers of change or adaptability (Figures 2.9). A hybrid was developed since there was some confusion between the space planning and adjacency layers of the format used in Phase 2 (see Appendix C). These were merged into one category labeled space plan (see Appendix C). The space plan layer was selected since efficiency is tied to the adjacency of service lines within health care facilities.

Research question one also included a requirement to discern what areas within the facilities were most impacted by the conversion. “Area” was defined as a specific hospital or service related function within the health care facility which was eliminated or changed as a direct result of the conversion from inpatient to outpatient care delivery. This requirement was accomplished by developing an Excel spreadsheet listing common service changes across the sites (see Appendix C). The information was placed within a matrix to determine coinciding areas impacted by the conversion.

Table 2.4 The Pentagonal Matrix with definitions of each layer

Change Layer	Definition
Shell	The support structure of the building
Services	The information cabling, plumbing, air conditioning, heating, fire protection, and elevators
Space Plan	The adjacency of various services within the health care facility
Scenery	The layout of partitions, drop ceilings, interior walls, etc
Set	The shifting of furniture by occupants

During Phase 2 data analysis the transcription of interviews presented a problem. It became apparent that the software limited the amount of reference marks to 15, which for interviews with duration below 60 minutes it did not present a problem. For most of the FM operator and planner interviews it did. It impacted the efficiency of data analysis during Phase 2. Therefore, during

Phase 3 the interviews were split into two parts coinciding with each research question posed for the planners and operators interviews. This solved the problem and allowed for greater use of index marks which was helpful when it came time to extrapolate quotes supporting the findings of the research.

During Phase 2 the participants were provided with an interview tool without brief definitions of the four factors of the TBL for health. The definitions were explained verbally during the interview and they were asked to rank order them. If questions were raised regarding the exact nature of the definition of a factor it was provided at that time of the interview. During Phase 2 there was confusion regarding the term sustainability in the context of the study, therefore it was further defined between from Phase 2 to 3. The confusion revolved around the use of the term sustainability in the context of the U.S. Army Medical Command facility management definition which pertains to maintenance related issues compared to the civilian sector use which pertains more to a green design related focus. This was clarified during Phase 3 by providing a written definition of all four factors of the TBL for health in the tool so that an accurate justification for the ranking of the four criteria could be made (see Table 2.5). There was no change in the prioritization of the factors by the participants, but the written definitions helped the participants differentiate between the factors.

2.6.7 Phase 3 Follow-up Interviews

The follow-up interview (Phase 3) was scheduled in June after the initial interview (Phase 2) data was analyzed. This was accomplished by providing the data in a graphical format identifying which elements either constrained or

benefited the conversion of the facility. The revised tool was composed of both MS Word and Excel documents depending on the scope of the site (see Appendix D). The high and medium scoped sites had two Excel spreadsheets and one Word document whereas the low scope sites only required one. This was on account of the low scopes sites smaller scope of change. Therefore research question pertaining to which areas within the facility were most impacted by the conversion effort did not apply. The varying spreadsheets

Table 2.5 Definitions of the Four Factors relating to the Triple Bottom Line or Health

Criteria	Definition
Quality of Care	The overall consideration given to how the design of the facility would positively enhance the quality of care provided/ received at the health care facility.
Adaptability	The overall consideration given to the future adaptability of the health care facility in general and the specific elements and spaces comprising the facility.
Cost	The overall considerations given toward the cost of the project.
Sustainability	The overall consideration given toward the environmentally responsible impacts associated with the project. The impacts may take many forms such as LEED certification, but within this study focused on material selection and energy conservation.

dealt with research questions (RQ) 1.1, and 1.2 through 1.4, and were sent to the planners and operators only. The spreadsheets identified which areas were most affected by the conversion. The spreadsheets also displayed which

systems within the five categories of change either constrained or benefited the conversion effort.

The user category of stakeholders received their own interview tool. It was a Word document questionnaire which focused on the top ten occurring design elements identified through Phase 2 and focused on issues related to delivering services at the desired level of quality. It focused on quality of care and quality of life perceptions directly related to their physical environment (see Appendix E).

The mean follow-up interview duration was 60 minutes. The planners and FM operators trended toward 60 to 75 minutes, while the IT operators and the user interviews trended toward 30 to 40 minutes. The follow-up interview was only conducted via teleconference. The main goal of the follow-up interview was to provide more detailed information, or clarify issues, relating to the specific constraints or benefits entailed by design elements, which areas were impacted, and the attitude or perspective relating to the prioritization of the TBL related questionnaire. The process mirrored the previous interview but was targeted toward specific issues which required clarification to aid the research toward understanding health care facility design adaptability and the varying perspective of the three stakeholders: planners, operators, and users. Unlike previous scheduling challenges found within Phase 2 suitable accommodations were available which minimized scheduling challenges associated with conducting focused interviews via teleconference during Phase 3.

2.6.8 Phase 3 Data Analysis

The collected qualitative data was analyzed to determine relationships between scopes and the category of change. All the data was recorded on an excel spreadsheet and organized across scope and category. Data analysis efforts during Phase 3 were focused toward gathering information regarding the adaptability of design elements across scopes and stakeholder group attitudes regarding the TBL and their relative importance within decision making during the conversion process. Once the data was transcribed and coded it was easier to place within the pentagon framework (Figure 2.9) and identify which design elements either constrained or benefited the conversion effort.

This was applied to determining which areas were most affected by the conversion. These areas were identified along the “y” axis of the spreadsheet under the subheadings of: specialty services, primary care services, ancillary services, and administrative and support services. The subheadings were selected based upon the volume of data received throughout the research study. The “x” axis identified the varying scopes and sites where the impacts occurred. Thus by using a simple spreadsheet and keying the varying areas within the hospital as: eliminated, converted, expanded, or reduced, it was easy to deduce which areas were the most impacted by the conversion (Table 2.6). More details on the findings will be discussed in the results section.

The revised tool provided a visual graphic of what occurred across the varying scopes. It was then easy to determine, based upon the data gathered, which elements constrained or benefited the conversion of the facility. This was

possible because the scopes of change were placed along the “x” axis and the five categories of change comprising the pentagon framework were arrayed along the “y” axis. Colors and symbols were used to identify constraints and benefits. Colors also associated with the varying level of scope change. Symbols associated whether the design element constrained or benefited the conversion. There were issues when disagreements between stakeholders occurred when coding the data and these are identified by labeling them both a constraint and a benefit with both a “B” and a “C” (Table 2.7). Disagreements were reviewed and if the design element was identified by a majority of the participants, defined as greater than 66%, it was included in the study. If it was less than 66% it was removed. Further details of findings will be explained in the results section.

Table 2.6 Data Analysis for Research Question 1.1

What Areas were most effected by the conversion and how? (RQ.1.1)

Specialty Services	Eustis HIGH	Meade HIGH	Lee MEDIUM	Rucker MEDIUM	Belvoir LOW	Jackson LOW
Operating Rooms	Converted to minor surgery	Converted to minor surgery	Eliminated	Eliminated	NA	NA
Emergency	Converted to Acute Care Clinic (ACC)	Reduced to 9-5 Urgent Care Clinic (UCC)	Converted to Primary Care Clinic	Converted to Primary Care Clinic	NA	NA
Inpatient Ward Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space
Ophthalmology	Eliminated	Eliminated	Eliminated	Eliminated	NA	NA
Internal Medicine	Split between floors (Gastro Entomology Svcs)	Eliminated	Eliminated	Eliminated	NA	NA
Dermatology	Eliminated	Eliminated	Eliminated	Eliminated	NA	NA
Orthopedics/ Podiatry	Reduced	Reduced	Reduced	Reduced	NA	NA
Primary Care Services	Expanded	Reduced	Expanded	Expanded	NA	NA
Mental Health	Expanded	Reduced	Expanded	Expanded	NA	NA
Women's Health	Expanded	Reduced	Expanded	NC	NA	NA
Pediatrics	Expanded	Reduced	Expanded	Expanded	NA	NA
Optometry	Expanded	Reduced	NC	Expanded	NA	NA
Physical Therapy	Expanded	Reduced	Reduced	NC	NA	NA
Occupational Therapy	Converted	Reduced	Reduced	NC	NA	NA
Ancillary Services						
Pharmacy	NC	Expanded	Expanded	Expanded	NA	NA
Pathology	NC	NC	NC	NC	NA	NA
Radiology	NC	NC	NC	Reduced	NA	NA
Admin and Support Services						
Central Material Services	NC	NC	Eliminated	Eliminated	NA	NA
Nutrition Care	Conversion due to Beta Test "Ala Carte" Site	Converted to Large Conference Areas	Converted to Break Area and Medical Warehouse	Converted to Medical Records Storage	NA	NA
Logistics	Reduced	Reduced	Reduced	Reduced	NA	NA
Information Technology	Expanded	Expanded	Expanded	Expanded	NA	NA
Medical Records	Reduced	Reduced	NC	Reduced	NA	NA
Morgue	Eliminated	Converted to Prev. Medicine Space	Converted to FM Maint Parts Room	Reduced in Size	NA	NA
Chapel	*Never had one.	Converted to Prayer Room	Converted to TRICARE benefits Office	Converted to Prayer Room	NA	NA
Treasury Office	Eliminated	Eliminated	Eliminated	Eliminated	NA	NA

Table 2.7 Comprehensive List of Coded Data by Scope, Site, and Layer

SITE SCOPE	Eustis HIGH	Meade HIGH	Lee MEDIUM	Rucker MEDIUM	Belvoir LOW	Jackson LOW
Which design/ building elements aided or benefited the conversion of the facility and which constrained the conversion? (RQ 1.2 and 1.3)						
Benefit = B / Constraint = C	B	C	B	C	B	C
SHELL						
Load Bearing Walls		C		C		C
Regular Column Pattern	B		B		B	
Irregular Column Grid		C		C		C
Building Shape		C		C	B	C
Building Envelope	B	C		C	B	C
SERVICES						
HVAC Distribution		C		C		C
HVAC Capacity	B		B		B	
Fire Suppression		C	B	C	B	
Plumbing		C		C	B	
IT - Voice/ Data		C		C		C
Electrical Capacity	B		B		B	C
Emergency Power Availability	B		B		B	
Electrical Distribution	B		B		B	
Lighting	B	C		C	B	C
SPACE PLAN						
Building Chassis Incongruency		C		C	B	C
Circulation Pattern		C		C		C
Unit Adjacencies		C		C	B	C
Available Transition Space	B	C	B		B	
Room Size		C		C		C
Room Type		C		C	B	
SCENERY						
Wall Materials		C		C	B	
Door Size		C		C	B	C
Ceiling Heights	B	C	B		B	
Flooring Materials		C		C	B	
SET						
Modular Furniture	B		B		B	C

The user stakeholder category was asked to identify which design elements were found to aid or constrain staff quality of life and the quality of care delivered. Common patterns developed from the ten design elements used as a basis to interview users (Table 2.8). The criteria used to decide if the design element aided QOC or QOL was a majority of participants (>50%) mentioning the design element during the focused interviews. The patterns present identified break rooms with 100% positive contribution, and dining options and access to nature both with 66% positive contribution. These will be further explained in the results section. No QOC design patterns (greater than 50% identification through focused interviews) were noted in this study.

Table 2.8 Data Collected from Users for Research Question 1.4 on Quality of Life (QOL) and Quality of Care (QOC) by Site, Scope, and Layer

SCOPE	Eustis HIGH		Meade HIGH		Lee MEDIUM		Rucker MEDIUM		Belvoir LOW		Jackson LOW	
	QOL	QOC	QOL	QOC	QOL	QOC	QOL	QOC	QOL	QOC	QOL	QOC
What was the impact of the design decisions of the Planners and Operators on the Users? (RQ#2???)												
Quality of Life = QOL / Quality of Care = QOC												
SHELL												
Access to Outside (QOL)	QOL									QOL		QOL
Building Shape					QOL	QOC						
High Ceilings									QOL			
SERVICES												
HVAC Control												
Electrical Accessibility		QOC										
Showering Facilities			QOL									
Kitchen Sinks												
IT - Voice/ Data Accessibility				QOC								
Cable TV Access								QOL				
Elevator Access and Reliability					QOL							
SPACE PLAN												
Dining Options (QOL)			QOL		QOL				QOL			QOL
Break rooms (QOL)	QOL		QOL		QOL			QOL		QOL		QOL
Patient Flow Patterns (QOC)		QOC				QOC		QOC				
Restoration Nodes or (PRPs) (QOL)	QOL		QOL					QOL		QOL		QOL
Walking Distances		QOC						QOL				
Shared Waiting Rooms									QOC			QOC
Staff Communication Patterns (QOC)		QOC				QOC		QOC				
SCENERY												
Access to Natural Light (QOL)	QOL				QOL		QOL					QOL
Access to Nature (QOL)	QOL				QOL		QOL					QOL
Color			QOL						QOL	QOC		
Module Room Design								QOC				
Door Sizes and Types		QOC	QOL						QOL			
Specialized Room Types												
The Personal Touch										QOC		
Orderliness									QOL	QOC		
Acoustics				QOC					QOL	QOC	QOL	QOC
SET												
Modular Furniture								QOL				
Access to the Equipment		QOC						QOL		QOL		QOC

The rank ordering of importance within the TBL for health by stakeholder category was reversed to provide a better graphical representation of the data gathered (taller is better). This was accomplished by reversing the order of importance from one equaling the highest priority to four equaling the highest priority. Stakeholders were asked to explain why they rank ordered the four factors the way they did and the results of the graph and will be detailed in the results section.

CHAPTER 3

RESULTS

3.1 Demographic Information

Table 3.01 Participants Interviews per Site

	Ft. Lee (High)	Ft. Rucker (High)	Ft. Meade (Medium)	Ft. Eustis (Medium)	Ft. Belvoir (Low)	Ft. Jackson (Low)
Planners	2	2	2	2	3	3
Operators	2	2	2	2	2	2
Users	1	1	1	1	1	1

A total of twenty-eight participants were interviewed during two phases over five months. It is important to note that one interviewee in the operator category was dropped after the first phase of interviews since he was not the facility manager, but was useful since he provided supporting background at one of the low scope sites. The participants were composed of the following cross section of stakeholder categories: ten planners, twelve operators, and six users. The main reason for a disproportionate share of planners is that some of the planners were involved at more than one site. Four of six sites were visited for personal interviews during phase one of the research; the remaining interviews were conducted over the phone. Phase 2 interviews were all conducted over the phone.

3.2 External Drivers and Research Sites

Most of the facilities in this project were mandated to close or directed to convert since they did not have appropriate demand to justify current staffing levels through the Base Realignment and Closure (BRAC) I (1995) and II (2005) process. BRAC II utilized an Integrated Health System (IHS) approach to providing health care for the MHS. What this meant was that if there was a duplication of effort its aim was to eliminate it under the purview of operating cost reductions. A comprehensive analysis was used with data gathered through multiple managed care and support services commonly known within the MHS as a Health Care Requirements Analysis (HCRA). If there were two hospitals in the same market area this normally meant the market area had excess capacity and one facility would be directed to close or minimize operations to reduce costs. This determination was accomplished by analyzing healthcare functional lines of operation (e.g. Surgical and Specialty Services). Ultimately, functional areas within the facilities were impacted since interior facility spaces are allocated and staffed based on the MHS HCRA performed.

3.3 Research Question (RQ) 1.1: Functional areas most affected by the conversion.



Figure 3.1 Typical Medium Scope Operatory Room

The two functional areas most affected by the demand analysis were the operating rooms (OR) and the Emergency Department (ED). Both the high scope and medium scope sites experienced drastic changes in space utilization when the procedures in the ORs were either eliminated, as in the high scope sites, or shifted to ambulatory, as in the medium scope sites (Figure 3.1). The OR closure impacted the space utilization of the former inpatient wards and eliminated their need so they were abandoned. The closure also impacted the former inpatient wards and related clinical and administrative support functions such the as: central material services (CMS), nutrition care services (NCS), medical logistics, chapel, morgue, treasury office, and medical records. The impact was less severe for the medium scope sites since CMS was retained in some semblance to support the ambulatory surgical mission. Since the OR was closed the ED could no longer be supported, therefore it was either closed, as with the high scope sites, or converted to an acute care clinic or an urgent care clinic with normal hours of operation, as in the medium scope sites.

This study found that outpatient services, or primary care services, and the information technology division areas all increased in size as a result of the conversion from inpatient to outpatient services. The outpatient services moved into former inpatient wards or areas vacated that were no longer required due to the change in mission. The information technology (IT) division was expanded with the growth of medical technology and has seen its support requirements increase significantly as a direct result of the introduction of the computer, the clinical support systems required to monitor managed care operations, and the EMR.

