



National Institute of
BUILDING SCIENCES

**The Academy for
Healthcare Infrastructure**
Collaborative Research Program

RESEARCH TEAM 5:

Reducing Capital Costs



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2015 Collaborative Research Program

Team 5

Reducing Initial Capital Costs

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Foreword

In 2013, the National Institute of Building Sciences established a collaborative research program to bring leading healthcare professionals together to address industry challenges at a national level. The Academy for Healthcare Infrastructure (AHI) would focus on improving the processes to create and maintain the complex built environment required to support America's healthcare mission. It would serve as a collaborative network with the purpose of exploring large, comprehensive ideas.

Upon establishing its charter and selecting Research Governors, AHI began the process of setting up Interdisciplinary Research Teams to identify current best practices; envision the future of the healthcare infrastructure industry; and engage appropriate industry leaders to develop new approaches for solving critical problems. Each of the resulting five teams consisted of leaders from the healthcare facilities industry and related subject matter experts, as well as an academician to facilitate the process who would be responsible for compiling the data and developing a white paper for publication.

The Academy's research methods were formulated to utilize the power of interdisciplinary collaboration to actively break traditional professional boundaries. Each of these small, focused teams of industry experts have committed to envision materially improved approaches to a specific critical industry issue. The structure is designed to result in breakthroughs in the creation, management and repurposing of healthcare infrastructure.

Each team focused on a specific topic: Owner Organization for Successful Project Outcomes; Developing a Flexible Healthcare Infrastructure; Speed to Market Strategies; Defining the Next Generation's Focus; and Reducing Initial Capital Costs.

Over the course of 2015, the facilitators coordinated with the healthcare facilities industry leaders and related subject matter experts, and began the process of compiling white papers with their findings.

This paper, "Reducing Initial Capital Costs," is the result of Team 5's efforts.

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Introduction

There are times when systemic incremental improvement is desirable. This is not one of those times. Affordable, quality healthcare is essential to sustaining a vibrant society. And yet, the American healthcare industry is facing overwhelming uncertainty in almost every segment.

The Academy for Healthcare Infrastructure (AHI) was established to materially improve the processes used to create and maintain the incredibly complex built environment required to effectively support America's healthcare mission. This collaborative research program is designed to focus on issues that are vital to improving the performance of the healthcare facilities industry, while avoiding the temptation to repeatedly address the same old issues.

The American healthcare system of today is being challenged to heal more patients with fewer resources. The built environment for healthcare must respond by being more supportive and costing less. AHI's Interdisciplinary Research Team 5 set out to investigate new, innovative ideas to reduce capital costs.

Overview of the Healthcare Industry

The United States spends a significantly higher percentage of its Gross Domestic Product (GDP) on healthcare than any other nation in the world. Healthcare spending in the United States reached \$2.9 trillion and accounted for 17.4% of the GDP in 2013. This rate is approximately 2.5 times the world average of 6.9% of GDP (see Figure 1). Compounding this disparity is the issue that U.S. healthcare expenditures are expected to grow at an average annual rate of 5.8% and reach 19.6% of GDP by 2024. At that point, federal, state and local governments are forecast to shoulder 47% of the nation's spending on patient care (CMS 2015). The current and forecast level of healthcare spending strains both public and private funding, and imposes a financial burden on the nation, which places the United States at a competitive disadvantage on the world stage (AHR 2012).

To combat this growing problem, the healthcare industry is under mounting pressure to reduce costs, while simultaneously improving healthcare delivery and patient satisfaction. Healthcare providers are being tasked with accomplishing these objectives in an environment of increasing demand, expanding use of technology and an evolving reimbursement structure with reduced levels of funding.

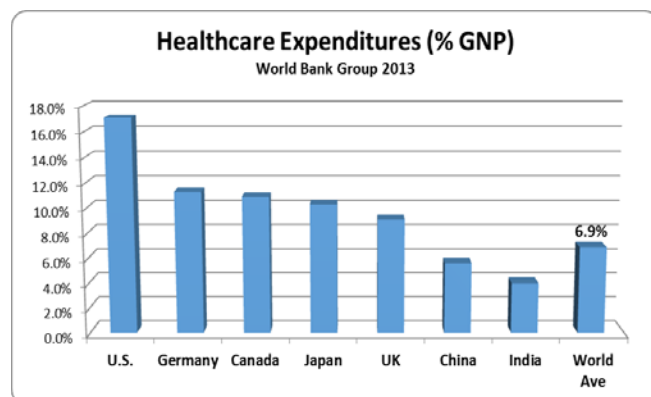


Figure 1: Healthcare Expenditures

Demand for healthcare services is being fueled by an expanding and aging population, technology (see Figure 2), and historical insensitivity to price. Over the next four decades, the population of individuals 65 and older is forecast to almost double from 43 million in 2012 to 84 million in 2050 (U.S. Census Bureau).

This places an ever-increasing burden on the healthcare industry because nearly half of a person's life-time expenditures on healthcare occur during their senior years (Alemayehu et.al. 2004). Per-person healthcare spending for seniors is five times greater than spent on a child and three times more than incurred by a working-age person. In 2010 the elderly comprised 13% of the population and represented 34% of the healthcare spending (CMS 2015).

In addition to population growth and aging demographics, advancements in technology have expanded diagnostic and treatment options that continue to fuel increasing healthcare expenditures. Technology has improved patient care, but has also increased the spectrum of procedures and healthcare services available for all age groups. Because of its initial cost; the complex and expensive techniques and equipment; and the expanded care options that it provides, technology is estimated to account for 38% to 65% of the increase of healthcare spending (Skinner 2013, Carr 2014).

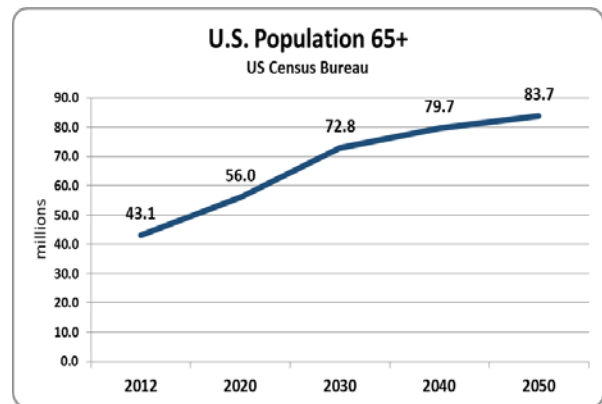


Figure 2: U.S. Population 65+

As the need for patient healthcare increases and treatment options expand, the population continues to demand access to high-quality care while it remains historically insensitive to its cost. This is mainly because healthcare costs are generally not paid directly by the patient, but rather third parties, typically the government or private insurers. Recipients of care often have minimal 'skin in the game'. Patient insensitivity to cost, combined with population growth and expanding treatment options, heighten the demand and cost for healthcare services (Skinner 2013, Carr 2014).

