Healthcare Villages: Development Strategies for Our Health

Prepared for:
Perkins+Will
May 2012

Author
Kasey R. Liedtke
SRED: 6020 Directed Research
Master of Sustainable Real Estate Development
Tulane School of Architecture
**Table of Contents**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner Information</td>
<td>3</td>
</tr>
<tr>
<td>Executive Summary:</td>
<td>4</td>
</tr>
<tr>
<td>Healthcare Villages</td>
<td>5</td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td>5</td>
</tr>
<tr>
<td>Defining Healthcare Village</td>
<td>7</td>
</tr>
<tr>
<td>Healthcare Village Case Study: Saratoga Medical Park</td>
<td>8</td>
</tr>
<tr>
<td>Malta Saratoga Hospital, Malta, New York</td>
<td>8</td>
</tr>
<tr>
<td>Part I- Healthcare System: A Broken Business Model</td>
<td>10</td>
</tr>
<tr>
<td>Economics of Hospitals in US</td>
<td>10</td>
</tr>
<tr>
<td><strong>PART II- The Way to Achieve Healthy Outcomes Through The Built-Environment</strong></td>
<td>12</td>
</tr>
<tr>
<td>Adopt an Integrated Design Approach</td>
<td>13</td>
</tr>
<tr>
<td>Integrated Operations Case Example: Skanska AB</td>
<td>13</td>
</tr>
<tr>
<td>Buying Into Green Building Programs</td>
<td>14</td>
</tr>
<tr>
<td>Why Green Rating Systems Are Needed for Healthcare Projects</td>
<td>16</td>
</tr>
<tr>
<td>Green Rating System Program</td>
<td>17</td>
</tr>
<tr>
<td>Green Rating System Building Case Study: The Living Building Challenge</td>
<td>18</td>
</tr>
<tr>
<td>Part III- Green Certification Programs and its Effect on the Bottom Line</td>
<td>20</td>
</tr>
<tr>
<td>The Misperception of Cost Premium Green Rating Systems</td>
<td>20</td>
</tr>
<tr>
<td>Increasing Employee Productivity</td>
<td>21</td>
</tr>
<tr>
<td>The Economic Value of the Real Estate</td>
<td>22</td>
</tr>
<tr>
<td>Part IV- Energy Efficiency and Independence The Future of Healthcare</td>
<td>23</td>
</tr>
<tr>
<td>Smart Efficiency Investment Yields Returns</td>
<td>24</td>
</tr>
<tr>
<td>Day-lighting and Fenestration</td>
<td>24</td>
</tr>
<tr>
<td>Lighting Controls</td>
<td>25</td>
</tr>
<tr>
<td>HVAC System</td>
<td>25</td>
</tr>
<tr>
<td>Part V- Prototypical Healthcare Village Energy Model</td>
<td>26</td>
</tr>
<tr>
<td>Case Example: Gundersen Lutheran Health Network</td>
<td>30</td>
</tr>
<tr>
<td>Future research</td>
<td>31</td>
</tr>
<tr>
<td>Conclusion</td>
<td>32</td>
</tr>
</tbody>
</table>
Partner Information

Perkins + Will is one of the world’s foremost architectural firms. Founded in 1935 by Lawrence B. Perkins and Philip Will in Chicago. In 2011, Perkins + Will was ranked the number one design firm in the world by ARCHITECT magazine. The firm has more LEED professionals than any other firm in North America and is considered to be one of the best sustainable design firms.

In 1985, a multinational corporation Dar Al-Handasah (Shair and Partners) headquartered in Beirut, Lebanon purchased Perkins +Will from the founders. Both Dar Al-Handasah and Perkins+Will are privately held companies. Dar Al-Handasah focuses on consulting organizations for engineering, architecture planning, environment, project management, and economics in Europe, the Middle East, and Africa. While Perkins +Will primarily practices in North America, the Far East, and the United Arab Emirates. The firm practices and consults in a multitude of specialties such as architecture, interior design, branding, preservation, healthcare, but is not limited to these areas.