All the facilities had an abundance of space immediately following the conversion but due to lack of funding to renovate the space for the change in function the facilities were unable to realize the required efficiencies to support modern healthcare. This was primarily as a result of the BRAC I and II process not recognizing the importance of effective master planning and making funds available to conduct master plans at each impacted site. In association with the BRAC the MHS conducted exhaustive managed care demand analysis per site. The analysis did not have criteria for operating efficiencies relating to changing operations within existing hospitals. No funds were directly allocated through the BRAC to create a new strategic plan with supporting master plan to enhance the conversion. The high cost of renovation also played a significant role since the facilities were indicative of the Hill Burton era and designed for obsolescence which made most of the renovations cost prohibitive since their interior building elements were not designed to be adaptable. Finally, as is the case throughout the government there are more requirements than available funding. These factors presented a problem. The converted areas were less

aesthetically pleasing since the previous wall and floor finishes remained due to funding issues and previous building standards. This was detrimental since interior aesthetics in healthcare environments has been identified as a key measure of perceived quality of care by numerous research studies. Overall the facilities made the most of what they had. Some of the most salient examples area explained below:

- Current guidelines for efficient primary care in the MHS call for one doctor office per every two exams (TRICARE, 2002). The old ward space accommodates a less efficient standard of a shared office exam which negatively impacts patient thru-put and negatively impacts organization efficiencies by reducing the number of patients seen per doctor per day (Figure 3.2).



Figure 3.2 Shared Office and Exam Configuration with former Inpatient Ward Area

- In support of outpatient services inpatient ward rooms were converted to waiting areas (Figure 3.3). As previously noted they satisfy a need, but their aesthetics leave much to be desired. With the increased focus on competition the MHS beneficiary population's has the ability to decide where they receive their health care. This is a negative impact of the MHS since studies have identified the link between patients' perceived care and the attractiveness of the physical facility (Becker and Douglas, 2006).



Figure 3.3 Standard Waiting Area found within previous Inpatient Ward Area

- Even though the newly converted facility experienced an increase in usable space it was forced to utilize it in an inefficient manner. This was due to a lack of programmed funds for the renovation of the areas. Funding restrictions placed upon the organization hampered the renovation of the areas to suit their new function. This is epitomized by the before and after utilization of the nutrition care service area (see Figure 3.4). This site reutilized its dining facility as a medical logistics warehouse as a cost saving measure. The loss of the dining facility had negative impacts on the staff

QOL which will be addressed later in the study. Due to the increased emphasis on efficiencies through managed care operations and time the staff is allowed for breaks and meals a near proximity healthy dining establishment is a necessity. The dining area also serves as a place for staff to nourish their bodies and minds before returning to patient care related activities and is supported by interviews from staff and also previous research (Hirschberg, 1998; Repetti & Cosmas, 1991).



Figure 3.4 Converted Nutrition Care Service Area into Logistics Warehouse

- A common theme throughout the research was former inpatient space converting to administrative support space. At this site the former ICU was converted into administrative space in support of mission readiness and soldier support (see Figure 3.5). The patient headwalls and nursing center can still be seen. This new function occupied the existing space and operated in the most efficient manner possible since funds were not available or allocated to renovate the area due to the high cost of conversion and competing priorities for limited funds.



Figure 3.5 Former Inpatient Intensive Care Unit used for an Administrative Function

In conclusion, the study found that the conversion of an inpatient facility to an outpatient model of health delivery led to an abundance of inefficient and unaesthetic space. In this study it was directly related to availability of funds, the Hill Burton Era standards of construction which were focused on building obsolescence versus adaptability, and a lack of funding through the BRAC initiatives to conduct proper strategic planning and programming so the facilities could be better adapted to their new functional use. Current EBD research, managed care business operating practices, and facilities management practices have shown a negative impact on the care received since the facilities are inefficient they increase the cost of providing services for the organization, they lower the perceived standard of care provided by the organization, and there is an increased cost to environmentally condition and maintain the inefficient space.

3.4 RQ 1.2 Constraining Design Elements

Table 3.2 Design Element Benefit and Constraint Matrix utilizing: Scope, Site, and Pentagon Framework.

SITEM SCOPE	Eustis HIGH		Meade HIGH		Lee MEDIUM		Rucker MEDIUM		Belvoir LOW		Jackson LOW	
	B	C	B	C	B	C	B	C	B	C	B	C
Which design/ building elements constrained the conversion of the facility in MED & HIGH scopes, but benefited LOW scopes? (RQ 1.2)												
Benefit = B / Constraint = C												
SHELL												
Irregular Column Grid		C		C		C		C		C		C
Building Shape		C		C		C		C	B	C	B	C
SERVICES												
HVAC Distribution		C		C		C		C		C		C
Plumbing		C		C		C		C	B		B	
IT - Voice/ Data		C		C		C		C		C		C
SPACE PLAN												
Circulation Pattern		C		C		C		C	B	C		C
Unit Adjacencies		C		C		C		C	B		B	
Room Size		C		C		C		C	B		B	
Room Type		C		C		C		C	B		B	
SCENERY												
Wall Materials		C		C		C		C	B		B	
Flooring Materials		C		C		C		C	B		B	
SET												

The study found the following design elements constrained the conversion of former inpatient facilities to an outpatient model of health care delivery (Table 3.2). The design elements were organized by utilizing the Pentagon Framework as defined earlier (see Table 2.4). The design element findings will now be described in more detail within subsequent paragraphs.

3.4.1 Irregular Column Grid (Shell Level)

The study found that an irregular column grid restricts the ability of the space utilization and introduces increased risk and cost to later renovation efforts. Unsymmetrical patterns make it difficult to support modular designs and require more space to accommodate rooms and equipment since the column grids are not spaced within a standard pattern. Column irregularity introduces increased

risk and cost in renovation efforts since the column placement is not predictable (Loosemore, et al 2006) It makes planning and implementing new spaces more difficult since outpatient spaces are most efficient when modularized in office and exam configurations with the appropriate clinical support spaces (DoD UFC-4-510-01, 2007). Risk and the increased cost associated with it are introduced since the room configurations and layouts may not be standardized.

Planner Perspective	Operator Perspective
<p>“It is more challenging on the design side and potentially on the functioning side when you have an irregular column grid. It does not lend itself to modules and also negatively impacts space planning efficiencies. Viewing through a patient safety aspect: we want people to understand how the room functions. A standard grid works much better. With an irregular grid you would not have the standard set-up in every room to minimize the risk of medical errors.”</p>	<p>“Irregular column grids prevented any symmetrical reconfiguration of the space. You do not get squares; columns are not placed at a regular interval like 12’ apart. It is not predictable It leads to an unsymmetrical pattern and lends itself to more risk and the increased cost associated with that risk. Cost and risk go together.”</p>

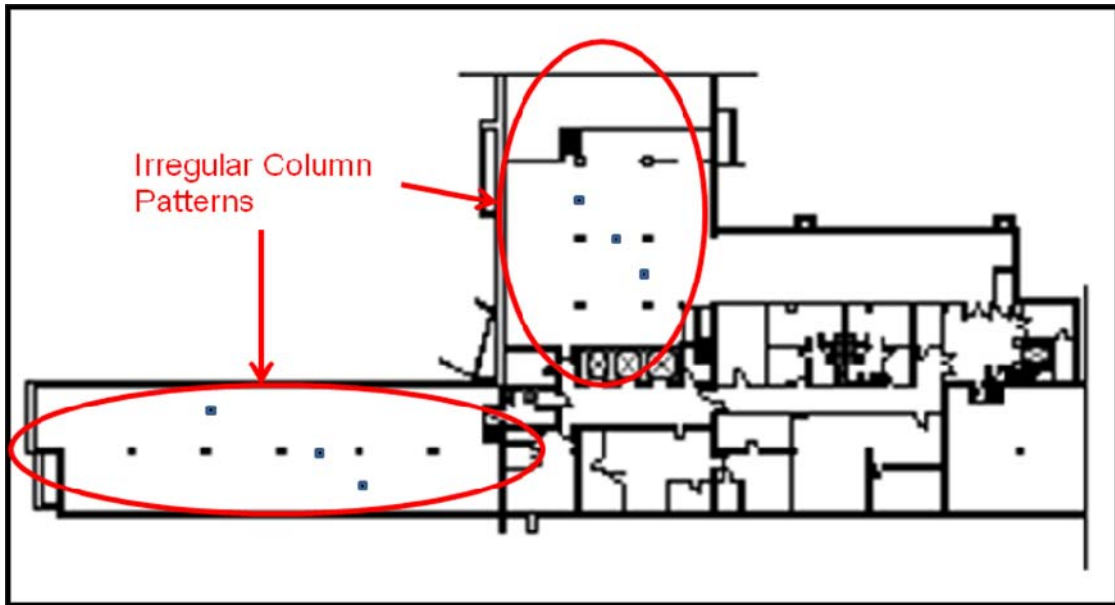


Figure 3.6 Irregularity Leads to Inefficient Space Utilization: Increased Uncertainty and Inhibits Modularization

3.4.2 Building Shape (Shell Level)

The building shape was identified as a constraint due to the challenges present when trying to layout the space for outpatient care. It was difficult to design an efficient pattern of office and exams, and a hub and spoke check-in and reception system to accommodate the new outpatient clinical function. The shape of the building with its single loaded corridors did not lend itself to efficient outpatient care delivery. This constraint was due in part to the lack of funds to renovate the space for optimum care delivery; therefore the solution was to use old inpatient nursing stations as reception and check-in areas with the closest inpatient room serving as a waiting room. In some cases local funds were available to conduct a partial renovation to help mitigate some of the constraints (see Figure 3.7). Typically walls were removed to support multiple

waiting are reception spaces which created a mixture of patients and staff within one a single corridor which was not the optimum functional or aesthetic solution since it increase staff walking distance and time and the healthcare environment was not aesthetically pleasing. Both of these results have been shown through EBD to have negative consequences on staff QOL and patient perceived QOC (Becker and Douglas, 2006; Carpman & Grant, 1993).

Planner Perspective	Operator Perspective
<p>“Generally an irregular shape is a constraint since you have differences in column grids between outpatient and inpatient services due to the differing column grid. It dictates how the design is laid out. Unusual shapes trend toward inefficient space utilization. ”</p>	<p>“The outpatient system is established like a spoke and wheel with a central hub and check-in, versus a long and linear system for inpatient systems it does not lend itself to that. What we have done is we have tried to put a hub in a linear type format and it doesn’t work as well. Plus, as we reconfigure space for new clinics, let’s say the clinic needs 2,000 square feet we are tied to the previous building shape. You are tied with your exterior walls and interior corridors being fixed so you may only end with 1,600 net square feet (NSF) available, therefore you are constrained.”</p>

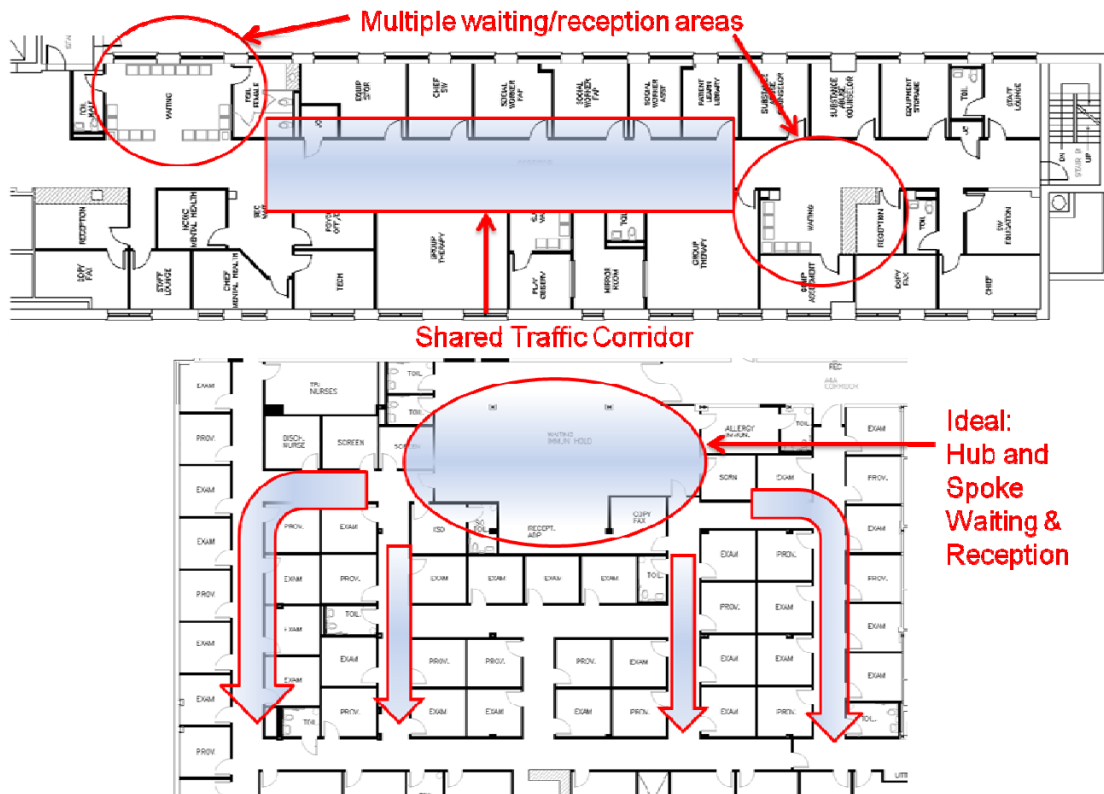


Figure 3.7 Building Shape Constrains Conversion by not providing Efficient Circulation, Space Utilization, and Patient Wayfinding

3.4.3 HVAC Distribution (Services Level)

The distribution of the HVAC presented numerous constraints during the conversion. Not only was it designed to accommodate a limited number of inpatient rooms, but it was aged and presented negative environmental impacts. As mentioned previously, the old ward spaces were overtaken by either clinical or administrative uses. Both of these uses increased the heat loads on the floors due to the increased number of people, equipment (medical and automation), and the temporary walls established to divide the spaces for

use. The ductwork had to be manipulated by increasing the number of supporting sub-lines to allow for increased airflow to reduce the heat load and maintain the proper level of air exchanges in support of the increased staffing volumes and the temporary interior wall changes (Figure 3.8). Balancing was a real challenge and was exasperated by the age of the VAV (variable air flow) boxes dating back to the 1960s. Finding spare parts hampered efforts and increased standards precipitated a major redesign effort to support the conversion. The existing designs composed zones isolated to one AHU (air handling unit) and did not allow for proper distribution and zonal control. This is important since it has been highlighted through EBD that staff control of their environment has been shown to reduce staff stress by allowing greater control over their environment and increase staff QOL, by lowering infection rates of SARS and TB infections. The decrease in infections relates directly to the proper rate of air exchanges. The preferred rate is between 12 and 15 per hour (Jiang et al, 2003; Menzies et al., 2000). The redesign of the distribution system led to environmental concerns since the system contained hazardous asbestos. Therefore existing areas would be required to undergo remediation. Utilizing non-toxic building elements in the future would negate the need for environmental concerns within health care environments and be in-line with the TBL for health.

Planner Perspective	Operator Perspective
<p>“If you try to use what is already there in a conversion it is difficult since there are different standards with exhaust and supply in support change in utilization from a inpatient room to multiple exam and clinical support areas. ”</p>	<p>“If you move interior walls around you have to alter the HVAC distribution system. Your ducts have to be sized differently and run in a different direction. Plus, the type of the system that is set-up, an induction type system. You are bringing in an increased volume of traffic and heat generators (e.g. computers and medical equipment), and it was tough to keep up with the heat load generated in the old inpatient spaces now being used in an outpatient or administrative capacity.”</p>

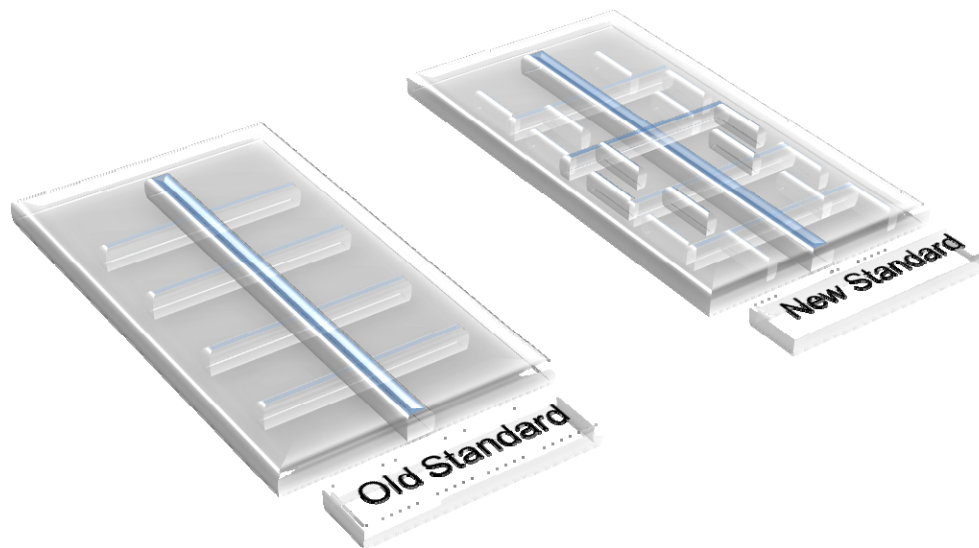


Figure 3.8 Conversion Necessitated Additional Branch Lines which Constrained the Conversion

3.4.4 Plumbing (Services Level)

The plumbing of the former hospitals presented constraints since it was old, difficult to access to repair and replace, was designed to support an inpatient function of healthcare delivery within a military setting, and presented cost and aesthetic issues. By the time of conversion the age of the existing plumbing system necessitated a total replacement. The replacement was constrained by cost since the design did not allow for ease of access to the plumbing system. Some sites were not negatively impacted since they had a crawl space that aided the replacement of the plumbing system, but most facilities were presented with plumbing systems which were design for obsolescence along with the facility and were difficult to gain access to and repair since they were imbedded in the concrete, or there was not enough space to accommodate repairs (Miller & Swensson, 2002). One site had a crawlspace which significantly benefited the conversion effort (Figure 3.9). The sites were also designed for single sex, gang latrines and attempts to modernize the facilities were negatively impacted by the cost to redesign the systems to accommodate the modern military (mix gendered) and health care environments. Aesthetical issues with retaining or removing the fixtures were an issue since there was limited funding and tradeoffs occurred between making a room more adaptable in the future and functionally aesthetic in the present.