While demand and costs have been rising, reimbursements from Medicare, Medicaid and private insurers have been under pressure. An example is the constraint imposed by the U.S. Department of Health and Human Services (HHS) 2016 budget, which includes a \$400 billion reduction in healthcare funding over the next decade (Gamble 2015). Several of the top financial challenges identified by hospital chief executive officers (CEOs) in the annual survey of American College of Healthcare Executives included Medicaid and Medicare reimbursement and government funding cuts (ACHE 2014). In addition, uncertainty regarding the reimbursement structure of the Affordable Care Act and rising federal regulations change the business model for healthcare providers. These conditions raise concerns and increase the need for cost containment (Fabris 2012).

In addition to rising demand, escalating healthcare costs and growing pressure on funding and reimbursement for services, healthcare providers are facing increased competition and rising 'customer' service expectations. Almost a decade ago, the Centers for Medicare and Medicaid Services (CMS) implemented a national survey to measure the quality of care provided by hospitals throughout the nation. The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is the first national survey to collect data regarding the patient's perspective of the care provided by a hospital. Once service data is collected and tabulated, it is shared with

the public to: a) permit comparison of hospital healthcare providers; b) provide an incentive for hospitals to improve patient and family satisfaction; and c) enhance transparency and accountability of the care provided (CMS). With HCAHPS and other service assessment methods, consumers continue to gain greater insight regarding hospital care delivery. This heightens the need to improve patient services, while simultaneously dealing with the ever-increasing pressure to lower costs (Carr 2014).

While healthcare spending overall has been increasing, capital expenditures for healthcare have been relatively stable (U.S. Census Bureau). Since emerging from the national recession in 2009, healthcare construction has hovered consistently around \$40 billion per year. However, unit costs for construction have continued to climb. During the past eight years, the unit cost per square foot for healthcare facilities has risen over 40%. Unit costs have increased at a pace that is approximately 25% faster than the 30-city average (see

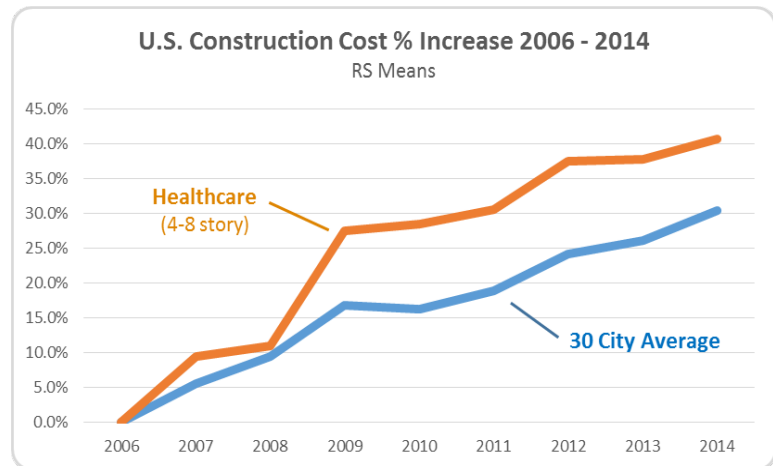


Figure 3: U.S. Construction Cost % Increase 2006 – 2014

Figure 3) for the rate of increase for construction in general (RS Means). Some of the increase in healthcare cost is driven by the demand for higher-quality finishes and to incorporate technology.

In summary, the healthcare landscape is shifting with the passage of the Affordable Care Act, changing reimbursement structure, aging demographics, increased competition from both regional and national systems, heightened focus on ‘customer’ satisfaction and the growing cost of healthcare delivery. In the past, the focus has been on managing patient flow through the system and rising costs, which could simply be passed through to those funding the delivery of care (Feder and Cutler 2010). Now, competition and reimbursement practices are forcing providers to focus on cost reduction and operational efficiency, while at the same time improving patient care (Rosenquist 2013). Moving forward, healthcare providers are expected to provide effective, efficient, high-quality care at an affordable cost (Feder and Cutler 2010).

Study Objective

Improving the delivery of services, while lowering cost, is challenging in almost any operational environment. Within the healthcare industry, an evolving reimbursement structure, changing technology, funding restrictions, increasing competition and rising customer expectations combine to make improving services while lowering costs, an especially daunting task for healthcare providers.

In this demanding environment, it is essential that providers prudently invest their capital to support their efforts to lower cost and improve operational efficiency. The objective of this white

paper is to identify new, innovative and effective actions concerning capital expenditures that healthcare providers are taking to help meet this challenge.

Methodology

White Paper Team:

To facilitate the collection of relevant and reliable data regarding the white paper topic, a team of healthcare experts was assembled by the Academy of Healthcare Infrastructure, a program of the National Institute of Building Sciences in Washington, D.C. The team consisted of 11 industry professionals with extensive healthcare expertise from leading healthcare providers, designers and contractors. Each held a leadership position in their respective organizations. Members of the Panel included:

- Jeffrey W. Land, Vice President, Corporate Real Estate, Dignity Health
- Robert McCoole, Senior Vice President, Facilities Resource Group, Ascension
- George A. 'Skip' Smith, System Vice President, Catholic Health Initiatives
- Don Wojtkowski, Executive Director, Plant & Properties, SSM Healthcare
- Richard J. Onken, AIA, EDAC, LEO A DALY
- David Prusha, Principal, HKS Architects
- Geoffrey Stricker, Director, Edgemoor Infrastructure
- Chris Kay, Managing Principal, Jacobs National Healthcare Practice, Jacobs Engineering
- Randy Keiser, Vice President, Turner Construction
- Brian Garbecki, PE, Vice President, Healthcare COE Leader, Gilbane Building Co.
- Shea De Lutis-Smith, Business Development Executive, Clark Construction

On the team were corporate officers with responsibility for capital expenditures from four national and/or regional healthcare systems. Three of these systems are ranked in the top 5 largest not-for-profit hospital systems in the United States by *Modern Healthcare*. Combined, the four healthcare systems represented by the team operate 287 acute care hospitals with more than 3,000 healthcare sites in at least 25 states across the United States. The two healthcare architects on the team are associated with architectural firms ranked in the top 10 by *Modern Healthcare* and, combined, had a healthcare volume in 2014 of \$5 billion. The four professional contractors on the team represent three of the Top 10 construction management firms and one is listed as a top 5 general contractor in *Modern Healthcare's* rankings. Combined, these contractors had an annual volume of over \$7.5 billion of healthcare construction in 2014.