Contacts:

Breeze Glazer LEED AP
Sustainable Healthcare Research Expert
+1 (212) 251-7113
breeze.glazer@perkinswill.com

Bio from P+W’s website: http://www.perkinswill.com/people/breeze.glazer.html

Breeze is a designer who has focused his entire career on sustainability in architecture. Breeze has applied this expertise to a broad variety of projects across a multitude of scales, from carbon neutral multi-family developments to branding projects for the Conservation Fund. As the Research Knowledge Manager for Healthcare Sustainability at our firm, Breeze’s research is currently focused on shifting the healthcare design paradigm to the necessary sustainable practices. His research targets the multi-faceted design of healthcare buildings, working to rethink standard practices inherent in the design process.
Executive Summary:
Healthcare Villages. Development Strategies for Our Health

This research paper addresses current issues within the US health care system and provides knowledge to health care providers and built-environment professionals in order to promote a better understanding of the burdens of the current US health care system. This paper also discusses the option of healthcare villages and its many benefits to the American healthcare system in hopes of helping to facilitate future investment in these healthcare villages.

It has become increasingly clear that design and operational costs of healthcare infrastructure has become exceedingly expensive. Healthcare villages are an opportunity for hospitals, which are usually built on a 50-year lifecycle, to be economically more viable by green certification programs such as LEED, Energy Star, and Living Building Challenge. Certification programs reduce energy and water demands thereby reducing operational costs as well as promoting healthier patient outcomes within the facilities through design and construction.

Within the document there is stylized prototypical healthcare village for energy modeling by use Energy Stars Target Finder that include a hospital, assisted living apartments, hotel, fitness center, medical offices, and central power plant. The energy model takes in to count key variables such as numbers of employees, hours of operation, technology demand, and refrigeration demand, more specifically for hospitals that took into account mechanical and imaging systems such as MRIs and number patient beds. The energy model hypothetically placed in four distinct to graphical cities; New Orleans Louisiana, Seattle Washington, Chicago Illinois, and New York City the model shows first year energy cost at present-day. Through the research there is a clear rationale for healthcare providers and infrastructure operators by greening a healthcare buildings through a green certification program reduces operation costs through utility savings as representative from the energy model and through data promotes healthier outcomes.

Conclusion:
Healthcare villages will help in alleviate the burden on the current system due to chronic illnesses, while retaining the superior acute illness care that the US has mastered. There are societal, financial, and environmental factors contribute to the argument that healthcare villages provide an economically sound model for hospitals in the US. Healthcare villages propagate the idea energy efficiency and green building improves health outcomes and reduced operational costs argument.
Introduction

Today, the United States health care system is a popular headline in the news; the usual conversations are about universal care or insurance reform, and occasionally acute epidemics such as HINI or SARS make new headlines and blog posts. However, beyond these buzz topics, little is discussed about the state of our health care system. The reality is that the US health care system is overwhelmed and burdened by chronic diseases like cardiovascular disease, cancer, and diabetes. According to the Centers for Disease Control and Prevention (CDC), chronic diseases are the leading causes of death and disability in the United States. It is estimated that chronic diseases contribute to almost 70 percent of all deaths per year in the US, and approximately 133 million American adults will acquire at least one chronic illness in their lifetime.\(^1\) However, the current health care system in America is not equipped to handle growing trends in chronic illnesses. The infrastructure alone speaks to the growing problems and negligence to compensate for current trends within the health care system. Insufficient delivery systems in hospitals, clinics, and supportive health care businesses along with inadequate public policy contribute to the systemic healthcare problems. The model of standalone hospitals and independent clinics, though once useful, are now failing because they are no longer

\(^1\) (Centers for Disease Control and Prevention July 7, 2010, 1)
relevant to the trends in disease burden within the United States; however, a new strategic model of “health villages” has the potential to address these systemic issues and positively impact the health care system through the use of the built-environment.