Planner Perspective	Operator Perspective
<p>“It was a benefit to have a crawl space under the facility when upgrading the plumbing services but we experienced some constraints because we had to core through the floors to get to it which was time consuming, disruptive to patient care, and costly.”</p>	<p>“It was basically a constraint because of the age of the facility 1964. It was old cast iron piping in a terrible state of repair. The second largest issue was due to the fixture locations: sink and hoppers, or bed pan cleaners. The old ward either has too many or they are in the wrong location to support outpatient care. Specifically the bed pan washers. But for the short-term reuse for an admin function it is in the way. It is not hard to cut and cap it but then it leads to an aesthetical issue, or you cut and cap and then later you have to incur the cost of reinstallation of the fixture. Either way you lose something.”</p> <p>“For restrooms it is a huge issue. Because we have a main trunk line running centerline along the whole wing or floor. You have to pump waste over v. the normal drain waste. It is limited by the ceiling height and plumbing locations of the old hospital. It is difficult to expand. It was designed for a military usage for open bay wards and gang latrines or centralized restrooms....based upon ceiling heights, etc, we were limited. We did not have enough angle drop, we had to bump it out. It was kind of like a pump station. There was no place to do an angle drop for sanitary or waste lines.”</p>



Figure 3.9 Lack of Mechanical Crawl Space Constrained Conversion

3.4.5 IT – Voice and Data (Services Level)

The study found there was a general lack of infrastructure to support Information technology (IT). This was a direct result of the impact of technological change within the healthcare environment (DoD UFC-3-580-01, 2007). There were four common concerns relating to IT infrastructure presented by both planner and operators: size, location, environmental conditioning, and available infrastructure. The size of the communication rooms was inadequate. Most were located within rooms of opportunity when the facilities expanded their IT infrastructure (Figure 3.10). Current standards call for at least 70 SF of space to be provided for communications rooms in existing facilities with proper cooling and ventilation requirements (DoD UFC-3-580-01, 2007). The location of the comm. rooms provided a constraint for the same reason listed above: rooms of opportunity. In some cases existing toilets or

janitor closets were utilized since they stacked vertically due to previous plumbing code standards. This aided the delivery of IT infrastructure since it accommodated the standard 4in. vertical penetration for data cabling from floor to floor, but constrained the effective functioning of the equipment since the HVAC requirements were not met. The best location for comm. rooms is in the center of the floor to ensure the maximum coverage possible. Current CAT5e cabling has a useful range of 100m from the comm. rooms. The requirement to environmentally control the comm. rooms was exacerbated by the utilization of rooms of opportunity which invariably lacked proper air conditioning or ventilation requirements to maintain the electronic equipment. This was also an issue since most facilities have transitioned to direct digital controls (DDC) HVAC controls which turn off at night to reduce energy. Therefore dedicated stand alone AC units were required to provide for conditioned space in the off hours. The final concern regarding infrastructure related to the lack of cable trays and data outlets within the entire facility. The transition from inpatient to outpatient or administrative functions required at least a two-fold increase in data outlets and the infrastructure to provide efficient connectivity between data outlet, comm. room, and computer room.

Planner Perspective	Operator Perspective
<p>“The old facilities were a mess; they were never designed for the IT infrastructure.”</p>	<p>“There was only one voice/data outlet per inpatient room and during the conversion you needed at least 3 data drops. You also had to figure out which communication closet you were going to feed the area from...the location of comm. rooms must be centrally located. This is directly related to the support radius of 100m. The second issue in the comm. room size...the standard is at least 70SF within existing space. The ideal is 110SF. Finally, the environmental aspects: appropriate air flow, air conditioning, and enough space to maneuver around racks within the closets.”</p>



Figure 3.10 Spot Coolers in Former Restroom Reconfigured as Communication Room.

3.4.6 Circulation Pattern (Space Plan Level)

Existing designs generated long corridors which increased travel distances for staff which accounts for 28.9% of work time and has been shown through EBD to contribute to staff effectiveness in inpatient settings or QOC (Shepley, 2002; Shepley & Davies, 2003). The single load corridor design did not support current service delivery models in which exam and treatment rooms and check-in and waiting areas are placed in a hub and spoke design to accommodate more efficient outpatient care circulation pattern (Figure 3.11). The placement of clinical services in the former patient tower impacted vertical circulation which will be discussed in the next category.

Planner Perspective	Operator Perspective
<p>“The biggest limiting factor for reutilization of space is the circulation patterns. The 8’ foot corridors are too wide and too long. They increase patient and nurse travel distances. Essentially the inpatient wards needed to be gutted and renovated to provide for more efficient space and smaller room modules. During a typical reuse concept the public side elevator and the private side elevator were used. We placed everything: check-in and waiting was collocated next to public side elevator to help with circulation. We took a couple patient rooms out to provide for a waiting area and reception room.”</p>	<p>“We have issues in the tower area. We have one hallway that takes you down and brings you back. The inpatient model of care delivery is a linear format versus a spoke and wheel type format for outpatient care delivery. You lose a lot of efficiencies, particularly in our ORs. You have to add more nursing staff to observe the Level One and Level two recovery areas since it is so strung out due to the shape of the building. The staff cannot see the patients at each location since the building is long and linear.”</p>

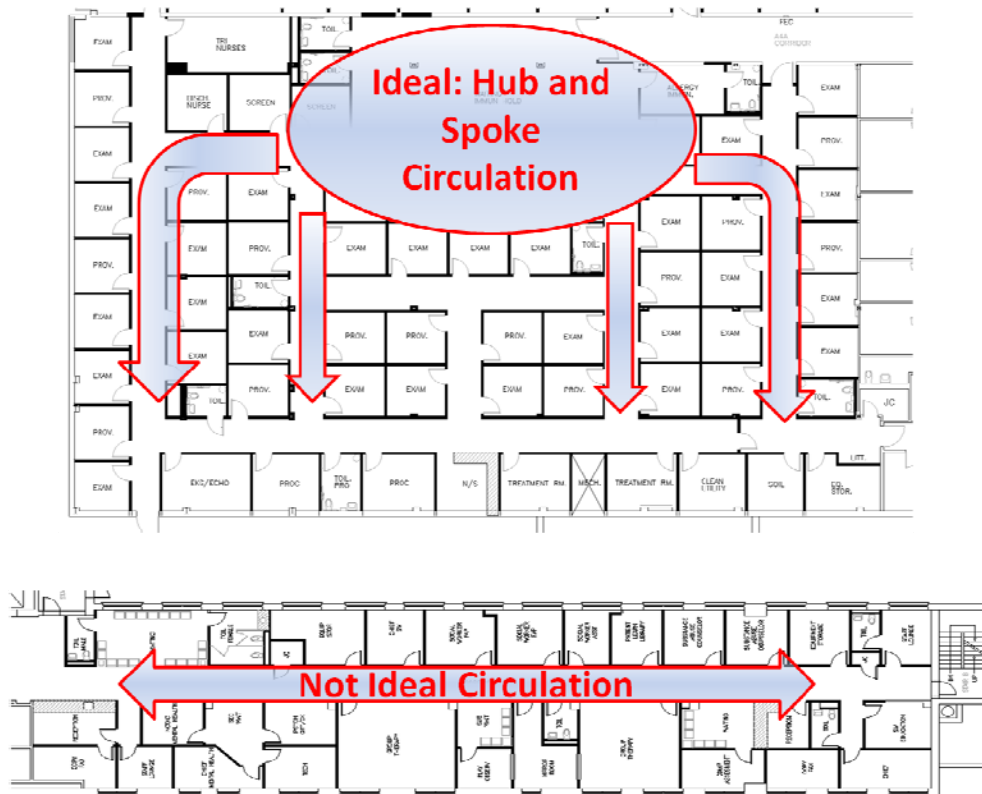


Figure 3.11 Inpatient Ward Area Constrains Typical Outpatient Circulation Pattern

3.4.7 Unit Adjacencies (Space Plan Level)

The conversion of the facility to an outpatient model of service delivery increased the demand and utilization of the elevators which were designed for inpatient use (Figure 3.12). The ten-fold increase in demand placed upon them caused numerous maintenance problems. Increased maintenance and repairs were required to maintain operation. A new perspective was required to aid quality of care (QOC). One site established one elevator within the existing elevator bank and reprogrammed it to provide dedicated service between the lobby and the 10th floor family health clinic. This decision positively impacted

the perceived QOC at the site since it was reported by staff that the patients new they were the focus of their attention.

Planner Perspective	Operator Perspective
<p>“We have a lot more people using vertical circulation systems so it is a constraint. You have an increased density of use of personnel and it negatively impacts the service life of the elevators.”</p>	<p>“You want to be as close to the ground floor as possible for outpatient service. We have issues in the tower area. The vertical infrastructure (elevators) get really stressed since with an inpatient you can plan on a fix number of patients whereas you have a variable amount and it is always higher than inpatient load. Especially since patient traffic is going vertical versus horizontal.”</p>

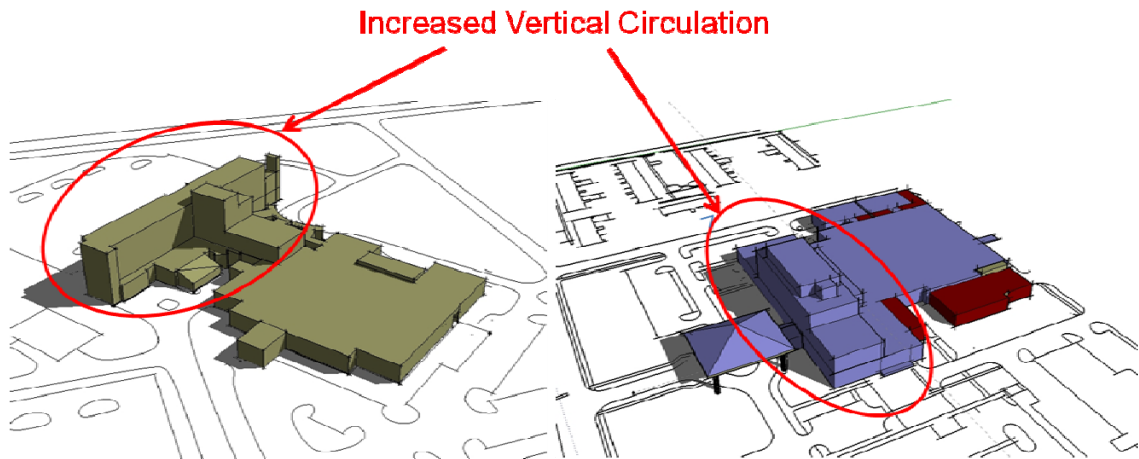


Figure 3.12 Vertical Circulation Constrains Conversion Due to Increased Elevator Usage

3.4.8 Room Size and Type (Space Plan Level)

The conversion of the inpatient areas resulted in an abundance of rooms ill suited for outpatient care delivery (see Figure 3.13). Inpatient rooms had varying sizes from single bed rooms sized at 180 square feet to shared, four, and eight patient rooms.

Planner Perspective	Operator Perspective
<p>“The inpatient wards were designed for long-term use as inpatient wards. They were not designed to be adaptable. Inefficiency factor of 30-35% is common especially in the existing OR spaces to meet new/current standards of care. The typical planning factor is 10-15% inefficiency factor for existing buildings.”</p> <p>“Inpatient rooms are too large for clinical use. They get a large office and a private toilet normally around 180SF and MHS criteria calls for 100 to 120 SF. This has a negative impact on the facilities operating budget since it impacts housekeeping, utilities, and aesthetics.”</p> <p>“The main challenge was the ORs were built for a purely inpatient procedure and were not adaptable, especially recovery areas relative to a modern standard of care.” To increase adaptability within the ORs recommend designing them to 600SF and position soft space around them to allow for utilization of new technology.”</p>	<p>“The room sizes are inefficient. They are too small for two people and too big for one person according to current MHS space planning criteria. They were too large since they were at least 160 SF versus the 120 SF criteria requirements for an office or exam space. It had a negative systematic effect on efficiencies: It takes longer to get from point to point, the housekeeping has to clean additional 40sf of space not including the extra toilet, you have to heat and cool the extra space. In addition, all inpatient rooms had medical gas connections and it was an added cost when renovating areas since we had to properly remove the systems.”</p>

Extensive renovation was required to provide for a more efficient design to delivery outpatient care services. Current MHS design criteria for exam and office spaces is 120 square feet (UFC-4-510-01, 2007). Most sites did not have the funds to renovate their inpatient wards and made due with minor renovations in support of outpatient care delivery in an attempt to increase efficiencies and aesthetics (Becker and Douglas, 2006).

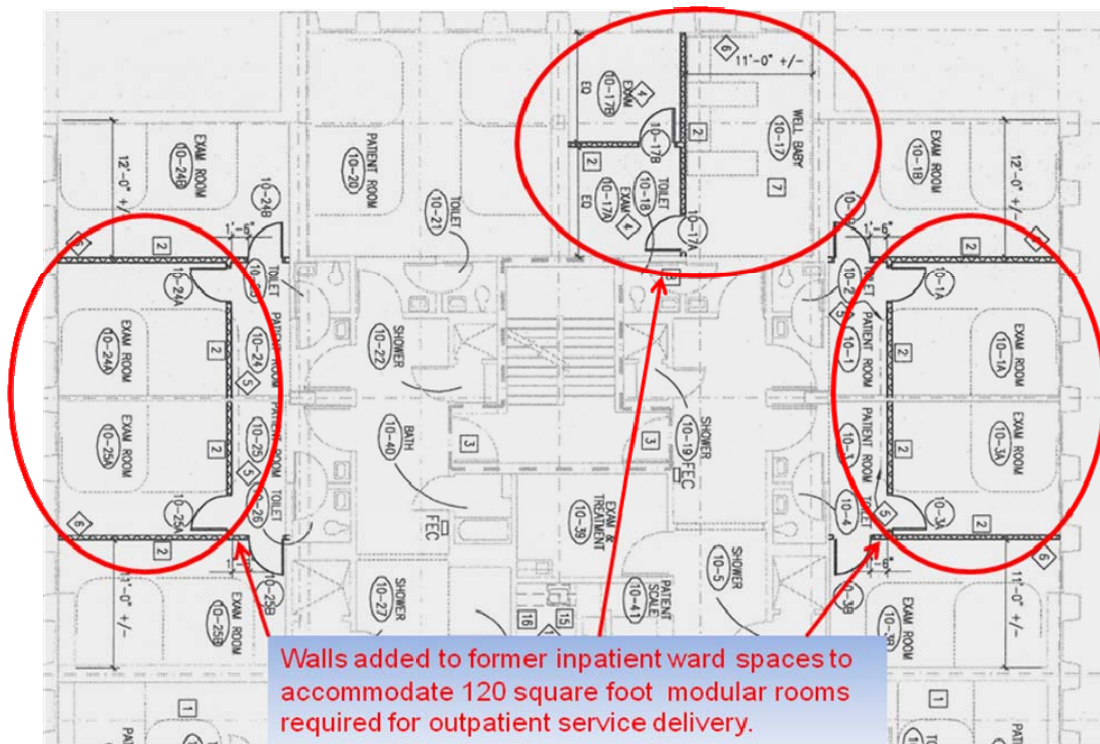


Figure 3.13 Conversion leads to inefficient space utilization which require changes to the interior space to support new service delivery

3.4.9 Wall Materials (Scenery Level)

The wall materials found throughout the sites studied were indicative of Hill Burton Era hospital facilities which were built for permanence and obsolescence

(Miller and Swensson, 2002). The cost and environmental issues associated with the removal and replacement of the interior walls provided a significant cost barrier during conversion. The removal and replacement of the CMU block and the possibility of the CMU and tile containing asbestos materials restricted the redesign of former inpatient areas and other inpatient areas (nutrition care and CMS) since it would significantly impact the delivery of care in respective area and also increase the cost of renovation (see Figure 3.14). Therefore, unless significant funds were made available for renovation efforts the sites studied were forced to make only minor changes to increase their local QOC.