Data Collection:

Prior to commencing the interview process, a literature search was initiated to identify relevant work with a focus on the area of study. Subsequent to completion of the literature search, a preliminary outline was developed to help guide the interview process. This preliminary outline was reviewed with the team chairs (representatives from the healthcare providers) and final edits incorporated. The final interview outline that was utilized during the interview process focused on the following six topics:

- *Definition of Cost:* How should capital costs be defined and evaluated?

- *Organizational Focus*: What should be the primary focus to reduce cost?
- *Delivery Process*: Organization and roles of the design and construction team.
- *Planning/Programming*: Best practices to efficiently and effectively respond.
- *Design*: Best practices to improve patient care and lower cost.
- *Construction*: Key issues/considerations for cost reduction during construction.

Within each topic area, a series of questions were developed to help stimulate thought and generate discussion during the interview. The finalized outline and questions for each topic were provided to the team members in advance of their interview.

Over a four-week period, interviews were conducted with each member of the team. The interviews were by phone, and the length of each ranged from 60 to 90 minutes. Each interview was recorded to ensure that the team member's input was properly captured. Once the interview was completed, the recording was transcribed and subsequently erased.

Data Analysis:

The strategy of this study, or theoretical framework, could be best classified as 'basic' qualitative research (Merriam 2009) or 'descriptive' qualitative research (Cooper and Schindler, 1998). Basic qualitative studies are utilized to investigate management and organizational topics and issues. The purpose of this study was to develop a descriptive summary of the data collected and the corresponding best practices to reduce capital costs. The objective of this study and data analysis was to identify common themes and/or patterns in the responses from the team members to provide a foundation for the findings of the study (Creswell 2003, Merriam 2009). Following are the central themes that surfaced during analysis of the data and which form the basis for the findings of this paper.

Findings

Evaluate Capital Cost Based on Life-Cycle Cost, Best Value

Cost reduction is a never-ending quest for healthcare providers. "There is almost never enough money for capital expenditures. It is always a compromise to balance needs with available funding," noted Robert McCoole with Ascension Health. The first step for any organization is to define and communicate their perspective concerning 'capital cost'. This is essential to provide guidance for the evaluation of capital expenditures.

Basically, there are two distinct approaches that a healthcare provider can take to evaluate capital costs. The simplest and an often-used metric is initial cost, or original purchase price, for the capital improvement. It is relatively easy to quantify and often a key factor influencing choice.

Another approach is life-cycle cost (LCC) analysis. Evaluation of the LCC of a capital expenditure is an expanded analysis because it evaluates the cost of the capital improvement over its useful life. Evaluating LCC is a more-comprehensive and complicated analysis because it incorporates both the initial cost and the cost of ownership. The analysis evaluates costs

throughout the capital expenditure's useful life, including operating and maintenance costs. Traditionally, this evaluation has focused on the costs of purchase, energy use, operating expenses, maintenance, replacement and financing costs. LCC analysis encourages an evaluation of a capital expenditure as an investment, rather than an expense. Its aim is to determine the 'value' that the capital expenditure provides the organization over its useful life. Evaluation of capital investment options using LCC analysis helps identify those expenditures that provide 'best value' to the organization. Because it evaluates performance over time, it often supports selection of an investment option with a higher initial cost. For example, high-efficiency lighting typically has a higher initial cost, but lower operating cost over its useful life. An analysis based solely on initial cost would likely discourage its use, but an evaluation utilizing LCC may provide support for the added cost because it provides better 'value' to the organization over the life of the capital investment. "The definition and evaluation of cost needs to move beyond the cost of bricks and mortar," noted Jeffrey Land with Dignity Health.

Hospital systems continue to deal with increased pressure on operating margins and are struggling to pay for the improvements necessary for the delivery of care and expansion of their services. As a result, there is a tendency for healthcare providers to lean toward evaluating capital expenditures based on initial cost in order to meet current needs with the limited funding available. This approach diverts the provider's focus away from LCC, or 'best value' selections, which often have a higher initial cost, but lower LCC because of reduced operating cost of the capital improvement over its useful life. The dilemma for healthcare providers is that basing the evaluation solely on initial cost may permit delivery of a facility to meet a need, but once completed, it may not be possible to operate it efficiently or effectively over its life. As a result, it may actually become a burden.

The consistent message from the team of experts was that healthcare providers should broaden their evaluation of the cost of capital improvements to include a LCC analysis. Decisions should be made on the basis of what provides best value to the organization, not solely focused on initial cost.

Select an Appropriate Useful Life

Best value is often a moving target based upon competitive pressures, available funding and a project's useful life. Of these three, determination of a capital improvement's useful life is often most challenging, but essential for an accurate evaluation of best value for the organization. The useful life of an asset impacts the selection of materials, systems and equipment for the space and, therefore, it is essential that it be realistically defined. However, because of technological advances and innovation, the estimated useful life of capital expenditures is often optimistic, especially from a clinical perspective. "With an imaging suite, anything greater than a 5-10 year life is unrealistic – you're walking on the wild side. So, using the highest-quality product with the longest life for the floor or ceiling, knowing that it will be torn out in five years, may not be wise nor an appropriate investment," advised Jeffrey Land with Dignity Health. Sometimes the best approach may be to incorporate lower-quality, lower-cost materials and support systems more closely aligned with a capital investment that has a limited useful life. *"We encourage our owners to establish expectations regarding the useful life of the facility early*

during the programming phase to help guide the selection of building systems and materials,” explained Chris Kay of Jacobs Engineering.

Useful life can and does vary from project to project. *“Determining the appropriate life of the initiative and the technology is the challenge,”* noted Don Wojtkowski with SSM Health. Regardless, it is essential that an accurate life be established for each capital improvement if the organization hopes to achieve best value.

Reducing Capital Cost May Not Be an Option

Healthcare construction costs are increasing; the regulatory environment is expanding; safety expectations and needs are rising; and technology, and the application of it, continues to mount. There is persistent pressure on capital budgets, while at the same time escalating cost to provide needed space and incorporate the technology needed to support patient services now and in the future. Technology greatly influences the type and quality of care delivery, and its impact on initial cost is increasing. *“A decade ago the technology component of our Capital budget was approximately 25% of our total cost. Now the cost for technology accounts for up to 40% to 50% of our total capital cost and this trend will likely continue,”* noted Jeffrey Land. Communication and technology needs are key drivers of the increased cost for capital improvements.