In contrast to other developed countries in the Organisation for Economic Co-operation and Development (OECD*), the United States spends a total of 17.4 percent of its GDP on health care, which is approximately $3,800 more per capita and 8 percent more than the OECD median. However, despite the additional costs in health care, the quality indicators of poor health in the US are surprisingly high when compared to other OECD countries. For example, asthma mortality rates for people aged 5 to 39 are approximately 4.5 times higher in the United States, and lower extremity amputation due to diabetes is approximately 3.3 times higher than the median.\(^2\) The wellbeing of the American people depends on access to quality hospitals, ambulatory centers, primary care clinics, and support servicing businesses like pharmacies, fitness centers, and supportive living centers. All these places play a vital role in preventative care and overall health, which is the most effective way to combat chronic illnesses. In order to address the growing burden of chronic disease, the OECD counties and other developing countries such as China, Sri Lanka, and Kenya are investing in “healthcare villages”.

This research paper addresses current issues within the US health care system and provides knowledge to health care providers and built-environment

professionals in order to promote a better understanding of the burdens of the current US health care system. This paper also discusses the option of healthcare villages and its many benefits to the American healthcare system in hopes of helping to facilitate future investment in these healthcare villages.

These healthcare villages will help in alleviating the burden on the current system due to chronic illnesses, while retaining the superior acute illness care that the US has mastered. There are societal, financial, and environmental factors that contribute to the argument that healthcare villages provide an economically sound model for hospitals in the US. Healthcare villages propagate the idea that energy efficiency and green building improve health outcomes and reduced operational costs argument.

Defining Healthcare Village

Although healthcare villages are the new form of planning and developing, they have strong roots in the past. Medical centers in ancient Greece have many similarities to the healthcare village developments. Oftentimes, the Greeks attached public markets to their hospitals, and within these markets were health related businesses like apothecaries. Modern-day healthcare villages are following this ancient model by simulating master-planned communities that are built using an integrated design approach, which addresses the needs and health concerns of the modern-day individual. Healthcare villages promote a holistic approach to healthcare, not just including hospitals as an anchor to a development, but also
including preventative or primary care services along with residential living, retail spaces, grocery stores, and fitness centers. This is a great opportunity for hospitals and private developers to create future investments and partnerships. Healthcare villages couple the highly technical operation of hospital business, which provide low margins of profitability but a critical infrastructure, to a society with the expertise of private real estate developers operating complex mixed-use spaces that can be highly profitable.

Healthcare Village Case Study: Saratoga Medical Park

*Malta Saratoga Hospital, Malta, New York*

The introduction of healthcare villages is important to illustrate the diversity of development in this option. The best part of healthcare villages is that additional services and components can be defined by the local economy. The uniqueness in these villages can redevelop the delivery system by addressing the needs of the population it is servicing, which will help combat the plague of chronic conditions and maintain all-round quality healthcare. The healthcare village model is a holistic approach that is gaining traction in the U.S. Here is one example that Perkins+Will is consulting for the Master Plan:

*Saratoga Medical Park at Malta Saratoga Hospital, Malta, New York*

"Equally important, the center acknowledges the challenges of the current healthcare environment and addresses them with an innovative, collaborative solution—one that we believe could be a model for similar efforts throughout the state and the nation.” Angelo Calbone, President and C.E.O. of Saratoga Hospital
Saratoga Medical Park is a 140-acre green-field site in Saratoga County, New York. It will be built out in 5 phases in 25 years. The healthcare village will include 100,000 sf of medical office/retail space, 60,000 sf ambulatory care facility, a 160-bed nursing home, a 120,000 sf assisted living facility, 30 senior townhouses, and a 440,000 sf hospital with 200 beds. The projected completion of this project will be 2032 (see the timeline for the development plan appendix-D). The site is planned to meet the needs of the patients and transform the healthcare delivery system within the next 50–100 years for the growing aging populations in the expanding Albany Metro area.

The Saratoga Medical Park, even though a “green field”, will be intergraded into the natural landscape of the area by leveraging existing agrarian fields and wetlands into the design. They will be made visual amenities for the trails and create beautiful vistas for the buildings, while maintaining a practical function by becoming channels for drainage and water retention. These environmental features will be used to promote holistic health with nature, which will build healthier communities. The local equestrian history will also be retained by integrated horse rehabilitation center into the village community. Furthermore, the community will have an open door policy that will allow better integration into the community outside the village by allowing the health village to host town events. There are also plans for a regular farms market.