Planner Perspective	Operator Perspective
<p>“The structural glazed tiles defined the nursing corridors and constrained adaptation efforts. They were more permanent and the standard practice of construction when the buildings were built. Buildings were built to last then, now they are being built to last (enclosure and shell) but also built to be manipulated within the interiors.”</p>	<p>“Burlap was used as a wall covering and did not meet new fire spread ratings. The fire spread was not acceptable. We did have an issue with structural glazed tile and the concrete masonry unit (CMU) it was adhered too. A couple of issues with their removal...they could be asbestos maintaining material. Due to the density of the interior walls they do not lend themselves well to hang a picture on or apply a coat of paint.</p>



Figure 3.14 Typical Inpatient Walls with Structural Glazed Tile

3.4.10 Flooring Material (Scenery Level)

The conversion of the facility led to numerous areas containing flooring not standard for outpatient services (see Figure 3.15). There was a cost associated with maintaining and removal of the flooring material due to environmental (asbestos) issues. The cornucopia of flooring materials presented an unwelcoming appearance which has been shown through EBD to negatively impact the perceived quality of care received at the facility (Becker and Douglas, 2006). Most sites were fiscally challenged; therefore they left the flooring in place and absorbed the added cost of maintenance.

Planner Perspective	Operator Perspective
<p>“There were too many inappropriate types of flooring for clinical settings like terrazzo or seamless vinyl, so we would recommend that they be replaced to save on maintenance and repair.”</p>	<p>“Certain specialty areas, amounting to about 10% of the floor space within the facility, had terrazzo floors and were not required in a clinical setting and maintenance. Issues associated with demo and removal. Another issue was all the old flooring materials had asbestos mastic used to lay the floor. It was a significant cost to abate the areas.”</p>



Figure 3.15 Typical cornucopia of flooring types throughout the facility post conversion.

3.5 RQ 1.3: Beneficial Design Elements.

Table 3.3 Design Element Benefit and Constraint Matrix utilizing: Scope, Site, and Pentagon Framework.

SITE SCOPE	Eustis HIGH	Meade HIGH	Lee MEDIUM	Rucker MEDIUM	Belvoir LOW	Jackson LOW
Benefit = B / Constraint = C	B	C	B	C	B	C
SHELL						
Regular Column Pattern	B		B		B	
SERVICES						
HVAC Capacity	B		B		B	
Electrical Capacity	B		B		B	
Emergency Power Availability	B		B		B	C
Electrical Distribution	B		B		B	
SPACE PLAN						
Available Transition Space	B	C	B		B	
SCENERY						
Ceiling Heights	B	C	B		B	
SET Definitions						

The study found the following design elements benefited the conversion of former inpatient facilities to an outpatient model of health care delivery (Table 3.3). The design elements were organized by utilizing the Pentagon Framework as defined earlier (Table 2.4). The design element findings will now be described in more detail within subsequent paragraphs.

3.5.1 Regular Column Pattern (Shell Level)

The study found a regular column pattern allows for a modular approach to designing functional space (Figure 3.16). Since outpatient services are modularized (one office per two exam rooms) this was a benefit during conversion. The modular design increases managed care efficiencies by allowing for a one doctor office and two exam room modular configuration which positively impacts QOC by allowing the doctor to easily and efficiently shift from

patient to patient in a timely manner. It is important to note there is a different structural pattern for inpatient areas directly related to the vertical height of the facility, but the presence of a regular pattern aids the redistribution of space into a modular setting. Symmetry was identified as beneficial since the interior floor arrangements are regular and predictable.

Planner Perspective	Operator Perspective
<p>“A regular column pattern allows us to set-up a modular type room setting or program. We can set-up a repeating pattern. Whether the room is right-handed or left-handed, etc. The staff knows how each room is set-up and it is a good thing for patient safety as well. Any clinical module has to fit with a column grid and pattern.”</p>	<p>“A regular column pattern was a benefit. As you make changes to the interior it is easier to layout a pattern of rooms, etc. You can move the walls around the room to expand or contract for the space usage. It is a flexible construction point. You can easily move around the columns with transoms or beams, etc. You can modularity out rooms, clinics, etc. It is a flexible construction point. Columns are easier to incorporate than load bearing walls.”</p>

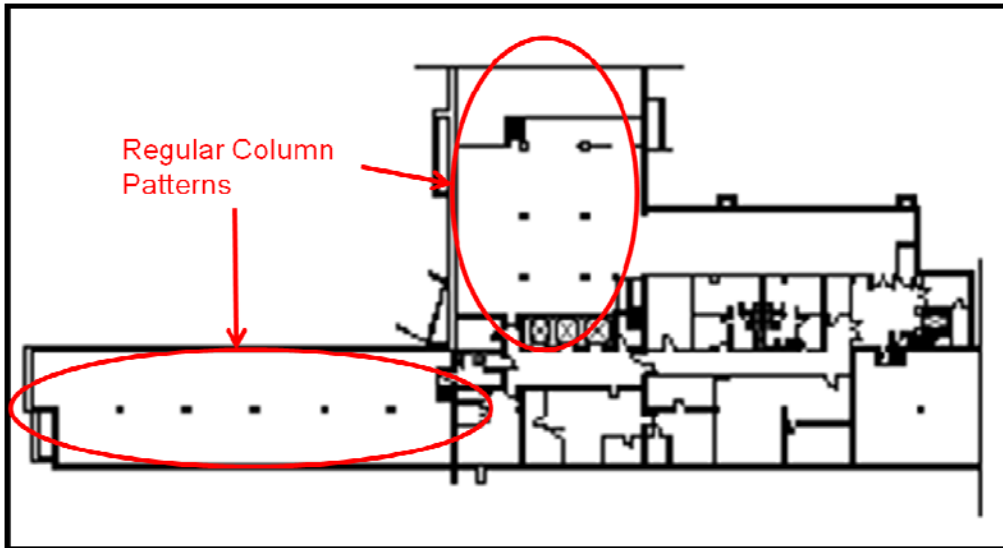


Figure 3.16 Regularity Leads to Efficient Space Utilization via Modularization of Space

3.5.2 HVAC Capacity (Services Level)

High and excess capacity in the chiller and cooling tower accommodated changes in equipment and service delivery without requiring expensive upgrades to the system or the space in which it was housed (Figure 3.17). The conversion presented possibilities to increase sustainable practices by replacing existing systems with more efficient and right-sized systems which reduced utility demands and provided for increased environmental comfort and control. The impact of an aging infrastructure and the need to constantly maintain throughout a systems service life was noted. The operators incorporated future adaptability into their new HVAC systems by ensuring that systems replaced due to age have 25% excess capacity to meet future needs. The constant rate of change on account of the impact of technology by requiring

additional cooling requirements, and changing building standards necessitate forward thinking and the operators understand this important point.

Planner Perspective	Operator Perspective
<p>“We actually had less load requirements due to the difference in utilizations from inpatient to outpatient. We had some dead spaces as well, but these were overcome by adding additional branch lines. We had excess overall, therefore it was a benefit.”</p>	<p>Plenty of chiller capacity and cooling tower capacity. We had 860 tons of chiller capacity and when you look at our square footage we had more than enough capacity. It looked like overcapacity was built-in. I had the two major AHUs replaced within the last five years with new state of the art systems. The chillers had been rebuilt within the last 10 years and had the new refrigerant which helped provide more efficient cooling services.</p> <p>Oversized steam boilers which were to serve humidification for the HVAC and to serve the OR and the NCS so we had excess capacity. So we utilized an ESPC (energy savings performance contract with payback over 20 years) contract and removed two large boilers and replaced it with a unit for humidity controls that was 1/10th their size. It is only turned on in the winter when humidity is low. You save money on utility efficiencies.</p> <p>The size of the units is a positive, but the flip side is since they were old they were set up for a certain percentage of inside and outside air. It mainly impacts during extreme seasonal changes. You want to add humidity in winter therefore you have to over humidify air since you bring in too much outside air so you have to over humidify due to that issue. On the flip side in Summer to dehumidify the air, which is brought in at 90 degree heat and 90% humidity, you have to over dehumidify.</p>

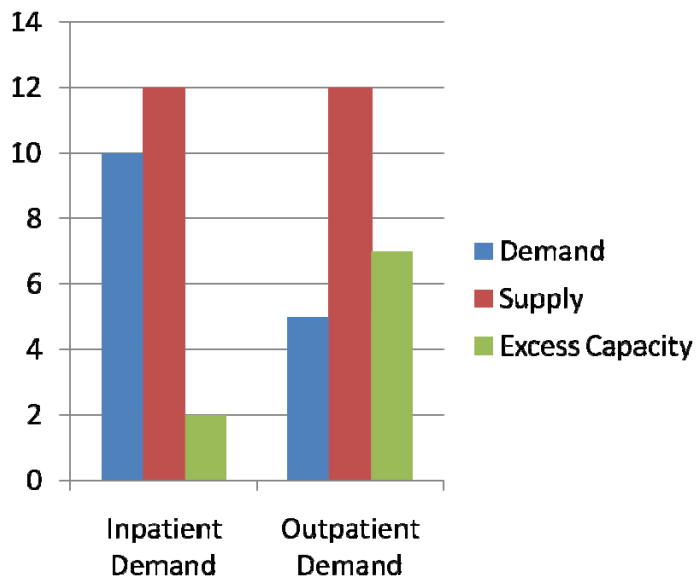


Figure 3.17 A simple bar graph with numeric set of relationships which helps to portray the facility conversion results in excess HVAC capacity due to reduced HVAC standards

3.5.3 Electrical Capacity (Services Level)

The elimination of the ORs, which are the most extensively serviced spaces within the hospital, generated excess capacity in terms of power, circuits, distribution boxes, etc., and therefore made it easy to accommodate any new ambulatory services (Figure 3.18).

Planner Perspective	Operator Perspective
<p>“We had plenty of power. The power requirements for inpatient facilities is more than what is required for outpatient and ancillary services, therefore it was a benefit. If you need more circuits or power it is typically not a challenge to bring it in.”</p>	<p>“There is no shortage of electrical power. It is better to have too much than too little. When operating a hospital you need more, primarily due to the need to support ORs and life support equipment requirements. Since they are no longer needed we had excess capacity based upon code and standard changes.”</p>

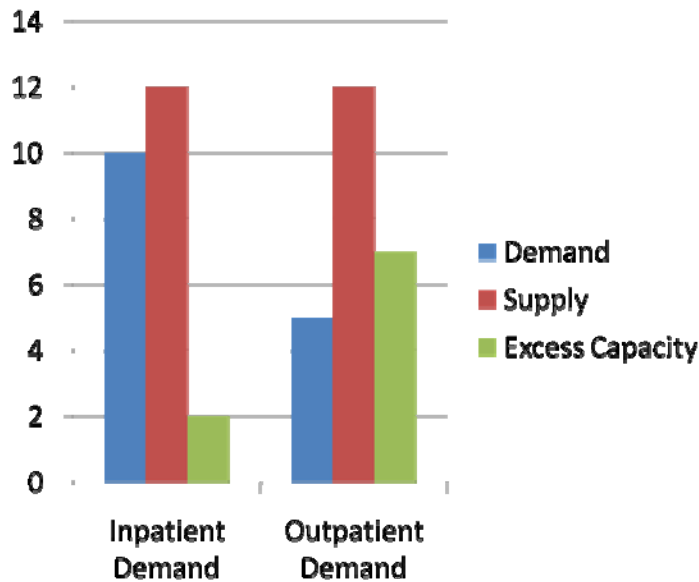


Figure 3.18 A simple bar graph with numeric set of relationships which helps to portray the facility conversion resulted in excess electrical capacity due to reduced outpatient demands

3.5.4 Emergency Power Supply (Services Level)

Emergency power supply provided an extra level of infrastructure security, especially during emergencies that threatened the power supply, whether natural or manmade; and given the reduced life safety requirements with the elimination of the OR (Figure 3.19). These benefits justified the \$2,000 per year paid to maintain and operate the system through its lifecycle versus the cost of removal and replacement estimated at \$360,000.

Planner Perspective	Operator Perspective
<p>“It was a benefit since it was available, but it is not required in this setting. An assessment was performed assuming anticipated cost savings with the removal of the emergency generator and maintenance reductions. But after an analysis of the replacement options, plus the fact that the Depart of Public Works requires the generators to balance loads in that portion of the post, and all the batteries in the existing egress lights need to be replaced. \$2K per year v. \$60k battery replacement every 10 years + \$300K removal of generator.</p>	<p>“We can provide a better service. During an electrical outage we can still supply services to the population. The only minor down side is we need to service the generators from time-to-time and change the oil. It is minor issue compared to the benefit gained by support in emergency situations. Having it affords also affords the opportunity to place pharmaceuticals on back-up power and you could lose money if those reefer goes down, so it is like an insurance policy.”</p>

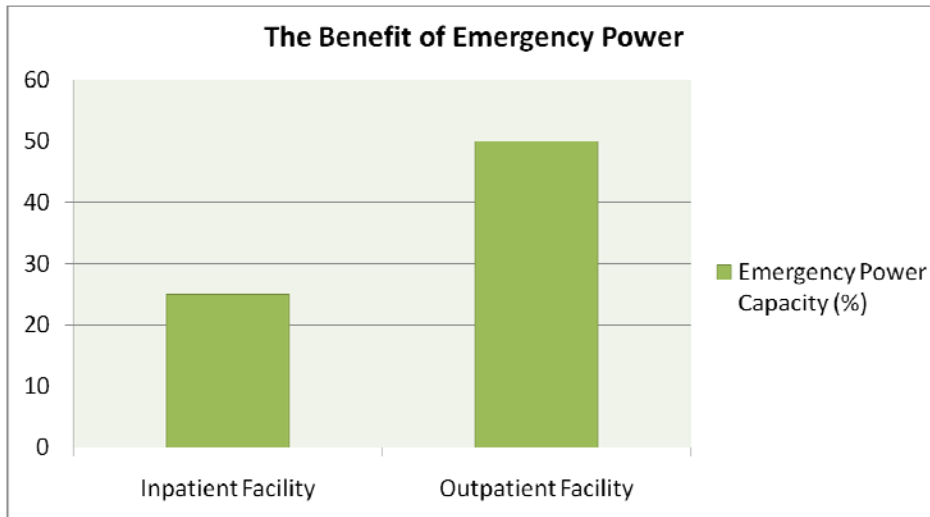


Figure 3.19 Conversion Benefits Outpatient Facility with Increased Emergency Power

3.5.5 Electrical Distribution (Services Level)

The study found there was ample capacity to support the outpatient power requirements. Minor constraints were present, but these were not sufficient to label the category a constraining factor. The primary issue was that power in inpatient rooms was located at the nursing head wall, not the opposing wall where it was also needed for outpatient services. Therefore an additional outlet had to be placed in support of the increased power requirements to support the new function, whether administrative or clinical (see Figure 3.20). It was noted that as long as the infrastructure was maintained within the current life safety code no major constraints were present during or post conversion.