Does a healthcare provider need to ‘increase’ capital expenditures to incorporate technology and other service needs to compete? *“Absolutely,”* noted Don Wojtkowski, *“It is not an issue of reducing capital cost, but rather spending capital dollars wisely and effectively to get best value.”* Technology, equipment, and building systems are becoming more sophisticated and as a result more costly. *“So reducing initial cost is not realistic,”* advised Skip Smith with Catholic Health Initiatives. *“Rather, the need is to ensure that we are getting good value and building it right. Our focus needs to be on delivering spaces that are functional, effective and efficient.”*

Focus on Operational Efficiency

Traditionally, the healthcare industry has focused on improving the building ‘process’ to become more cost-effective regarding the selection of materials and building systems. When utilized, the emphasis of a LCC analysis is often limited to an evaluation of initial cost and the regular maintenance expenses for the investment. However, Jeffrey Land advised, *“We need to elevate our sights to become more inclusive as to how we define costs for capital improvements.”*

Over the life of a facility, the costs to build and maintain the space are a small percentage of the investment’s LCC. Over the life of a healthcare facility, 60 to 75% percent of the costs are for staff (Carr 2014). Staff costs far outweigh design and construction costs, commonly by a factor of five or more. Cost of the ‘space’ (building) and maintenance are not the key drivers. How effectively the space is utilized and the technology that is incorporated to deliver the services are the primary drivers for overall cost during a facility’s life.

“Most expenditures are to address operational needs, improve efficiency and enhance the level of services. An emphasis on initial capital cost, at the expense of operational efficiency, is not an

appropriate focus,” noted Jeffrey Land. Simply reducing facility cost can yield disastrous results if staff can’t effectively and efficiently deliver services or the patient care suffers. “Healthcare providers must concentrate on the life-cycle costs of the operational elements – costs which can easily be overlooked by the development team,” advised Don Wojtkowski.

Make Existing Processes Lean First

Prior to programming a capital improvement or building new space, the organization should first make existing processes ‘lean’. Healthcare providers need to comprehensively examine their organization’s current approach to healthcare delivery. They must evaluate existing systems, processes, space configuration, staffing and work flow to identify areas to improve operational efficiency and enhancement of the patient experience. Healthcare providers should make, or at the very least, identify, lean improvements in the existing delivery system first. “Evaluate and lean existing service delivery before planning to expand, alter or replace it,” advised Randy Keiser with Turner. Before initiating the planning process for a new space, first take a fresh look at the current delivery of services to determine the most effective and efficient way for the hospital to function. An effective way to save money and improve service may be to build less by more effectively using what you already have.

Engage clinical staff to help identify areas where waste can be eliminated and services improved. “Examine key operational issues such as patient flow, disease management, staff efficiency, space configuration, physician effectiveness and service needs before starting to plan the next capital improvement,” noted Richard Onken with Leo A Daly. Analyze workflow and existing processes to eliminate waste and improve the effectiveness and efficiency of care delivery. “To improve operational efficiency and reduce total cost, you must evaluate current delivery of service first,” advised Randy Keiser with Turner.

Concentrate on the Patient Experience

For years, the efficiency of service delivery, or ‘throughput’, has been king. While operational efficiency and cost control remain important, the focus has shifted to the patient and family experience. The patient experience is now a key driver for program outcome. What the patient and their loved ones see, touch, hear and experience once they enter the facility, and then subsequently receive throughout the delivery of patient care, is of paramount importance.

Prior to entering into program planning for new space, healthcare providers need to address a key question. What is the optimum patient experience that they want to deliver with this project? Once identified, the desired patient experience will likely require delivery processes to be adjusted, which, in turn, will influence facility design and subsequent delivery of care. Let the patient experience drive programming and the design process. “If you want extraordinary results, you need to focus on the patient experience,” noted Don Wojtkowski.

But how can healthcare providers define the optimum patient experience? For every major clinical area, have a leadership team of clinicians and members of the design team (planners, programmers and designers) follow patients through delivery of the services throughout the

hospital. Work to make sure that the team experiences delivery of care as viewed from the patient's perspective. "You don't need a national model to help see the world through a patient's eyes, just an organizational desire," noted Skip Smith. Focus on value from a patient's perspective.

This investigatory process may need to continue for months, so every key operational constituency is exposed to the process. Once completed, these efforts will result in a laundry list of issues, concerns and situations that impact the patient experience from both a positive and negative perspective. With the insight gained, an appropriate list of programming and design issues can be developed. Defining the desired 'patient experience' will establish the desired level of care the healthcare provider wants to offer. The desired patient experience will drive processes, programming, facility design and, ultimately, delivery of care.

Manage Real Estate as Valued Assets

Healthcare providers have traditionally viewed real estate (facilities) as a means to an end. Typically, once a need was identified, the facility was designed, constructed and equipped to provide the required service. Because of the wide geographical distribution of facilities within a given healthcare system, real-estate investment decisions were often guided by local leadership with limited organizational insight and development experience.

With continuing pressure to reduce operating costs, healthcare providers have shifted organizational focus. Most now view real estate as an asset that should be actively, aggressively and wisely managed. Healthcare systems have established departments with talented and knowledgeable in-house personnel to help evaluate existing building stock and guide future service requirements. These professionals also help the organization develop effective system-wide strategies to address operational needs. Per Robert McCoolle with Ascension Health, "It's the difference between real estate being professionally managed and led, as opposed to the decisions being made by leaders in each service area that likely do not have the knowledge and expertise to make prudent decisions. Before this shift in organizational focus and approach, leadership did not see our real estate as an asset. It was viewed purely as bricks and mortar that was needed to provide a service." Establishing and/or developing this in-house expertise permits the organization to more effectively leverage both current and future capital assets.

Expand the Options to Address Patient Care Needs

An organizational shift toward professional management of real estate holdings broadens the owner's options, improves the quality of development decisions, helps the owner to be more competitive and enhances the ability to meet service needs. The adoption of a professional approach to real estate management and development allows healthcare systems to regularly evaluate a spectrum of options to meet their service needs. This has given healthcare providers a much 'broader' view and flexible perspective to evaluate options and select an approach that best suits their needs. They are regularly asking themselves, "Should we build to meet the service need?" As a result, many have found that building a new facility, or repurposing existing stock, may not be their best solution.

Healthcare providers are ramping up their capabilities and organizational focus to effectively manage their real estate holdings and development activities. Many consider leasing space in lieu of building, especially for outpatient and satellite facilities. “Unless it is core to our services, we don’t want to own the real estate,” noted Robert McCoole.

Leasing space reduces the need for capital and typically enhances flexibility to respond to shifting service needs. In addition, in-house real estate management expertise permits healthcare providers to professionally negotiate new and existing leases and, thereby, effectively reduce operating costs while ensuring compliance with the Stark Law¹. In addition, healthcare providers increasingly are evaluating whether they should consider selling and then leasing back their facilities. Some are monetizing existing stock to generate funds to meet operating costs and/or provide capital for other investment opportunities.