The project is a for-profit development, and is funded by the two largest medical providers in the region: Saratoga Hospital and Albany Medical Center. This project has allowed these two businesses to formed a partnership in which both Saratoga Hospital and Albany Medical Center will own the buildings and lease the healthcare village to a new not-for-profit corporation, Healthcare Partners of Saratoga, Lt. The first phase ambulatory care facility construction is projected to cost $14 million; the total development cost for phase 1 is $17.5 million with installed medical equipment.

---

4 (Perkins+Will 2011, 1-3)
5 (Anonymousa)
Part I- Healthcare System: A Broken Business Model

Economics of Hospitals in US

According to American Hospital Association (AHA), hospitals have an economic impact of $2.2 trillion on the U.S. economy every year; including both hospital expenditures at $680 billion and economy multiplier at $1,557 trillion. Hospitals create one in nine jobs in the U.S and employ approximately 5.4 million people making it the second largest source of private sector jobs in the United States.  Furthermore, American Hospital Association found that the median revenue growth for all hospitals has fallen to 4 percent compared to 9 percent in 2001 while total operating expense are rising as a result 28 percent of hospitals running at a net loss in revenue, clearly a problem.

Why Hospitals are Poor at Generating Revenue

Many positive strides have been made in the United States within the last century. Since the early 20th century, infectious diseases have been mostly eradicated in the US. Many of the epidemics that once plagued the American healthcare system are all but memories to modern day medical systems. In the mid-

---


1900s, the healthcare systems in the United States transformed into delivery systems of episodic care. Since the early 90s, chronic illnesses have become the foremost issue, in regards to health care. The increased trend in chronic illnesses is the fundamental issue in all aspects of healthcare implementation including the healthcare infrastructure.  

**The Demand of Chronically Sick on Healthcare**

The burden of chronic diseases in America, key fact about chronic illness.

- By 2030, 171 million American will at least one chronic condition
- 26% of children have chronic condition/s
- 90% of seniors have chronic condition/s

The cost to the Health System

- 85% of all healthcare spending come a patients with chronic condition
  - 51% of the population do not have a chronic condition accounting for only 15% annual expenditures
- 65% of healthcare spending people who have multiple chronic condition
- Two-thirds of all Medicare expenditures come from chronic ill people
  - 4% of population have five or more chronic condition
    - account for 31% of hospitalizations
- Twice likely to have an in-patient stay

---


PART II - The Way to Achieve Healthy Outcomes Through The Built-Environment

It is vitally important to understand and accept the philosophy of living building systems. The interaction that people have with buildings affects their daily lives and well-being. Value structures such as the triple bottom that values community, and environment that is realized in economic returns and stability. The path forward with healthcare villages is through integrated design and green certification programs that affect health outcomes while generating profit.

The Triple Bottom line Philosophy

The triple bottom line is defined as valuing a projects social and environmental benefit while striving for and maintaining overall profitability. Taking this triple bottom line approach in developing healthcare villages is very important. If companies adhere to this approach, they will have access to certain economic benefits like low income tax credits, CDBG, and other governmental funds. However, healthcare development fundamentally serves a higher social purpose and without buy-in from operators and owners, the business is doomed to fail society, in terms of health outcomes, and greatly weaken the financial stability of the company. Healthcare infrastructure is a long-term health investment, often with a 50-100
lifespan, as a consequence putting social and ecological value will directly benefit generations, this is the triple bottom line philosophy.

**Adopt an Integrated Design Approach**

Integrated design is a key implementation for cost saving in operating expenses and total development cost. The integrated design approach includes all the key stakeholders: the development team, construction managers, architect engineers, maintenance and operation, commissioning agents, and most importantly, the medical staff. When developing and constructing buildings for the specialty projects such as a project within the healthcare villages. Furthermore, the technical day-to-day work for medical professionals within labs, emergency rooms, operating rooms, radiology centers, assisted living centers, and out-patient hotels, as well as other development professionals in retail, commercial-office, and housing will have to be included. It is paramount that all actors who are involved during development be part of the planning and design because this will save money and make for a more durable project as well as allow for a more productive environment for the tenants and employees within the healthcare villages.