Planner Perspective	Operator Perspective
<p>“Due to the type of distribution through the floor it was a benefit. Since we had lines run to each headwall we could adjust and transfer the service to the neighboring wall.”</p>	<p>“Much like with the HVAC. We had ample capacity in the substation rooms. Distribution became a problem when we changed walls since the homeroom circuits had to go all the way back to the substation in the mechanical rooms...getting to where we actually needed it was sometimes a problem, but not a very expensive one.”</p> <p>“We had to add electrical outlets since everything was centered on the headwalls. There were not enough electrical outlets sometimes. We had to add outlets on opposing walls throughout the converted ward areas.”</p>

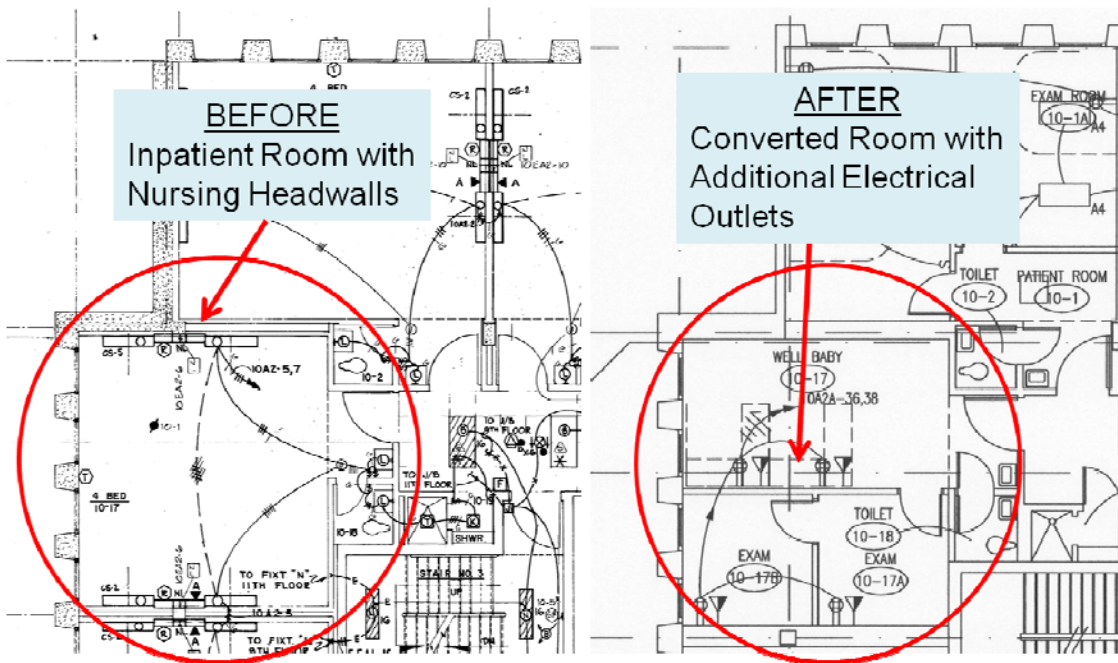


Figure 3.20 Conversion Results in Requirement for Additional Electrical Distribution

3.5.6 Available Transition Space (Space Plan Level)

Since the inpatient wards were vacated the facilities had ample transition space in the short-term which reduced the cost of converting space in the short-term, but eventually trailer space was needed to accommodate other on-going projects. One of the sites presented figures showing that to provide for transition space within the facility cost \$250/SF while 5,000 GSF of modular trailer space cost \$100/SF. The cost is different per each region, but this example is indicative of the initial cost savings which could be attained if an appropriate master plan was developed to aid the systematic conversion of the facility. One site used mobile wall partitions which had a higher front end cost to convert the space. This decision was motivated by the hospital directive to maintain the adaptability of the space so that it could be rapidly reconfigured to inpatient care if required. Overall the conversion of the facility allowed for increased transition swing space for future renovation projects.

Planner Perspective	Operator Perspective
“You must have available transition space to conduct a project. Due to the elimination of the inpatient services: food service, CMS, and some clinical functions due to staffing and workload justification, space became a benefit when they followed the master plan since they had swing space.	“We were able to have swing space available initially since many of the wards were vacated. It was a real benefit in the beginning since it saved us \$100 per SF in exterior modular transition buildings. Now we are looking at \$275 per SF on the interior of the building if we want to use it for transition services.”

3.5.7 Ceiling Heights (Scenery Level)

The study identified that the former inpatient ceiling heights at 12ft. to 12.5' was a benefit during the conversion (Figure 3.21). Current standards call for 14ft. for outpatient facilities, but during the timeframe of the conversion the 12' ceiling height was seen as a benefit since it was able to accommodate all the utilities changes required to convert the various areas within the sites studied.

Planner Perspective	Operator Perspective
<p>The 8.0ft.suspended ceiling heights were OK. But one of the biggest constraints we have with adaptive reuse of hospitals is the 10ft. floor to floor ceiling heights. To do an acute care hospital setting is really hard. It really limits things and what you can do. For the services we are trying to provide: major duct lines to return and supply, cable trays, sprinkler lines, The ideal is 12.5 feet: 8ft. for drop ceiling, 1- 1.5ft. for structure, 1-1.5ft. for ductwork, 4-6in. fire suppression, 4-6in. lights, and 6-12in. for the cable tray. The construction standards now building more adaptable ceiling heights at 14' for outpatient areas."</p>	<p>"We had 12.5' ceilings so we did not have a problem. Most systems are designed around that. 8' drop ceiling, and 3-4' for bldg services. We had a standardized ceiling height throughout the first floor at 8' suspended ceiling and it saved cost since we did not have to worry about ceiling heights when converting areas on the first floor."</p>

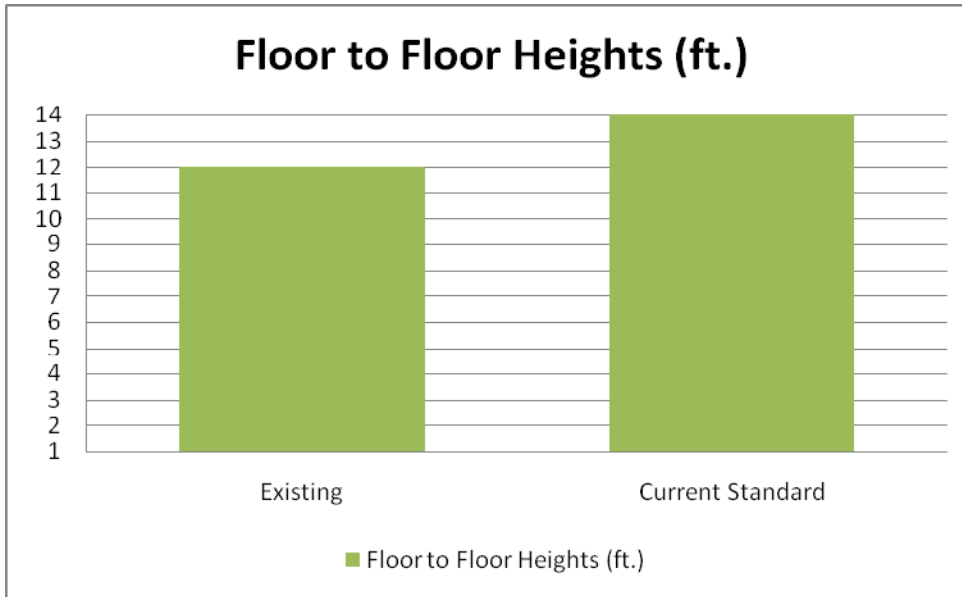


Figure 3.21 High Ceiling Height Benefited the Conversion to Outpatient Care

3.6 Perceived impact of physical environment on quality of care provided and quality of life at facility.

The triple bottom line for health maximizes corporate, environmental, and staff outcomes. The conversion overlooked and under emphasized the impact of the physical environment. The conversion considered multiple health care requirements which were quite comprehensive for both rounds of BRAC. But there was very little monetary support allocated for the conversion in acknowledgement of the impact of the physical environment on service delivery. There were no criteria from which to gauge the impact of the physical environment on quality care internal to the BRAC review process. During the study none of the participants believed that any of the physical design elements examined in this study affected the quality of care at the facility. End users,

those providing care, did report that elements of the physical environment affected their quality of work life. By themselves, if the focus is on care quality, these data would suggest that staff quality of life is unimportant. More likely, the results reflect the commitment to quality of care among all participants in the study, and their belief that the military is doing the best it can to provide quality of care. Study participants overwhelmingly attributed the environmental features afforded by their break rooms as positively impacting their quality of life. Features included: access to nature, penetration of natural light, their respective window aspect, and availability of seating and kitchen style furniture and fixtures all were positively correlated with increased staff quality of life. Four of the six participants in the user category reported that access to nature and dining options positively impacted their quality of life. Access to nature was defined as the availability of either window views to a natural setting outside or the inclusion of nature theme artwork within the interior of the facility. Dining options was defined as access or the availability of on-site eating establishments. The study found that both environmental features correlated with increased quality of life for the staff and these design elements are currently undervalued, and their impact is not fully understood in the MHS.

Table 3.4 Results of the study portray the elements of the physical environment which positively enhance staff quality of life (QOL) across the participating sites and scopes of the research study.

SITE SCOPE	Eustis HIGH	Meade HIGH	Lee MEDIUM	Rucker MEDIUM	Belvoir LOW	Jackson LOW
What was the impact of the design decisions of the Planners and Operators on the Users?						
Quality of Life = QOL , Quality of Care = QOC	QOL	QOC	QOL	QOC	QOL	QOC
SHELL						
SERVICES						
SPACE PLAN						
Dining Options						
Break rooms	QOL	QOL QOL	QOL QOL	QOL	QOL QOL	QOL QOL
SCENERY						
Access to Nature	QOL		QOL	QOL		QOL
SET						

3.6.1 Break Rooms (Space Plan Level)

Break rooms are critical to staff since they provide a place of restoration to staff:

- “It breaks up the day and it is a place to get away. You come out refreshed ready to work.”
- “I wish the break rooms were on the exterior of the building since we could have a window.”

Break rooms send a message to hospital staff regarding their importance and perceived worth to the organizational mission:

- “I hate our break room. It has no windows, no light, no space...to tell you the truth we eat in the conference room since it has panoramic views, , its light, and has a big table, and we just feel better there. If someone cares about me I will work harder, if they care about me I care about them, and

have a positive attitude which impacts on the quality of care.” (see Figure 3.22)



Figure 3.22 Break Room (Left) and Conference Room actually used as the Break Room (Right)

- “It was like they forgot about it and then just placed it anywhere because they have to. Management forgets about the importance of it. We felt like we were an afterthought.”

The study has provided new emphasis on the value of break rooms and its impact on staff quality of life. Staff quality of life is a key component of the triple bottom line for health. More emphasis within the MHS is required to ensure that staff break areas are planned for since they provide a much needed acknowledge of the worth of our staff to the patient care mission. More supporting research is required to overturn the views of senior leadership as evidenced by this quote:

- “It’s more of a union issue than anything else, break rooms become very territorial. I do not think that it is heavily utilized. The better solution is a centralized break area so that staff is forced to go. They need to come out of their shell and interact with the organization. Multiple break areas separate the organization versus unifying it.”

3.6.2 Dining Options (Space Plan Level)

The study found that users are pressed for time, but want a place to also get away and have a decent and healthy meal during their lunch break. When hospitals convert to health clinics the dining facility is removed and the lack of dining options has a negative impact on staff quality of life:

- “People really liked it a lot around here when we had a dining facility. It was nice because it was somewhere quick that you could go eat and it was someplace you could have contact with staff members you did not have frequent contact with (Figure 3.24). We do not have anything now. We have a coffee cart, but no place to sit down, no common area associated with eating now. It is sort of snack items. When we had a dining facility it was nice since it had windows.”
- “Some people just grab crackers and keep going because they do not have time to have lunch...so if it does impact on your quality of life...The better you feel, in some minor way it weighs into how you are able to provide care to someone else.”
- “The dining facility closed and there were no options for staff to obtain lunches: had negative impact on collaboration, camaraderie, a place to get

away. It was also an infection control issue since you now had people eating in their work areas.”

- “Especially for nurses...people cannot run in and out of hospitals to go eat.”
- “A hospital is not a happy place but you can do more to help by providing access to nature, seating options, etc. in the dining areas”



Figure 3.23 Hospital Dining area with access to nature (left) and good example of reuse as Staff Break Area (right)

3.6.3 Access to Nature (Scenery Level)

The study identified the positive value of providing access to nature to staff quality of life:

- “There is something very calming about trees and flowers and true nature and light. It is not artificial. It gives a feeling that the people taking care of you care about what you look and see.” (Figure 3.23)
- “You are not isolated and separated from life. You need something normal and calming: trees and waters.”

- “You just feel calmer. It just gives you a nicer feeling. It adds to a soothing and calm environment.”

It is evident that not affording staff access to nature has negative impacts on health care staff:

- “It’s like living in a box, it is depressing. The staff makes comments that we have to get out to see nature and recharge, it is depressing, even the window views have no view. Our windows look into a loading dock and an AHU. I have a screensaver of nature art so that helps.”
- “We are in like a box, we have no windows.”
- “We have a few scenic pictures with flowers, etc. They are not real clear, but blurred and they are not clear pictures and they are not pleasing since they are blurred and smudgy.”



Figure 3.24 Hallway with access to nature via artwork (left) and example of natural artwork (right)

3.7 Research Question 1.4: What if any desired building changes were not made and why?

The study highlighted the desire of all participants to plan and fund long range, sustainable projects. This desire was countered by existing policies which limit funding requirements, do not value adaptability of the built environment, and set annual budgetary limits to result in a zero sum gain at the end of the fiscal year. The study also highlights the need for increased understanding of the role of the physical environment impact on QOC and QOL. This is especially important since none of the three design elements: break rooms, dining facility, and access to nature were identified as important.

Several of the planners talked about how the fiscal funding cycle negatively affects decisions regarding the conversion of the facility.

- “We call it the \$3 million dollar question since it’s a \$3 million dollar minimum to rehabilitate areas and convert them from inpatient space into efficient outpatient space.”
- “The funding limits in Department of Defense (DoD) are bizarre, they incentivize “warts”. Warts are characterized as the main building having umbilical cords attaching it to neighboring smaller new work funded projects instead of a comprehensive solution. Because you cannot fund everything in one year it actually drives up costs....and the efficiency of the space is an issue in the long-term as a result of the funding limits.” (Figure 3.25)



Figure 3.25 Example of a \$750,000 “Wart” which is characteristic of the restrictive nature of the current COC funding limits to long range, cost effective facility solutions

The value of planning is understood as evidenced in this study by the following remarks from planners, but the tempo of change in the MHS is dramatic:

- “Funding priorities and limits...there is money for the master planning, but not the projects, at least there is funding for the plan, because you have to have a plan first to identify the needs. There are competing issues like mental health and TBI so the Surgeon General has changed priorities. Unfortunately money does not flow right away; there are commander priorities as well. There are many needs...”
- “I think they understand the importance of the master plan, and it is a snapshot to address immediate needs, but commanders and sites have differing and shifting priorities, plus available funding issues based upon priorities, it’s complicated.”

In summary, the study highlighted the desire of all participants to plan and fund long range, sustainable projects and how increased awareness and understanding of the physical environment is an important aspect of QOL and QOC. This desire was countered by existing MHS policies which limit funding requirements, do not value adaptability of the built environment, and set annual budgetary limits to result in a zero sum gain at the end of the fiscal year.

3.8 Research Question 2: What factors were considered and/or emphasized during the conversion of the facility?

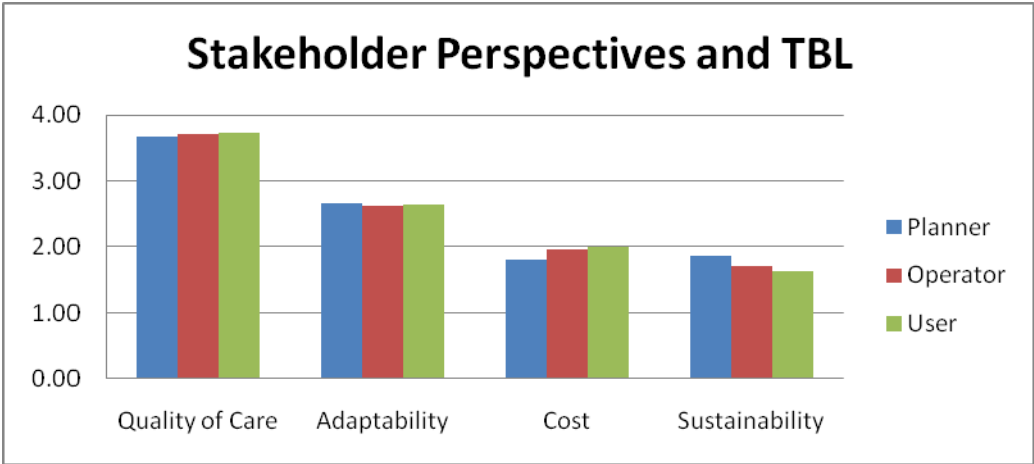


Figure 3.26 Stakeholder Perspectives on the Triple Bottom Line (TBL) for Health

The results of the survey to understand what considerations or emphasis was given to the TBL for health by the stakeholders during the conversion are displayed in Figure 3.26. There were a total of 29 participants (n=29) in the survey across three stakeholder categories: planner, operator, and user. The scale of the survey ranged from one to four. The scale ranked the number four

as the highest and one the lowest. The four factors of the TBL for health were defined as previously noted (Table 2.5), and provided to each participant in writing prior to the survey. The numbers are only suggestive, not definitive, due to the comparatively small sample size involved in the survey (n= 29). It is important to note the uniform distribution of ranking across stakeholders regarding the importance of each factor of the TBL for health. In line with the health care mission, the quality of care was ranked the highest among the four factors. This was followed by adaptability, then cost and sustainability. It is clear from the bar graph that the last two factors: cost and sustainability present some minor differences of opinion between the three stakeholders. The planners' ranked sustainability slightly higher than cost. The operators and the users ranked cost slightly higher than sustainability. The greatest gap in consideration or prioritization occurred between the planner and the user in both cost and sustainability (2.0 to 1.8, and 1.87 to 1.64) (see Table 3.4). This gap can be explained by the differences in understanding between the two stakeholder categories. The planners understood the value of sustainability more than the users. The users possessed a greater understanding of the impact of cost over sustainability.