Hospital systems must address healthcare service needs efficiently and effectively. The organization’s response must be accomplished in a manner that makes sense for the market it serves and, sometimes, that may not be additional facilities. “With the competitive nature of the industry, the market will not tolerate excess capacity. Organizations that don’t recognize this will have a difficult time competing in the new and changing healthcare environment,” advised Jeffrey Land.

In some cases the best response to a service need may be to partner rather than lease, build new or repurpose existing building stock. On occasion, reaching out to other healthcare providers and/or competitors to meet the need may be the most effective and competitive response. Partnering broadens an organization’s options, can drive down operational costs and reduces the need for capital expenditures.

Jeffrey Land noted that Dignity Health is looking more and more to acquiring and/or partnering to provide services where they are needed, not just expanding them where they currently have healthcare facilities. They believe that purchasing or sharing an existing asset is an approach that will permit them to efficiently and effectively expand their ‘reach’.

In reality, most hospital systems do not have enough capital or cash flow to do all that they want to do. Needs often outpace the available funding. In addition, the market imposes a penalty for overbuilding or building when the need does not fully materialize. Faced with a scarcity of funding in a competitive market, healthcare providers cannot afford to make poor decisions regarding capital improvements. Prudent healthcare providers are evaluating a spectrum of options to address service needs in their current market and/or expand their reach. They are convinced this approach creates value, and will help them to become more competitive while meeting patient needs in the markets that they intend to serve.

¹ Section 1877 of the Social Security Act, also known as the physician self-referral law and commonly referred to as the “Stark Law,” among other items, prohibits a physician from making referrals for certain designated health services payable by Medicare to an entity with which he or she (or an immediate family member) has a financial relationship (ownership, investment, or compensation), unless an exception applies. See: <https://www.cms.gov/Medicare/Fraud-and-Abuse/PhysicianSelfReferral/index.html?redirect=/physicianselfreferral/>

Programming Should Drive the Budget

Skip Smith noted, “All of us have lived through the era of pricing a hospital on a napkin on the basis of a cost per square foot. The foundation for this crude estimate is often the cost per square foot of a past project and, magically, this estimate becomes the budget, with little thought given to program requirements.” This approach can be disastrous. Sophisticated healthcare providers get a clear picture of what is required prior to establishing a budget. Programming drives the cost of the project, versus a hastily prepared square foot estimate. They determine their needs first and then establish a realistic budgeted cost to meet those needs. Prudent owners take the needed time upfront to develop a firm understanding of program requirements, before they establish a budget. They avoid trying to develop a program around available funding. Per Skip Smith, “Programming needs should drive the budget, rather than the budget driving the programming.”

Address Needs, Not Wants

During programming, it is essential that the development team effectively evaluate all of the program requests and guidance received from leadership and staff to separate needs from wants (wishes). Program needs are requirements that are necessary for effective delivery of service, whereas wants/wishes typically drive up cost and may have marginal or no impact on the level of care provided. Often, incorporating ‘wants’ into program requirements results in a project that exceeds available funding, which then requires the team to expend time and effort to unravel the program scope that has been developed. Organizational leadership and management must remain focused on addressing program needs. If they do not, the project will grow to accommodate everyone’s wishes and result in a non-competitive response. The healthcare marketplace dictates that program needs be addressed and wants/wishes culled and discarded.

Developing a program focused on addressing program needs versus wants is one of the most-effective ways to reduce capital cost. Enlist the aid of the design team to help shape a design response in line with market needs and available resources. Development of appropriate expectations lays the foundation for alignment of program, design, cost and schedule during project development. “When projects go off the rails during the planning stage, it is generally because everyone doesn’t have the same understanding of the program,” noted Chris Kay with Jacobs Engineering.

Select Team Members on Fit, Understanding and Qualifications

A number of contractual options are available for construction of healthcare facilities and the process selected for a project has significant impact on time, cost, quality and team relationships. “There are so many iterations of basic delivery methods, they are like flavors of ice cream,” noted Jeffrey Land. However, most delivery options fall within two generic categories. Contractors can be selected based on price, or selected on their qualifications—the perceived value that they bring to the delivery team.

The delivery process, where selection of a contractor is based on low price, is generally referred to as design-bid-build. With this approach, the project is designed, then priced (bid) by a group of interested contractors and, subsequent to receipt of bids, a contractor is selected and construction starts. With this delivery method the contractor is not involved during programming or design, and the overall timeframe for development is extended because construction cannot start until the design is complete. It is often not well-suited to complex healthcare facilities because it does not foster a team environment, permit contractor input during design or easily accommodate changes during the development period. With this method, innovation in medical equipment and clinical procedures often outpace delivery of the facility. The initial design may be obsolete before the project is delivered. "Design-Bid-Build contracting for healthcare can be a complete disaster because a healthcare project is apt to have significant change throughout the delivery process, and accommodating change is often cumbersome and costly," advised Don Wojtkowski. The delivery method must be able to adapt to change and design errors quickly and cost-effectively.

Selecting delivery partners that have an efficient operation and competitive attitude is important, but they must also be competent and committed to the owner and project team. That combination of attributes is difficult to attain when choice is based solely on price, but is often achievable when selection is centered on the value that the delivery partner can bring to the project team. Integrated project delivery, or relational contracting, "... fosters an environment and behavior where everyone is working in the owner's best interest. We get better flexibility, quality and time performance without additional cost," expressed Don Wojtkowski.

For optimal results, the team of experts suggested that a healthcare provider build relationships with a limited number of delivery partners to foster alignment of project goals and promote robust communication and collaboration. Establish a stable of qualified designers and contractors from which to choose. To facilitate the success of each project, extend the investigation of each firm during the selection process down to the level of the project team. "Select delivery partners based on the fit, understanding and qualifications of the firm's personnel that are actually delivering the project. That is more important than even the delivery method," stated Jeffrey Land.

Foster Team Development – Select a Team Early

Adoption of relational contracting provides a foundation for efficient and effective development of the owner-designer-contractor delivery team. To promote early involvement and bonding between the architect and contractor, consider having them present as a team during the selection process. To lend additional impetus, make the selection process a 'design competition'. This will enrich the architect/contractor working relationship, generate a spectrum of creative ideas for the project and help ensure that the owner is getting each firm's best project team. "If you make the selection process a competition, you almost always get their A-team," stated Jeffrey Land. Effective communication and collaboration is the goal. "If you can get the design and construction team members working closely together from the start, it improves performance, reduces cost and enhances value," noted Skip Smith.

Performance Contracting

Selection of delivery partners based on fit, understanding and qualifications provides a good foundation for project success, but may lack needed incentives to drive performance of the team and effectiveness of the facility during its useful life. Performance expectations such as cost, time and quality are common for the contractor, but performance metrics are less-often utilized when contracting with the design team. However, performance-based contracting for the design team is becoming more common. Owners are increasingly placing greater emphasis on achievement of programming and design objectives.