Table 3.5 Results from survey per stakeholder on the TBL for Health (n = 29), survey range was four to one (4 = highest, 1 = lowest)

	Quality of Care	Adaptability	Cost	Sustainability
Planner	3.67	2.67	1.80	1.87
Operator	3.71	2.63	1.96	1.71
User	3.73	2.64	2.00	1.64

3.8.1 Quality of Care

- “It’s the number one concern.” (planner)
- “The main real reason we are here is to provide cost effective quality of care.” (operator)
- “Because that is what we are here for and that is the most important thing. As a nurse to be proud of what I do. To help people and to trust me. Starts with the staff, but is impacted by the environment, we are so visual. I do not want to be cared for in a cluttered/dirty environment, or by a disheveled nurse.” (user)

3.8.2 Adaptability

- “It is important since we need to think about the future and how things change. Our population is increasing here since they are bringing more schools here, etc. They failed to think about the future and now we are negatively impacted by space constraints.” (operator)
- “I think you are setting yourself up for failure, especially in the military where we are in a constant state of flux, if the facilities are not expandable or adaptable you are kind of setting yourself up for failure.” (operator)

- “If you build a facility that it adaptable in the beginning then it will defray costs later due to its ability to absorb future changes.” (planner)
- “In the medical field we change the way our focus is. It is important to change the space to suite your needs, what happens if you need to switch from women’s health to another specialty. If you are not adaptable you have to rearrange things and cause more work: increased cost and staff frustration. Instead of minor changes, you need to have major changes.” (user)

3.8.3 Cost

- “Well, I know cost is a big thing. But I think some things even though they may be considered cost effective they may not necessarily be best for us. If we do not do the right thing first, even though it costs more...in the long run it will cost less...you get what you pay for...the best decision in the long-run is the right thing to do and the best thing for the organization.” (operator)
- “I think we need to be fiscally responsible, but we are taking care of soldiers and their families and I think that cost is important but my thought is that...hopefully, if we are taking consideration of the other three factors then cost, in the long run, will be taken care of.” (user)
- “The amount of money you put into the project affects the outcome of the project.” (planner)

3.8.4 Sustainability

- “I guess to be a responsible member of the society. Are we taking care of the environment and doing the right thing. It is our responsibility as a part of the government, as big as we are, we could really have a positive impact on the environment if we practice sustainability.” (operator)
- “We should be considerate of the environment and we need to respect it. I think for a hospital it is important since we are in the business of promoting healing. We get most of our medicine from nature.” (user)
- “I think it can save the organization money in the long run with utilities savings. (operator)
- If the fixed cost is \$450/SF and the LEED improvements at \$10/SF it is money well spent in the long run.” (planner)

3.9 Summary of Findings

The study examined what design/building changes were made to accommodate the change from an inpatient to an outpatient care business model, and whether differences existed relating to the function of scale: high, medium, and low scopes. No differences were identified.

- **Research Question (1.1) What areas within the facility were most affected by the conversion?** The study found the conversion of an inpatient facility to an outpatient model of service delivery constrained the facility operations since it leads to an abundance of inefficient and unaesthetic space. Since the facilities are inefficient they increase the cost

of service delivery due to increased staff walking distances and lower the perceived standard of care provided by the organization due to inappropriate interior design elements. Exam and office arrangements are not ideal for the deliverance of primary care. There are increased costs associated with environmentally conditioning and maintaining the space designed for inpatient service delivery.

- **Research Questions (1.2 and 1.3) Which existing design/building elements generated significant constraints or benefits when implementing the desired new design concept?** Numerous design elements were found to both benefit and constrain the conversion of the facility to an outpatient model of service delivery.
 - Those design elements found to benefit the conversion were:
 - SHELL: Regular Column Pattern.
 - SERVICES: HVAC and Electrical Capacity, Emergency Power, and Electrical Distribution.
 - SPACE PLAN: the availability of Swing Space, and Floor to Floor Ceiling Heights.
 - Those design elements found to constrain were:
 - SHELL: Irregular Column Patterns and Building Shape.
 - SERVICES: HVAC distribution, Plumbing, and IT infrastructure.
 - SPACE PLAN: Circulation and Unit Adjacencies.
 - SCENERY: Room Size and Type, plus Wall and Flooring Materials.

- Modular Furniture was identified as a benefit by Planners, since it provided for a common aesthetic feature and a constraint by Operators due to high cost of churn related to warranty issues, contract labor, and lack of in-house trained relocation staff.
- **Research Question (1.4) What, if any, desired design/building changes were not made, and why?** The study highlighted the desire of all participants to plan and fund long range, sustainable projects. This desire to achieve long-term cost savings is countered by existing policies which limit project funding and support short sighted remedies, do not value long-term adaptability of the built environment, and an annual budget process which results in a zero sum gain at the end of the fiscal year.
- **Research Question (2) What factors were considered and/or emphasized during the conversion of the facility: social (quality of care and/or quality of life), economic (cost), or environmental (adaptable and sustainable)?** All Stakeholders believed QOC was the most important factor guiding their decision making process when converting the facility to a different model of service delivery. This was followed in order by cost, adaptability, and finally sustainability. It is important to note that while all participants put quality of life (QOL) first, actual conversions seem to put cost first since it was tied to the budget cycle and availability of funds, and paid virtually no heed to sustainability.

CHAPTER 4

DISCUSSION

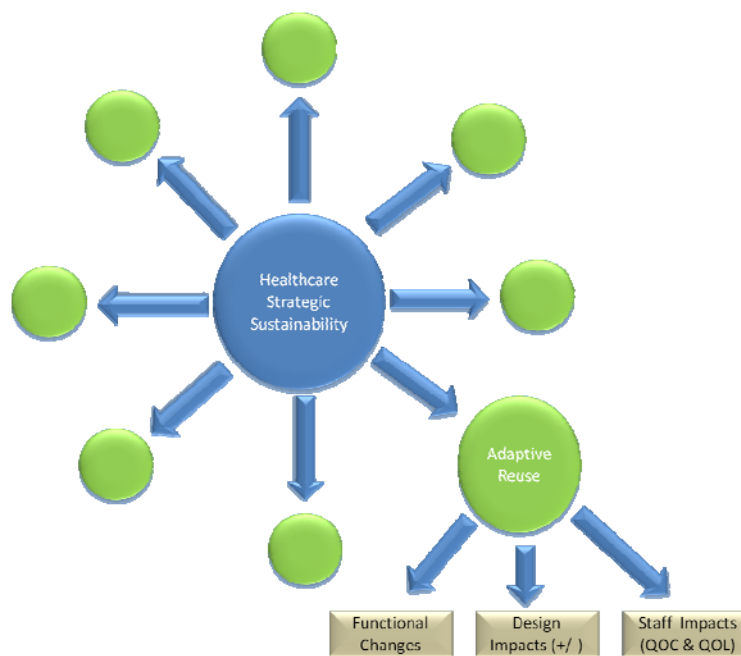


Figure 4.1 Research Focus within the Healthcare Strategic Sustainability was the Adaptive Reuse of Healthcare Facilities

4.1 Purpose and Overall Intent of the Study

The overall intent of the study on adaptive reuse of healthcare facilities was two-fold: to educate health organizations on which design elements to invest their limited funds to increase their overall health facility strategic sustainability, and to elevate the importance of design that impacts staff quality of life which has a direct impact on retention and recruiting and helps moderate the quality of health care provided at the facility (CHD, 2006; Jones, 2004). Currently there is a deficit of study regarding the adaptability of health care facilities in general

(Kendall, 2008; Pati et al, 2008). More research is required to build a significant body of evidence to identify and justify the importance of sustainable design. This exploratory study's goal was to contribute to the literature on health care facility adaptive reuse. This study builds on previous health facility studies by looking at the adaptability of the built environment and which design elements lend themselves to be more adaptable than others (ABC, 2007; Kendall, 2008; Pati et al, 2008; Slaughter, 2001; Valen & Larssen, 2006).

This study compliments the perspective of previous studies by looking at the role the physical environment plays within converted and existing hospitals and how the physical environment either positively or negatively impacted the conversion effort from the perspective of planners and designers, facility managers, and medical staff. The focus for the medical staff' was on the effects of the conversion on staff quality of life and the quality of care they provide to their patients. It provides a gauge to discern the permeability of the sustainable movement within the MHS through the lens of the TBL for health. There is a growing need, not only for economic reasons but for socially value-based reasons to create strategically sustainable health facilities.

4.2 Beneficial and Adaptable Design Elements

The study supports current journal articles which have identified the following design elements as adaptable: floor to floor heights, longer spans for structural grids, vertical chases, corridor space and circulation patterns, HVAC modularity and surplus capacity, electrical capacity, information technology capabilities, modularity and standardization in room design, and the adjacency of soft space

to expand and contract as changes in medical technology and practice dictate (ABC, 2007; Kendall, 2008; Pati et al, 2008; Slaughter, 2001; Valen & Larssen, 2006). The beneficial design elements were noted by all stakeholder categories as allowing for an ease of conversion from inpatient to outpatient service delivery.

Within the study there were a number of design elements, essentially the mirror image of the positive factors, which were identified as constraining the conversion effort. These constraining design elements were: irregular column grid, the building shape, HVAC distribution systems, plumbing and information technology services, the circulation pattern, unit adjacencies, room size and type, and wall and flooring materials. Health organizations now have more research which can be used to provide EBD decisions with increased confidence pertaining to which design elements in which to invest their limited funds in order to increase overall health facility strategic sustainability.

As noted above, this study supports previous research findings which identified numerous design elements as adaptable, therefore beneficial and sustainable. The adaptive reuse of a hospital results in between 35-45% inefficient space use (Hayward, 2006). The Impact of the inefficient space use is increased administrative operating space in the former hospital, higher maintenance and repair costs, higher operating costs due to specialized HVAC, and inefficient space utilization. This is important to note since the main drivers for new facilities is aging facilities (50%) and the need to improve efficiencies (38%) (Carpenter, 2008). This study also supports the demand for open space floor

plan (ABC, 2007), interstitial space (Valen & Larssen, 2006; ABC 2007), and the demand for pre-wired expansion (ABC, 2007) within future health facilities.

The study also contributes to evidence justifying two emerging design approaches for long term flexibility and adaptive reuse of hospitals. For example, the “Core and Shell” and “Fit Out” design and construction of Switzerland’s, Canton Bern, Insel hospital (Kendall, 2008) is not based on technical systems: mechanical, plumbing, electrical, partitions, lighting, finishes. Rather, it is based on systems separation: primary (100 year lifespan), secondary (30 year lifespan), and tertiary (5 year life plan). The Martini Hospital in Groningen, Netherlands, used Industrial, Flexible, and Demountable (IFD) construction because of its complete lifecycle focus, and the potential to convert the hospital from primarily inpatient to outpatient use over time, and then even to completely new uses such as residential housing.

4.3 Physical Environment impacts Staff and QOL

The purpose of the study was to address the current state of MHS facilities which have been converted from inpatient to outpatient facilities, the impact of such conversions on the facility and staff. Since the MHS has to justify all the funds required to provide healthcare for soldiers and family members it is important to note that upon conversion of facilities no additional funds are provided to transition to the different form of service delivery and ensure staff QOL is retained. One key example of this failure to consider the impact of a conversion on staff QOL was the elimination of dining facilities. As a result staff had to eat within a short timeframe in unattractive break rooms without

windows. Studies have identified that natural light is a key indicator of increase staff QOL (Mroczek et al., 2005). The research literature indicates that one consequence of the absence of a restorative space and access to daylight and outside views are increased staff stress levels (Ulrich, 2008; Van Den Berg et al., 2003). Stress levels, in turn, have been connected with decreased quality of care provided by medical staff in inpatient settings (Smith et al, 2001). The opportunities for chance social interactions are also minimized by not providing an on-site dining facility. Similarly, this study found that break rooms were also shifted to rooms without windows because they were not viewed as important by organizational leadership. Providing quality dining and break areas are likely to contribute to staff feeling valued and have the potential to reduce costs associated with nursing retention (C.B. Jones, 2005). The consequences for staff of the downgrading and/or elimination of dining facilities and break rooms decisions are contrary to what the MHS Epidaurus projects hopes to attain within the MHS (Malone et al., 2007).

4.4 Organizational and Funding Context

The synthesis of a strategic plan tied to a master plan is paramount for any organization wishing to find a sustainable solution (Hayward, 2006). A major challenge for achieving this within the MHS is restrictive funding levels for projects. For instance the new work limit set at \$750,000 is not indexed to inflation and does not receive an adjustment for changing costs in labor and material. The same is true for the three million dollar limit for repair and maintenance projects. Going forward, the Military Health System (MHS) should consider providing a different set of cost metrics with a greater focus on return

on investment (ROI) through life cycle costing (LLC) and sustainability, rather than continuing what appear to be fairly arbitrary funding limits. Another restriction central to all site conversions is the availability of one year funds vs. longer term dollars.

For the above reasons, the federal government's primary budgeting process should be reviewed, especially for non-payroll related expenditures, to ensure that high ROI and long-term strategic infrastructure projects are able to be funded. Currently it appears that too much emphasis is placed on front-end costs vs. life-cycle costs, despite evidence indicating that high front-end projects have a better back-end cost savings (Dowdeswell & Erskine, 2006; Kats et al, 2003; Kobus et al., 2000; Slaughter, 2001).

Several external drivers made it difficult for the stakeholders to develop strategies and make desired design changes that not only addressed technical changes in service delivery, but the impact of the converted facilities on staff. These external drivers were identified as a high frequency of CEO changeover, the annual budgeting process, and the current funding limits restrictions. The frequency of leader changeover in the military is normally between two and three years. The norm is two years. During this time new CEOs, called hospital commanders in the military, set forth new strategic guidance directions and aim to make their mark on their new hospital or clinic by setting forth a new strategic management process. This two year cycle of command negatively impacts the long-term adaptability of the facilities since the constant state of churn undermines the ability to implement a strategic plan that typically is planned to unfold over a five year period. Commanders typically make

decisions which can be implemented during their tenure. Compounding the problem of Commander churn, the annual budgeting process in the military restricts funds from carrying over from year to year. Therefore, there is an incentive to make changes that can be accomplished and funded within a one-year timeframe. More judicious practices need to be put in place by elected officials to ensure that strategic sustainability has a chance to really blossom in the MHS. Finally, the current funding limits which cap new work at \$750,000 and renovation work at \$3 million before Congressional approval restrict actions taken by the MHS and its consultants to truly integrate adaptable design elements within its infrastructure. As an example the \$750,000 new work limit is not indexed to inflation and has been fixed at \$750,000 for the past 5 years. Yet global demand for steel and other construction materials have drastically increased the cost of construction. It is imperative that new funding limits are sought and that they are indexed to inflation and something along the same lines as mileage reimbursement for personal vehicle travel which is adjusted on a monthly basis. Once accomplished, the government can start realizing the cost benefit of truly long-term sustainable facility solutions.

4.5 Stakeholder Perspectives

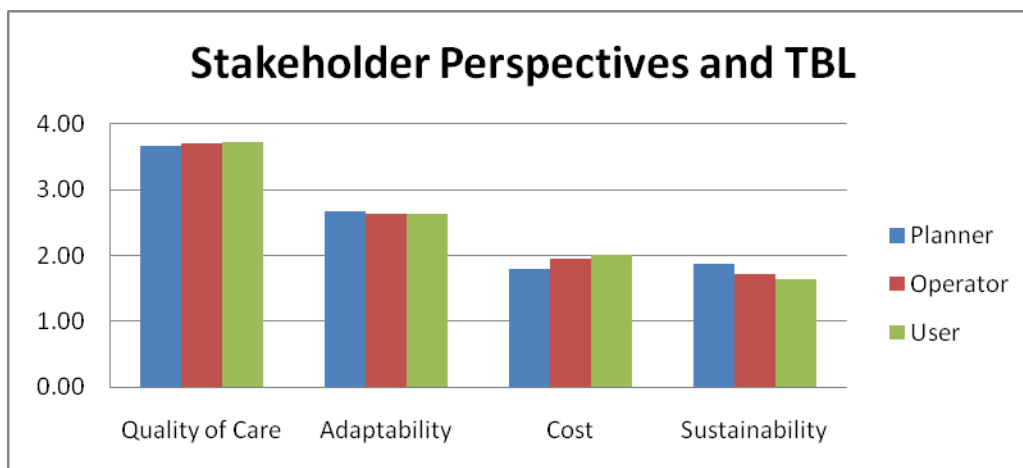


Figure 4.2 Stakeholder Priorities by Category within Triple Bottom Line for Health

The three tiers of stakeholders: planners, operators, and users, all identified their primary mission as insuring high quality care (Figure 4.2). The study showed that all stakeholders preferred facilities designed and built with a long-term perspective. All the stakeholders felt that the overall cost was not as important as an adaptable facility. The importance of investing in an adaptive facility was attributed to the dynamic nature of the MHS, exemplified by mission changes, unplanned political decisions, and the frequency of senior leader changes within each organization. Not valuing the triple bottom line for health, and in particular the impacts of physical design on the social environment (defined in this study as QOL issues), could have negative repercussions since the physical environmental plays a role in service delivery and stress reduction (Mrockzek et al., 2005).