Performance-based design establishes objectives for building and operational performance, and incorporates consequences should they not be met. The performance criteria can range from building energy performance to operational efficiency, depending on the program criteria established when the project was initiated. “We regularly establish targeted savings of operational cost and base our fee on the level of achievement of those performance objectives,” noted Chris Kay.

Jeffrey Land explained how Dignity Health adds language to their design contracts that requires the design team to use sustainable best practice and evidence-based design, or explain clearly and completely why the design team has made a decision not to before he will approve the design choice(s). He noted, “Performance-based contracts for both the contractor and the designer are becoming more commonplace. If they don’t meet their professional obligations, there will be consequences.”

It’s All about Getting the Right Design

Design has a significant impact on the initial investment, operational costs, patient outcomes and the satisfaction of clinical staff. “It’s all about design— getting the right design for the care you intend to deliver,” advised Skip Smith.

In the past, there has been somewhat of an ‘arms race’ to build fancy, spacious, high-finish spaces under the assumption that this would lead to enhanced patient satisfaction. However, studies have shown that is not the case (Rau 2015). In addition, “With the competitive nature of the market and declining reimbursement rates, hospitals do not have the ability to ‘pass through’ unnecessary or excessive expenditures for capital improvements,” noted Skip Smith.

For decades, architects have addressed their clients’ needs from a perspective of programming, aesthetics and initial cost. Now, the design team must also address operational efficiency. “The design team’s focus must consider use of the space and the efficiency of the healthcare delivery processes it supports,” advised David Prusha with HKS Architects. “It is function, not form that should drive the design,” noted Jeffrey Land.

To produce an effective design that addresses programming, aesthetics, cost and operational needs, it is essential that the design be based on what has proven to be effective for healthcare providers. “Designers and healthcare providers must avoid cutting-edge designs and the lure of building a monument,” advised Jeffrey Land.

The foundation for design decisions must be based on reliable input or experience that supports the design. There must be validation and evidence supporting design decisions. Evidence-based design is defined by the Center for Health Design as, “The process of basing decisions about the built environment on credible research to achieve the best possible outcomes.” (Carr 2014). Evidence-based design establishes a foundation and methodology to benchmark facility design.

Evidence-based design is not some abstract or theoretical concept. The evidence, or knowledge base, that should drive design decisions is not just sourced in third-party studies or research, nor does it solely exist in some external database or repository. “Evidence-based design can be reflective of industry experience or based upon the insight a healthcare provider obtains by analyzing its own operational environment,” noted Don Wojtkowski.

Don Wojtkowski with SSM Healthcare shared an experience he had regarding patient room orientation. For years, SSM Healthcare built adjacent patient rooms opposite hand to take advantage of the economies of shared mechanical, electrical and plumbing (MEP) services. When his clinical staff wanted the patient rooms in a new facility built ‘same-hand,’ he was skeptical that the added construction costs were warranted. However, once the facility was completed, the impact on operations was evident. With a consistent room layout, clinical staff was more efficient and because there wasn’t a shared wall at the head of the bed, noise transmission was reduced. “The results were astounding and now it is our standard practice,” noted Don Wojtkowski.

Regardless of the source, evidence-based design relies on factual data (evidence) to guide program and design decisions. It is an approach where the design is built upon what has been found to be effective. Evidence-based design is moving mainstream. It encourages sound decisions that have a favorable impact on cost and operational efficiency. Conversely, it restrains egos and discourages poor or uninformed decisions during programming and design. In the final analysis, “It is all about design. You can build the wrong building really well,” advised Robert McCool.

Develop Design Standards

“One of the places we see tremendous savings is standardization,” noted Chris Kay. “Many of our clients are standardizing certain aspects of their hospitals to make their facilities most efficient for their operations. Standardizing design also reduces delivery time for the project and gets their services to the marketplace quicker.”

Design standards can incorporate both prescriptive and performance standards. Prescriptive standards provide detailed guidance, while performance standards give the design team the flexibility to accommodate trends and advancements in service delivery. Jeffery Land explained how Dignity Health wanted their design standards to be less prescriptive. He developed standards that provided a more open, flexible and reactive framework to allow decisions to be made by the team as delivery of the project unfolded. To add design value and lower cost, Robert McCool and Ascension developed detailed architectural and engineering design guide standards with the help of their healthcare design teams. Don Wojtkowski and SSM Healthcare’s approach

has been to limit the number of architectural design teams so their standard approach and design expectations are well-known by each of the designers. Regardless of their approach, healthcare providers on the team support development of design standards. Standards enhance design efficiency, improve performance and lower cost. Standardized design can also enhance branding of a healthcare system, especially for free-standing outpatient facilities. It enhances name recognition and helps standardize delivery of care.

“Standardizing the design reduces the delivery time for the project, enhances quality and consistency, improves efficiency and reduces cost,” advised Skip Smith. It lowers initial capital cost and improves operational efficiency and delivery of care.

Leverage Technology

Building information modeling (BIM) is becoming mainstream. Its use during the design phase enhances team understanding and evaluation of design choices. During construction, building models improve planning and field coordination. Once the facility is occupied, BIM provides insight to improve operations and the maintenance of systems and equipment. Building models facilitate better designs and reduce the cost of ownership.

Virtual reality is also an expanding technology that holds tremendous potential for improving programming and design choices. Computer automatic virtual environments (CAVE) permit the design team and clinical staff to virtually experience the proposed space configuration and use prior to actual construction. Design choices can be more-effectively examined and options easily explored. “With virtual-reality technology, clients are able to walk through their project while it is still in the planning stage and get a richer sense of space and functionality,” noted Geoffrey Stricker with Edgemoor Infrastructure. Virtual reality technology improves design decisions and creates more useful and efficient facilities. “This technology also has training capabilities for the staff. They are able to enter a virtual environment and become familiar with the space and its use before it is constructed,” advised Brian Garbecki with Gilbane Building.

Seek Construction Expertise Early

“Construction is essentially paint by the numbers. By the time construction starts, the scope has been determined and it is now just a matter of execution to deliver what has been designed,” noted Robert McCooles. The primary decisions impacting cost are made during the programming and design phase. It is important to involve team members with construction expertise early in the design phase when material, equipment and system selections are made.

“If subject matter experts (SMEs) are not involved early, the process is driven by cost. With SMEs involved, the focus tends to be project scope, and delivery of what is needed to effectively address programming and service delivery needs,” per Robert McCooles. To reduce cost and achieve best value, it is essential to involve team members with construction knowledge and insight to help the team evaluate design options.

Prefabricate and Modularize

With an aging construction workforce and a recovering economy, the construction industry has been dealing with an ongoing shortage of skilled workers. This situation has a negative impact on almost all project performance metrics, including time of delivery, product quality, worker safety and project cost.