Different stakeholders valued different elements of the TBL differently. For example, the planners and operators at one site connected a former emergency room with an existing primary care clinic to expand service delivery. This resulted in increased staff walking due to a 100 meter long connecting corridor. For the planners having excess space was viewed positively, since from their perspective the more typical problem is insufficient space. However, for end-users, the clinical staff, this space was a clear negative. Increased staff walking has been shown to increase staff stress and decrease QOC and QOL which negatively impact both retention and the organizations bottom line (Jones, 2004; Shepley, 2002; Shepley & Davies, 2003). In order for the MHS to embrace healthcare strategic sustainability in the context of the TBL, the results of this research suggest it will have to place a higher priority on understanding the consequences of emphasizing cost over other TBL factors.

CHAPTER 5

CONCLUSIONS

5.1 Overall Conclusions

Overall, results of the study show that there are design elements that are more adaptable than others, that the conversion of an inpatient hospital to an outpatient health facility results in inefficient space utilization, and that the perspective of stakeholders involved have a uniform view of the TBL for health. The results of the study support previous research studies that emphasize adaptable design elements and the high rate of change within the healthcare environment. The results also highlight a shift in priorities from the stakeholder perspective that cost is not the most important factor when considering the TBL for health.

5.2 Study Limitations

In interpreting these significant findings, it is also important to consider the limitations of this study. The study was an exploratory comparative case study of six facilities, five of which had the same design, and were comprised of three varying scopes of change. Though exportable to the civilian healthcare sector, the MHS does have some operational and funding peculiarities since it is a centralized, governmental health system. Specifically regarding the stakeholder perspectives; a larger representative sample should be pursued to increase the validity and application to EBD. The sample of participants was small and is not large enough to have a critical impact on EBD in health care facilities.

5.3 Future Research Directions

Healthcare facilities are among the most expensive buildings to construct, and given that healthcare organizations often face budget constraints, more research is needed to identify specific design elements that improve the adaptability of the facility to changes, and which elements improve patient quality of care and staff quality of life. Specifically, future research should consider:

- which design elements can be replaced with more sustainable materials through LCC.
- the rate of change within the MHS healthcare facilities, particularly the frequency of change and level of disruption different departments and clinics experience over time;
- the utilization of previously incorporated shell space to determine if it met its intended purpose;
- the impact of leader changes on the utilization of space and project cost.
- the amount of churn and cost savings associated with interstitial or IBS (Integrated Building System) to determine its positive application for government facilities since it has been identified as a high cost design element (Miller & Swensson, 2002).

5.4 Implications for Practice

These findings confirm the impact of certain design elements on the conversion and adaptability of hospitals. The findings suggest the need to educate organizations on which design elements to invest in for that not only meet cost and environmental quality goals, but also, like dining and break facilities, contribute positively to staff quality of life. This, in turn, is likely to affect retention and recruiting.

The long term goal should be to increase strategic sustainability. Here, that has been defined as the ability of an existing facility to accommodate new uses over time while delivering a high quality of care and balancing the triple bottom line for health: economic, social, and environmental costs and benefits.

APPENDICES

APPENDIX A

Strategic Sustainability in Health Care Facilities



Cornell University
College of Human Ecology

Interview Preparation Document

The goal of this research is to provide a greater understanding of the adaptability of the built environment in healthcare facilities. I would like you to provide detailed responses to the questions listed below based upon your target category: planner, operator, and user. I will provide an example to aid you.

A level of detail is required in order for the Army to receive a benefit from the study. I have provided a framework to help you remember and also categorize the areas in which change occurred. Within each category that applies I would like you to describe what you did specifically, why you did what you did, and what made it easy or difficult. This research is broad in nature, but requires a level of specificity in order to be helpful. You are encouraged to take time out prior to the interview and review past project scopes and work order logs to help you answer the questions with the level of detail required to provide maximum benefit to the Army.

I thank you for your participation and I assure you that the lessons learned will be disseminated to all relevant stakeholders to the Army Medical Command's maximum benefit.

See below for a by-category list of example responses:

CATEGORY	RESPONSE EXAMPLE
Structural	<p>What were the drivers? The facility was converting to an ambulatory healthcare center which involved multiple changes within the existing shell of the facility. What you did specifically and why? The inpatient areas were converted into administrative and primary care service areas to improve operational efficiencies. Multiple interior walls were added and resulted in additional building services demand per area renovated.</p> <p>What made it easy or difficult? The steel framing and structural column grid added the rapid building services</p>

	<p>and layout conversions. If load bearing walls would have been present these would have hampered efforts.</p>
<p>Building Services</p>	<p>What were the drivers? The conversion of the facility from an inpatient to out-patient care model impacted the medical gas lines infrastructure.</p> <p>What you did specifically and why? The medical gas line infrastructure was left intact, but cut and capped throughout the facility. This was done to minimize the overall conversion cost, since there might be a need for the service in the future. But, to prevent the need for further JCAHO compliance certification and negative cost impacts on the facilities operation budget the infrastructure needed to be de-certified and capped.</p> <p>What made it easy or difficult? Since the service was no longer required it was very easy to de-certify the system since the piping network ran parallel to the finger corridors in the in-patient areas. All access panels were located in the main ward hallways.</p>
<p>Building Layout</p>	<p>What were the drivers? Due to the conversion to an out-patient care facility the ER was transitioned to an Acute Care Center (ACC).</p> <p>What you did specifically and why? The ACC required less space than the existing ER did but due to HIPPA regulations more private exam rooms were required within the ACC area.</p> <p>What made it easy or difficult? The terrazzo flooring within the old ER area was not what would normally be specified for waiting and exam room type areas. It would not hold up to a high volume of traffic and present an appropriate aesthetic. The floors had to be replaced, walls added, and services brought into the old ER area.</p>

<p>Equipment and Furnishings</p>	<p>What were the drivers? The conversion of the MEDDAC to an AHC and the increased patient volume expected drove the need to expand pharmacy services.</p> <p>What you did specifically and why? The pharmacy was relocated to a location which could be easily expanded if required. The location also accommodated drive through pharmacy services to better service the needs of our patients. There was a need for automated dispensing service equipment and mobile storage shelving units to accommodate the increased demand and also provide for a more flexible working environment. These systems required additional electrical and IT services to be brought into the area. to support the added patient requirement.</p> <p>What made it easy or difficult? The new location provided for increased expansion if required and also accommodated all the IT requirements based upon the increased use of automated dispensing units.</p>
<p>Adjacencies</p>	<p>What were the drivers? The conversion from a MEDDAC to and AHC triggered a need to redesign the model of HC delivery within the facility. The new model was heavy PLX and FP.</p> <p>What you did specifically and why? Since a primary care model would be adopted the patient flow had to change and the specific needs of primary care patient addressed. Therefore the main floor was renovated to provide for increased pharmacy, laboratory, and radiological services in support of the family practice and women's health care clinics. The laboratory was</p>

	<p>moved from the basement to the main floor and the women's health was given its own wing with special imaging services.</p> <p>What made it easy or difficult? The radiology service equipment and lead shielding requirement made the existing space more costly to reconfigure and the movement of the equipment was difficult since it was cumbersome and required special building service and IT support.</p>
Staffing	<p>What were the drivers? The conversion of the MEDDAC to an AHC required a transition of staffing to better accommodate the new patient care focus.</p> <p>What you did specifically and why? The vast majority of the specialized medical contracts would be cancelled and the nursing staff template required a significant change to better accommodate the new patient care focus.</p> <p>What made it easy or difficult? The annual medical specialist contracts made the transition or conversion from a MEDDAC to an AHC easier. If they were three year contracts it would have proved more costly to the government since the physicians would have to be paid a settlement to change their existing contract.</p>

CONTACT INFORMATION

Thank you for your assistance during this research project. If for any reason you feel the need to contact me please do not hesitate. I may be contacted via email @ djz6@cornell.edu, or phone by (cell) 808-551-7481, or (home) 607-319-4657.

APPENDIX B



Interview Preparation Document

A level of detail is required in order for the Army to receive a benefit from the study. I have provided a framework to help you remember and also categorize the areas in which change occurred. Within each category that applies I would like you to describe what you did specifically, why you did what you did, and what made it easy or difficult. This research is broad in nature, but requires a level of specificity in order to be helpful. You are encouraged to take time out prior to the interview and review past project scopes and work order logs to help you answer the questions with the level of detail required to provide maximum benefit to the Army.

I thank you for your participation and I assure you that the lessons learned will be disseminated to all relevant stakeholders to the maximum benefit for the Army Medical Command.

See below for a by-category list of example responses:

CATEGORY	BULLETIZED RESPONSE EXAMPLE
<p>Structural - defined as the foundation and load-bearing elements of the building.</p> <p><u>Partial list of examples</u> Steel Columns Steel Beams Truss Load Bearing Walls</p>	<p>What did you do specifically? - multiple interior walls were added</p> <p>Why did you make those changes? - converted ER area to an acute care clinic which required additional exam and screening rooms.</p> <p>What made it easy or difficult? - steel framed structure accommodated the easy redesign of the interior space.</p>
<p>Space Planning - defined as the physical change of location or function such as size, layout, and arrangement of a department or area.</p> <p><u>Partial list of examples:</u></p>	<p>What did you do specifically? - converted terrazzo flooring to VTC</p> <p>Why did you make those changes? - existing OR experienced heavy wear due to high foot traffic and change in</p>

<p>Ceilings Interior Walls and Partitions Flooring Windows Doors Room Size and Dimension</p>	<p>function.</p> <p>What made it easy or difficult? - terrazzo was difficult and costly to replace while maintaining operations.</p>
<p>Adjacencies - defined as the change of location or process of a function within the facility.</p> <p><u>Partial list of examples:</u> Imaging Acute Care Services Pharmacy Laboratory Medical Records Computer Room</p>	<p>What did you do specifically? - change in health care delivery model increased the importance of out-patient imaging services.</p> <p>Why did you make those changes? - to improve patient care and staff efficiencies, functional adjacencies were altered.</p> <p>What made it easy or difficult? - imaging services made the new design more difficult since it required costly and time-consuming changes to the physical environment: lead shielding, structural support, and IT.</p>
<p>Building Services - defined as the working guts of a building. The systems that provide essential services to a facility.</p> <p><u>Partial list of examples:</u> Medical Gas System HVAC System and Controls Electrical Circuits Cable Trays Elevator and Escalators Fire Suppression Security</p>	<p>What did you do specifically? - de-certified medical gas system.</p> <p>Why did you make those changes? - medical gas system was no longer required since all inpatient procedures were eliminated.</p> <p>What made it easy or difficult? - piping network was easier: ran parallel to finger corridors in the inpatient areas.</p>
<p>Equipment and Furniture - defined as the physical furniture and equipment (medical and non-medical) within the facility.</p> <p><u>Partial list of examples:</u> Systems Furniture and Chairs Storage Cabinets Computer or Server Farm CAT Scan or MRI Laboratory Analyzer Dental Equipment</p>	<p>What did you do specifically? - increased the amount of systems furniture</p> <p>Why did you make those changes? - to provide for greater flexibility</p> <p>What made it easy or difficult? - wall mounted strips made the reassembly of systems furniture more difficult: costly and time consuming.</p>

<p>Staffing - defined as the philosophy of care or goals of the medical and administrative staff that work within the facility.</p> <p><u>List of examples:</u> Contract length, type, and number Quality of care issues Quality of life issues</p>	<p>What did you do specifically? - the specialty service contracts, such as general surgeon, were canceled.</p> <p>Why? - new business model eliminated the need</p> <p>What made it easy or difficult? - contract length (one year) made is easy.</p>
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FINAL CLOSING QUESTION

This question will be posed at the end of our interview.

Q. Is there anything that I have not asked about that you think would be important to know about directly related to this research?

ADDITIONAL GUIDANCE

The following interview process will be followed for each of the six categories above, with one exception explained below. The USER interview category will be asked to explain how the aspects of the physical environment impacted their delivery of quality health care and their quality of life. You (PLANNER, OPERATOR, and USER) will use the process below to aid you in providing the level of detail required for the study to produce a positive impact.

Planner and Operator perspective. (The key for all questions is to provide specific and detailed examples for each of the six categories mentioned above.)

1. What did you do specifically?
2. Why did you make those changes; what specific factors lead to them?
3. What made it easy or difficult?
4. Was there anything you didn't do because it was deemed too costly, disruptive, time-consuming, etc.
 - a. What was not done and why?
 - b. Were there any consequences of not doing it...for operations, quality of care, efficiency, etc?

User perspective. (What is the impact of the physical environment on direct health care and staff quality of life?)

1. Is there anything which makes it harder or easier to deliver the quality health care services that you would like?
2. Is there anything in the previous six categories that make it harder or easier for you to work effectively and comfortably?
3. Is there anything that is not present that makes it more or less difficult for you to work effectively and to delivery the quality of care that you would like too?

CONTACT INFORMATION

Thank you for your assistance during this research project. Please do not hesitate to contact me, MAJ David Zajac, for help clarifying matters concerning this research. I may be contacted via email @ djz6@cornell.edu, or phone by (cell) 808-551-7481, or (home) 607-319-4657.

APPENDIX C



Second Interview Preparation Document

The goal of this research is to provide a greater understanding of the adaptability of the built environment of healthcare facilities. After completing the first interview, analyzing the data gathered, and developing a framework from which to view the data across site, scope and stakeholder **I need to gather more detailed information** to complete my thesis research.

- The suspense for data collection is Monday 16 June 2008.
- The time requirement is 60 minutes or less.

The information required is based upon the previous two research questions (RQ):

1. What design/building changes were made to accommodate the change from an inpatient to an outpatient care business model?
 - 1.1. What functional **areas** within the facility were **most affected** by the conversion?
 - 1.2. Which existing design/building elements generated **significant constraints** when implementing the desired new design concept?
 - 1.3. Which design/building elements made it **easy to implement** new design concepts?
 - 1.4. What, if any, desired design/building changes **were not made**, and why?
2. What factors: social (quality of care), economic (cost), environmental (sustainability), or future adaptability, were considered and/ or emphasized during the conversion of the facility?

I have developed two tables to help you identify the information required per site, scope, and stakeholder. The **first table** (Table 1.1) refers to **RQ 1.1**. My primary goal is to complete the population of the cells identified with a question mark (?). If you see a question mark for your site please begin to gather the information for me so that when we conduct the interview you will be able to assist me. I need to understand if the service was either: a) converted, b) eliminated, c) reduced or d) expanded in scope/size of services performed. NA simply means "not applicable". The "NA" designator primarily deals with the LOW SCOPE sites since their changes were isolated to only one floor. NC simply means "no change". Please just focus on your site and begin gathering the information so I may tell the "story" of what occurred per site and scope. Please use Table 1.1 to aid you in gathering data prior to our next teleconference.

The **second table** (Table 1.2) refers to **RQ 1.2 and 1.3**. This table identifies which design or building elements either constrained (C) or benefited (B) conversion efforts. The cells are also colored coded for ease of recognition: green for benefited, and red for constrained. If you have a question mark (?) within one of the layers of change I need to know whether or not the design or building elements either constrained or benefited conversion efforts. I also need to have you explain why or how it benefited or constrained the conversion of the facility. The explanation

of the constraint will be covered during the interview so please be prepared to answer at that time.

For **RQ 1.4** I simply need you to inform me of any changes that were not made and why. I would like to have **at least three per site** so I can determine if there are any similarities across sites and scopes. You have done a good job identifying them thus far, please be prepared with a list of three design changes which were not made and why when we have our interview.

For **RQ 2** I need you to explain in greater detail “why” you ranked the categories the way you did. If you do not remember “how” you rank ordered them from our previous interview send me an email and I will send you your scores. In summary I will interview you to get more of the “why” since you have already provided the “how”. I have provided the definitions below to help you prepare for the interview.