With the aid of BIM, the construction industry has been expanding the prefabrication and modularization of building systems and components. “Prefabrication of building components reduces onsite labor, increases the quality and consistency of the installation, decreases the time for delivery and reduces cost,” noted Skip Smith.

Jeffrey Land with Dignity Health believes that prefabrication should be an integral part of building delivery. He cited an example where the project superintendent championed the idea to prefabricate bath units, which resulted in a savings of \$8 million in construction costs on the project. Don Wojtkowski with SSM Health advised that, with the aid of BIM, they have been prefabricating building components such as restrooms, overhead piping and ductwork. He noted that it has been extremely effective, and will likely expand to patient toilets and, possibly, clinical spaces. “The industry is continuing to evolve, and what may not have been modular last year could be moving in that direction now,” advised Skip Smith.

Leverage Purchasing Power

Standardizing the design reduces delivery time, enhances quality, reduces cost and promotes design consistency. Having design consistency from project to project results in similar selections for materials, products and equipment required for each project. This situation also lends support for national purchase agreements for building components, such as carpet, ceiling tile, studs, equipment and other commodities, that are typically incorporated into each project. “Not only does this drive down the cost of the commodity, but it also lowers maintenance cost, personnel training and design costs because product and equipment decisions have already been made,” noted Skip Smith. In addition, leveraging purchasing power with national purchase agreements can lower both initial and operating costs.

Package for Cost-Effective Procurement

Healthcare construction is, by nature, difficult and complex. It has extensive and sophisticated mechanical and electrical systems; expansive code and life safety requirements; and high expectations regarding quality to support delivery of care. This type of construction environment tends to restrict competition by limiting the number of general contractors and specialty firms that can or wish to participate in the project. In addition, those that choose to participate often build in additional cost to address the unique and demanding requirements of healthcare construction.

However, some of the components and systems incorporated into a healthcare project are not unique to healthcare. With these more commonplace building components, there may be an

opportunity to assemble procurement packages for the project that increase competition and reduce cost without sacrificing project quality. One of the things that Chris Kay with Jacobs Project Management recommended is to consider building the structure and shell with a commercial contractor that has office building expertise, and the interiors with another firm that has specialized healthcare expertise. “People ask about the overlap and lack of continuity, but it’s a pretty clean break and we have found that it can generate considerable savings,” noted Chris Kay. This approach may also be effective for medical office buildings and outpatient facilities, where a lower degree of project complexity and difficulty permit additional procurement options.

Elevate the Project Team’s Commitment and Understanding

Generate a high level of commitment from project supervision, subcontractors and vendors for the project. Develop joint ownership of project objectives and an understanding of the level of care needed to deliver patient services.

Jeffrey Land with Dignity Health shared an experience on a recent renovation project. He conducted a planning session with the project team (superintendents, site managers and assistants) where he asked them to share their personal experiences when they or a loved one had received care. Many of their stories were quite emotional. After they shared their personal experiences, Jeffrey asked them, “How would you make a difference in that experience for someone else?” Their responses generated some exceptional ideas. The experience helped all of them to look at the building process from the patient and family perspective. It also resulted in the team having a stronger commitment to the project and the delivery process. The outcomes included a better patient experience during the renovation effort and a higher-quality facility for delivery of service once complete. “Raising the level of commitment of the construction team and helping them empathize with the patient experience improves the performance of the team during the delivery of the project,” noted Jeffrey Land.

Summary and Conclusions

The healthcare landscape is in a state of transformation, with the implementation of the Affordable Care Act, changing reimbursement structure, increasing competition and elevated focus on ‘customer’ care and satisfaction. Increasing costs coupled with growing competition and reductions in funding are compelling healthcare providers to concentrate on streamlining cost reduction and operational efficiencies while simultaneously improving patient care. This study investigated effective steps that healthcare providers are taking to reduce cost to effectively address the challenges they face in this changing marketplace.

The consensus of the team was that capital improvements should not be assessed solely on the basis of initial cost. They should be evaluated based upon LCC, or ‘best value’. Capital expenditures should be assessed based upon their value to the organization over the useful life of the capital investment. Key to the LCC analysis is a realistic estimation of the useful life of the capital improvement, which will vary based upon the life of the technology employed and the evolving requirements for delivery of patient care.

With the current environment of increasing regulations, expanding safety requirements and mounting pressure to incorporate complex and sophisticated equipment and technology, reducing the initial cost of capital expenditures may not be a realistic expectation. Rather, the focus should be on getting best value. A comprehensive assessment of the value brought to the organization needs to include the LCCs of the operational elements. The costs for clinical and support staff over the life of the facility far outweigh the cost for design and construction. The evaluation of capital improvement costs needs to include the impact on operational effectiveness and efficiency.

Prior to programming and design of an improvement or a new facility, the organization should first implement lean existing processes. Healthcare providers should examine their current delivery model to eliminate waste and identify needed service improvements for care delivery before planning to expand, alter or replace existing space. An essential step in this process is to view delivery of care from the patient's perspective. The owner and the design team need to gain an understanding of what the patient and their loved ones see, touch, hear and experience during delivery of patient care. This insight is essential to ensure effective programming and operational efficiency.

Most healthcare providers have an extensive capital portfolio and, therefore, should be taking steps to make sure it is effectively and professionally managed. Prudent healthcare providers develop in-house expertise to permit the organization to both effectively manage their current capital assets and properly evaluate future needs. This management expertise facilitates an evaluation of the spectrum of options available to address patient care needs. It gives the organization the objectivity and expertise to evaluate options such as building, leasing and/or partnering to meet patient care needs.

Once a need is identified, programming should drive the budget. The budget should not drive the program. In addition, the program should address service needs, not the wishes of management and staff. Program needs are requirements that are necessary for effective delivery of service, whereas wants/wishes drive up cost and often have marginal impact on the level of care.

Healthcare owners should select the delivery team based on fit, understanding and qualifications. They should build relationships with a limited number of delivery partners to foster alignment of project goals and promote robust communication and collaboration. Owners need to foster an environment where members of the team are working toward the owner's best interest. In addition, healthcare owners should incorporate performance-based contracts to provide incentives for achievement of programming, design and construction objectives.

Most of the key decisions impacting cost are made during design. Design has a significant impact on the initial investment, operational costs, patient outcomes and the satisfaction of clinical staff. It's all about getting the right design. The design team must address the healthcare provider's needs from a perspective of programming, aesthetics, initial cost and operational efficiency. The design team must consider use of the space and the efficiency of the healthcare delivery processes it supports. It is function, not form that should drive the design. Evidence-based design should provide the foundation for decisions during programming and design.