Cost

- The overall considerations given toward the cost of the project as a whole.

Sustainability

- The overall consideration given toward the environmentally responsible impacts associated with the project. The impacts may take many forms such as LEED certification, but within this study focused mainly on material selection and energy conservation issues since LEED is a recent improvement.

Quality of Care

- The overall consideration given to how the design of the facility would positively enhance the quality of care provided/ received at the health care facility.

Adaptability

- The overall consideration given to the future adaptability of the health care facility as it responds to changes in medical technology and medical practice.

For USERS ONLY:

(Q: What is the impact of the physical environment on direct health care and staff quality of life?)

1. Is there anything which makes it harder or easier to deliver the quality health care services that you would like?
2. Is there anything in the previous five categories (see Table 1.2) that make it harder or easier for you to work effectively and comfortably?
3. Is there anything that is not present that makes it more or less difficult for you to work effectively and to deliver the quality of care that you would like too?

I thank you for your participation and I assure you that the lessons learned will be disseminated to all relevant stakeholders to the Army Medical Command’s maximum benefit. Please take the necessary time out of your busy schedules to complete the tasks above.

- I will be contacting you via email to determine the best time to interview you.
- Interviews will begin on Monday the 2nd of June.

CONTACT INFORMATION for Major David J. Zajac

Thank you for your assistance and participation in this research project. If for any reason you feel the need to contact me please do not hesitate. I may be contacted via email @ djz6@cornell.edu, or phone by (cell) 808-551-7481, (home) 607-319-4657, or (fax) 607-255-0305.

Table 1.1

	SITE SCOPE		Eustis HIGH	Meade HIGH	Lee MEDIUM	Rucker MEDIUM	Belvoir LOW	Jackson LOW
	What Areas were most effected by the conversion and how? (Rq. 1.1)							
Specialty Services								
Operating Rooms	Converted to minor surgery and enlarged	Converted to minor surgery and enlarged	Converted to Admin Areas	Eliminated	NA	NA	NA	NA
Emergency	Converted to Acute Care Clinic (ACC)	Converted to Urgent Care Clinic (UCC)	Converted to Primary Care Clinic	Converted to Primary Care Clinic	NA	NA	NA	NA
Inpatient Ward Space	Converted to Admin or Clinical Space		Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space	Converted to Admin or Clinical Space
Ophthalmology	Eliminated	Eliminated	Eliminated	Eliminated	NA	NA	NA	NA
Internal Medicine	Split between floors (Gastro Entomology Svcs)		Eliminated	Eliminated	NA	NA	NA	NA
Dermatology	Eliminated	Eliminated	Eliminated	Eliminated	NA	NA	NA	NA
Orthopedics/ Podiatry	Reduced	Reduced	Reduced	Reduced	NA	NA	NA	NA
Primary Care Services								
Mental Health	Expanded	?	Expanded	?	NA	NA	NA	NA
Women's Health	Expanded	(Birthing Center?)	?	?	NA	NA	NA	NA
Pediatrics	Expanded	?	Expanded	?	NA	NA	NA	NA
Optometry	?	?	?	?	NA	NA	NA	NA
Physical Therapy	Expanded	?	Reduced	?	NA	NA	NA	NA
Occupational Therapy	?	?	Reduced	?	NA	NA	NA	NA
Auxiliary Services								
Pharmacy	NC?	Expanded	Expanded	Expanded	NA	NA	NA	NA
Pathology	NC	NC	NC	NC	NA	NA	NA	NA
Radiology	NC	NC	NC	Reduced	NA	NA	NA	NA
Radiographic	?	?	?	?	NA	NA	NA	NA
Ultrasound	?	?	?	?	NA	NA	NA	NA
Mammography	?	?	?	?	NA	NA	NA	NA
Fluoroscopy	?	?	?	?	NA	NA	NA	NA
CT	?	Added 64 slice CT	?	?	NA	NA	NA	NA
MRI	?	Mobile MRI	Mobile MRI	?	NA	NA	NA	NA
Admin and Support Services								
Central Material Services	?	?	Eliminated	Eliminated	NA	NA	NA	NA
Nutrition Care	Conversion due to Beta Test "A la Carte" Site	Converted to Large Conference Areas	Converted to Break Area and Medical Warehouse	Converted to Medical Records Storage	NA	NA	NA	NA
Logistics	Reduced	Reduced	Reduced	Reduced	NA	NA	NA	NA
Information Technology	Expanded	Expanded	Expanded	Expanded	NA	NA	NA	NA
Medical Records	Reduced	Reduced	Reduced	Reduced	NA	NA	NA	NA
Morgue	Eliminated	Converted to Prev. Medicine Space	Converted to FM Maint Parts Room	Reduced in Size	NA	NA	NA	NA
Chapel	?	Converted to Prayer Room	Converted to Prayer Room	Converted to Prayer Room	NA	NA	NA	NA
Treasury Office	Eliminated	Eliminated	Converted to TRICARE benefits Office	Converted to Prayer Room	NA	NA	NA	NA

Table 1.2

Which design/ building elements aided or benefited the conversion of the facility and which constrained the conversion? (RQ 1.2 and 1.3)	SITE SCOPE		Eustis HIGH		Meade HIGH		Lee MEDIUM		Rucker MEDIUM		Belvoir LOW		Jackson LOW	
	B	C	B	C	B	C	B	C	B	C	B	C	B	C
SHELL	Benefit = C / Constraint = C													
Load Bearing Walls	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Regular Column Pattern	X	?	X	X	X	X	X	X	X	X	X	X	X	X
Irregular Column Grid		X		X		X		X		X		X		X
Building Shape		X		X		X		X		X		X		X
Lack of X-Bracing	?		?		?		?		?		?		?	
SERVICES	Benefit = C / Constraint = C													
Facility Codes and Requirements	X	X	?	X	?	X	?	X	?	X	?	X	?	X
HVAC		X		X		X		X		X		X		X
Electrical	X		X		X		X		X		X		X	
Fire Suppression		X		X		X		X		X		X		X
Plumbing		X		X		X		X		X		X		X
IT - Voice/ Data		X		X		X		X		X		X		X
IT - Cable TV	X		X		X		X		X		X		X	
Emergency Power Availability	?		?		?		?		?		?		?	
Utilities Capacity	X		X		X		X		X		X		X	
SPACE PLAN	Benefit = C / Constraint = C													
Building Chassis Incongruity		X		X		X		X		X		X		X
Race Track Design	X		X		X		X		X		X		X	
Circulation Corridors		X		X		X		X		X		X		X
Adjacencies		X		X		X		X		X		X		X
Available Transition Space	?		?		?		?		?		?		?	
SCENERY	Benefit = C / Constraint = C													
Glazed CMU Block Walls		?		?		?		?		?		?		?
Room Dimensions Incongruity		?		?		?		?		?		?		?
Door Size		?		?		?		?		?		?		?
High Ceiling Heights		?		?		?		?		?		?		?
Flooring Type (Terrazzo)		?		?		?		?		?		?		?
Specialized Room Types		?		?		?		?		?		?		?
SET	Benefit = C / Constraint = C													
Modular Furniture (open panels)	?		X		?		X		?		X		?	

APPENDIX D



Preparation for Second Interview

The goal of this research is to obtain a greater understanding of the adaptability within the built environment of healthcare facilities. Thank you for your assistance thus far and I look forward to our final interview together. After completing the first interview, compiling the data gathered, and developing a framework from which to analyze the data across site, scope and stakeholder, I would now like to interview you for more detailed information to complete my thesis research. The final data collection will occur between the 9th and 20th June 2008. Please review your schedules and set aside time for our final one-hour interview.

For review, the information required is based upon two research questions (RQ):

3. What design/building changes were made to accommodate the change from an inpatient to an outpatient care business model?
 - 3.1. What functional **areas** within the facility were **most affected** by the conversion?
 - 3.2. Which existing design/building elements generated **significant constraints** when implementing the desired new design concept?
 - 3.3. Which design/building elements made it **easy to implement** new design concepts?
 - 3.4. What, if any, desired design/building changes **were not made**, and why?
4. What factors: social (quality of care/ life), economic (cost), environmental (sustainability), or future adaptability, were considered and/ or emphasized during the conversion of the facility?

I have developed two tables to help you identify the information required per site, scope, and stakeholder. The **first table** (Table 1.1) refers to **RQ 1.1**. My primary goal is to complete the population of the cells with the key provided. If you see a question mark for your site please use the key provided to fill in the cell(s) prior to our interview. I will populate the cell(s) during our interview.

The **second table** (Table 1.2) refers to **RQ 1.2 and 1.3**. This table identifies which design or building elements either constrained (C) or benefited (B) conversion efforts. The cells are also color coded for ease of recognition: blue for benefited, and red for constrained. If you have a clear cell within one of the layers of change I need to know whether or not the design or building elements either constrained (C) or benefited (B) conversion efforts. Simply place a B or C in the cell(s). I will populate the spreadsheet during our interview. I will then ask you to explain why or how it benefited or constrained the conversion of the facility.

For **RQ 1.4** I simply need you to inform me of any changes that were not made and why. Some examples which have been given thus far were funding priorities and funding limits (e.g. new work limits). You have done a wonderful job thus far. Please prepare a list of two or three

design changes directly related to the conversion of the facility which were not made and why. We will discuss them during our final interview.

For **RQ 2** we will have a more detailed dialog regarding your perspective of what factors were considered or emphasized during the conversion of the facility. I have provided the definitions below to help you prepare for the interview.

Cost

- The overall considerations given toward the cost of the project as a whole.

Sustainability

- The overall consideration given toward the environmentally responsible impacts associated with the project. The impacts may take many forms such as LEED certification, but within this study focused mainly on material selection and energy conservation issues since LEED is a recent improvement.

Quality of Care

- The overall consideration given to how the design of the facility would positively enhance the quality of care provided/ received at the health care facility.

Adaptability

- The overall consideration given to the future adaptability of the health care facility as it responds to changes in medical technology and medical practice.

I thank you for your participation. Please take the necessary time out of your busy schedules to complete the tasks above.

- Please contact me via email with the best time to interview you. If you have a preferred time/ date send me an email and I will provide confirmation via email or phone.
 - Weekends and evenings are an option if it is easier for you, just let me know.
- Interviews will begin on Monday the 9th of June and end on Friday the 20th of June.

CONTACT INFORMATION for Major David J. Zajac

Thank you for your research assistance and participation. If for any reason you feel the need to contact me please do not hesitate. I may be contacted via email @ djz6@cornell.edu, or phone by (cell) 808-551-7481, (home) 607-319-4657, or (fax) 607-255-0305.

Table 1.1

SITE	Lee
SCOPE	MEDIUM
What Areas were most effected by the conversion and how? (RQ 1.1)	
<i>Specialty Services</i>	
Operating Rooms	Converted to Admin Areas
Emergency	Converted to Primary Care Clinic
Inpatient Ward Space	Converted to Admin or Clinical Space
Ophthalmology	Eliminated
Internal Medicine	Eliminated
Dermatology	Eliminated
Orthopedics/ Podiatry	Reduced
<i>Primary Care Services</i>	
Mental Health	Expanded
Women's Health	?
Pediatrics	Expanded
Optometry	?
Physical Therapy	Reduced
Occupational Therapy	Reduced
<i>Ancillary Services</i>	
Pharmacy	Expanded
Pathology	NC
Radiology	NC
<i>Admin and Support Services</i>	
Central Material Services	Eliminated
Nutrition Care	Converted to Break Area and Medical Warehouse
Logistics	Reduced
Information Technology	Expanded
Medical Records	Reduced
Morgue	Converted to FM Maint Parts Room
Chapel	Converted to TRICARE benefits Office
Treasury Office	Eliminated

KEY

Eliminated

- service and space requirements were removed or eliminated as a result of the conversion of the facility.

Converted

- service and space requirements for the space were changed as a result of the conversion of the facility.

Expanded

- Size or Scope of the service or space were increased as a result of the conversion of the facility.

Reduced

- Size or Scope of the service or space were reduced as a result of the conversion of the facility.

NC

- No Change

Table 1.2

SITE SCOPE	Lee MEDIUM	
Which design/ building elements aided or benefited the conversion of the facility and which constrained the conversion? (RQ 1.2 and 1.3)		
Benefit = B / Constraint = C	B	C
SHELL		
Load Bearing Walls		C
Regular Column Pattern	B	
Irregular Column Grid		C
Building Shape		C
Building Envelope		
SERVICES		
HVAC Distribution		C
HVAC Capacity	B	
Fire Suppression		
Plumbing		C
IT - Voice/ Data		C
Electrical Capacity	B	
Emergency Power Availability	B	
Electrical Distribution	B	
Lighting		
SPACE PLAN		
Building Chassis Incongruence		C
Circulation Pattern		C
Unit Adjacencies		
Available Transition Space	B	
Room Size		C
Room Type		C
SCENERY		
Wall Materials		
Door Size		
Ceiling Heights	B	
Flooring Materials		C
SET		
Modular Furniture		

APPENDIX E



Preparation for Second Interview

The goal of this research is to obtain a greater understanding of the adaptability of the built environment of healthcare facilities. Thank you for your assistance thus far and I look forward to our final interview together. After completing the first interview, compiling the data gathered, and developing a framework from which to analyze the data across site, scope and stakeholder, I now need to query you for more detailed information to complete my thesis research. The final data collection will occur between the 9th and 20th June 2008. Please review your schedules and set aside time for our final one-hour interview to complete this research endeavor.

For review, the information required is based upon two research questions (RQ):

5. What design/building changes were made to accommodate the change from an inpatient to an outpatient care business model?
 - 5.1. What functional **areas** within the facility were **most affected** by the conversion?
 - 5.2. Which existing design/building elements generated **significant constraints** when implementing the desired new design concept?
 - 5.3. Which design/building elements made it **easy to implement** new design concepts?
 - 5.4. What, if any, desired design/building changes **were not made**, and why?
6. What factors: social (quality of care/ life), economic (cost), environmental (sustainability), or future adaptability, were considered and/ or emphasized during the conversion of the facility?

The initial data analysis has identified the following areas within the physical environment related to **RQ 1** as having positive or negative impacts on direct health care and/or staff quality of life. The following areas are defined below:

- 1. Access to Natural Light.**
 - a. The availability of windows and other design elements to afford the penetration of natural light within the interior of the facility.
- 2. Access to Nature.**
 - a. The availability of either window views to a natural environment outside or the inclusion of natural restorative artwork within the facility.
- 3. Staff Dining Options.**
 - a. The availability of on-site eating establishments.
- 4. Staff Break Rooms.**
 - a. The location, size, and amenities afforded by break rooms.
- 5. Patient Flow Patterns.**
 - a. The physical environments ability to aid or constrain the delivery of effective and/or efficient patient care.
- 6. Staff Communication Patterns.**
 - a. The physical environment's ability to aid or constrain staff quality of life.

7. Interior Design.

- a. The availability of indoor aesthetic treatments and color selection to provided for a restorative environment.

8. Access to Medical Equipment.

- a. The availability of updated and operable medical equipment and the necessary space to store it without creating a “cluttered” environment.

9. Acoustics.

- a. The ambient noise level within the interior environments impact on staff and patients.

10. Door Dimensions.

- a. Refers to the size of patient and administrative doors within the facility.

During our final interview I would like to discuss in greater detail **how** and **why** these ten elements of the physical environment impacted direct health care and staff quality of life.

For **RQ 2** we will have a more detailed dialog regarding your perspective of what factors were considered or emphasized during the conversion of the facility. I have provided the definitions below to help you prepare for the interview.

Cost

- The overall considerations given toward the cost of the project as a whole.

Sustainability

- The overall consideration given toward the environmentally responsible impacts associated with the project. The impacts may take many forms such as LEED certification, but within this study focused mainly on material selection and energy conservation issues since LEED is a recent improvement.

Quality of Care

- The overall consideration given to how the design of the facility would positively enhance the quality of care provided/ received at the health care facility.

Adaptability

- The overall consideration given to the future adaptability of the health care facility as it responds to changes in medical technology and medical practice.

I thank you for your participation. Please take the necessary time out of your busy schedules to review and prepare for our final interview by reviewing the ten areas listed above.

- Please contact me via email with the best time to interview you. If you have a preferred time/ date send me an email and I will provide confirmation via email or phone.
 - Weekends and evenings are an option if it is easier for you, just let me know.
- Interviews will begin on Monday the 9th of June and end on Friday the 20th of June.

CONTACT INFORMATION for Major David J. Zajac: Thank you for your research assistance and participation. If for any reason you feel the need to contact me please do not hesitate. I may be contacted via email @ djz6@cornell.edu, or phone by (cell) 808-551-7481, (home) 607-319-4657, or (fax) 607-255-0305.

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