Design decisions should be based on reliable input or experience. There should be validation and evidence supporting all significant design decisions. To aid the effort, the owner and the design team should seek construction expertise regarding material and building systems. In addition, healthcare owners should leverage modeling and virtual reality technology to help make prudent programming decisions.

To aid the design effort, the team suggested that owners standardize common design elements of their facilities. There was consensus that standardizing the design reduces the delivery time for the project, enhances quality and consistency, improves efficiency and reduces cost. The consistent use of building materials and components also permits the owner to leverage purchasing power with national agreements.

There is wide and growing support for prefabrication and modularization of building components. Most agreed that it reduces onsite labor, increases quality, reduces project delivery time and lowers construction cost. There was consensus that its use will continue to expand.

The subject matter experts also suggested that the delivery team explore ways to creatively package the work to stimulate interest within the contracting community in an effort to generate lower construction costs. In addition, healthcare providers should take steps to raise the level of commitment of the construction team and increase their understanding of the patient experience. Elevating the team members' commitment and awareness will improve their performance during delivery of the facility.

Appendix A

Panel of Healthcare Experts



Jeffrey W. Land, Vice President of Corporate Real Estate at Dignity Health, Land is responsible for providing leadership in the areas of real estate strategy, acquisition, disposition, joint ventures, energy utilization, master planning, and major capital construction for Dignity Health's diverse healthcare portfolio. He is a past President of the Building Owners and Managers Association/Oakland, a life member, the Board of Trustees for the Building Owner's and Manager's Institute, International, and has served as a member of the School of Business Advisory Council, California Polytechnic State University.



Robert McCooles, Senior Vice President of the Facilities Resource Group at Ascension, provides leadership for all facility planning, design and construction, real estate, energy and facility management for Ascension and its subsidiaries. His group also oversees Ascension's Environmental Stewardship Program and Facilities Infrastructure Pool. Prior to joining Ascension, Mr. McCooles was the CEO of Alberici Group, a large, multi-market contractor and construction services firm typically ranked in *Engineering News-Record's* top 50 contractors in the United States. During his 23-year career at Alberici, he also worked in project management and business development.



George A. 'Skip' Smith, System Vice President at Catholic Health Initiatives, is responsible for the development and ongoing leadership of the CHI's Physical Asset Services group (PAS). PAS is made up of service organizations supporting Clinical Engineering, Architectural Services, Facility Management, Environmental Services and Physical Security/Emergency Management Programs. Additional responsibilities include national and regional sourcing of supplies and services, identification of best practices related to operations, energy management, integration of services in new locations, and strategy development for all managed service lines.



Don Wojtkowski, Executive Director Design, Construction, Facilities & Properties at SSM Health, is a graduate of the University of Missouri and was awarded the University's Professional Degree in 1994. He was inducted into the University's Academy for Mechanical and Aerospace Engineers and has served as a past President and Board member of the Academy. Don is a past National President of the American Society for Healthcare Engineering of the American Hospital Association and is a Fellow member of the Society. He has managed healthcare-related design, construction, facilities management and real estate initiatives for over 40 years. The American Society for Healthcare Engineering recognized his expertise with the society's inaugural "Excellence in Facilities Management" award in 2009.



Richard J. Onken, AIA, EDAC, Lt. Col. (ret.), LEO A DALY: As senior project manager, architect and health facility planner over a 26-year career, Onken has excelled at providing world-class healthcare facilities for the U.S. Department of Defense, private, and overseas clients. He has managed 245 projects totaling over \$4.3 billion in construction value in 15 countries. His experience includes hospitals, laboratories, medical clinics, aero-medical staging facilities, dental clinics, and veterinary facilities. His professional affiliations include the American Institute of Architects, American Society of Healthcare Engineering and the Project Management Institute.



David Prusha, Principal and Healthcare Practice Leader for HKS Architects, has been involved in the planning, design and construction of healthcare projects throughout the United States over his 27-year tenure with the firm. David spent much of his career leading projects in the for-profit healthcare arena. He currently directs those philosophies of design and construction toward project development and implementation for non-profit healthcare companies.



Geoffrey Stricker, Director at Edgemoor Infrastructure, provides executive level oversight for the planning and execution of a portfolio of infrastructure and real estate deals, including public-private partnerships. Since joining Edgemoor Infrastructure & Real Estate in 2001, he has played an instrumental role in developing public-private opportunities for the company in the fields of higher education, K-12 education and transportation, including the Route 28 Corridor Improvements Project of Fairfax and Loudoun Counties and the Long and Kimmy Nguyen Building at George Mason University.



Chris Kay, Managing Principal, Jacobs National Healthcare Practice, Jacobs Engineering, has worked exclusively in the non-profit and public healthcare markets for over 17 years. Kay's overall experience includes 25 years of commercial design and construction delivery on a wide range projects throughout the Americas and MENA regions. He is member of the American Institute of Architects, Texas Society of Architects, Design Build Institute of America, Project Management Institute of America, American Society of Healthcare Engineers, and the American College of Healthcare Executives.



Randy Keiser, Vice President, Turner Construction, has been building and renovating major, complex medical facilities for over 30 years for Turner Construction Company. Randy came up through the ranks from Superintendent, Project Manager, Project Executive and currently oversees Turner's healthcare construction in the United States as Vice President and National Healthcare Director.



Brian Garbecki, Vice President, Healthcare Center of Excellence Leader, Gilbane Building Co., has more than 25 years of experience in the healthcare sector as an engineer, builder and facilities professional. Over the past 10 years, Brian has led Gilbane's healthcare center of excellence working in partnership with healthcare clients and project teams, assisting in developing and implementing high-level strategic facility plans often involving cost studies for master facility planning and other long-term capital needs. Prior to joining Gilbane, he was the Director of Facilities Planning for a major Massachusetts health care system and a Professional Engineer designing healthcare facilities.



Shea De Lutis-Smith, Business Development Executive, Clark Construction, with twenty years of experience in the construction industry, provides oversight of Clark Construction's national Healthcare and Higher Education business development activities. In this position she serves to leverage the firm's national and regional strength through coordinated strategic initiatives, relationships and opportunities. She also supports regional offices in the strategic development of the firm's most complex project pursuits, such as the \$750M Walter Reed National Military Medical Center in Bethesda, MD.



Facilitator Dennis C. Bausman, PhD, FAIC, CPC, has over thirty years of experience in construction and construction education. Dr. Bausman is currently a Professor and CSM Endowed Faculty Chair at Clemson University in the department of Construction Science and Management. He has received a variety of awards for his excellence in education and research including the WA Klinger Construction Education Award and The Associated Schools of Construction Outstanding Researcher Award. Prior to Dr. Bausman's current position at Clemson University, he was in large commercial contracting, where he held project management and executive level positions over a 22-year career in industry.

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