**Integrated Operations Case Example: Skanska AB**

Skanska AB is a multi-national construction and development company headquartered in Stockholm, Sweden, with over 50,000 employees. It has a diverse portfolio of projects in healthcare, residential, infrastructure, office, retail, and
education building projects around the world. It is a company that supports and understands the business operations of their clients and focuses on key elements during the development process by applying best practices to their model of a healthcare village maximizing the operation for the long term.

Sustainable Development can be defined in many ways. Common definitions include meeting the needs of the world today without compromising the ability of future generations to meet their own needs. In financial language, it means living on income rather than consuming finite capital. In family terms, it means not cheating on our children.¹⁰

Skanska AB is at the forefront of integrated operations. Skanska has adopted the Global Reporting Initiative (GRI) to develop their own Sustainability Agenda. GRI is an international non-profit organization develop the prevalent standards for sustainability reporting that gives information about economic, environmental, social and governance performance of the company. Within the built-environment profession, Skanska is a world leader in “Integrated Operations” and “System Thinking”. The key areas of the Skanska sustainability agenda are: social, environmental, and economic.

Their social agenda platform includes the following focus areas: human resources, health and safety, corporate community involvement, and business ethics. These focal areas make for a stronger and safer company. The environmental agenda focuses on energy and climate, materials, ecosystems, and local impacts, making Skanska a world leader in building “green project” and enables them to push the industry such as the Living Building Challenge from the Cascadia Foundation. Their economic agenda focuses on project selection, supply, and value, making Skanska one of the most dominate construction and development company in the world.¹¹

Kaiser Permanente is an example of an integrated healthcare insurer, owner, and healthcare administrator that have partnership with developers that has affected change on health outcomes while saving on operations.

Buying Into Green Building Programs

¹⁰ (Anonymousb)
¹¹ (Anonymousb)
Design and build "green" ratings systems like LEED, Living Building Challenge, and American Society for Healthcare Engineers and the Green Guidelines for Healthcare Construction (ASHE)-(GGHC) are all well suited to be implemented in healthcare village development projects. Health care structures have some of the longest life spans and benefit greatly from the rating systems. Using these rating systems in healthcare villages can improve the overall health of all patients, visitors, and medical staff. The green building programs within healthcare villages requires accountability and transparency to the general public as well as employees, and shows the true value of the healthcare operator on health.

It is important for a development team to have a working definition of sustainable design by setting project goals and understating how a green rating system will benefit the project. ASTM International’s definition of sustainable design is as follows:

*A building that achieves the specified building performance requirements while minimizing disturbance to and improving the functioning of local, and global ecosystems both during and after its construction and specified service life.*

This is a great definition for project implementation and development because it emphasizes that achieving key performance standards is critical to healthcare villages because it minimizes the impact on ecosystems and has the greatest health benefits. While sustainable design projects differ greatly by geography, climate, and

---

budget, it is critical for all project development teams to develop their own goals. An integrated design approach can help develop such goals to achieve the key performance standards the owner and operator desire.

Why Green Rating Systems Are Needed for Healthcare Projects

Below is a snapshot of the healthcare industries waste consumption, pollutants, and public health issues. The following examples make it clear that implementing green rating systems into development projects would vastly improve current standards in healthcare projects.

- The Healthcare industry is responsible for 5,000,000 tons of landfill waste;
- Hospitals have the fourth highest energy use of all building types;
- Medical waste is the single largest contributor of carbon dioxide and air pollution in the United States;
- Approximately, 150,000 patients every year acquired infections due to operation and design;
- Nurses have the highest rates in work related asthma in occupations13

Research shows that good design improves health outcomes. By implementing the green rating system, quality design can be implemented within the healthcare system and greatly improve current health system practices. According to Joseph, installing a day-lighting design within buildings in a healthcare village and allowing

for access to natural sunlight, will reduce patients suffering from bipolar and
depression by 3.67 days. They go on to report that sunlight greatly reduces the
stress and pain patients suffer from with traditional hospital rooms. In fact, patients
with good day-lighting took 22 percent less analgesic medication per hour—a cost
saving of 21 percent on medication over the course of their stay. Furthermore, a
study conducted by the Department of Horticulture, Recreation and Forestry at
Kansas State University showed direct health benefits for patients who have contact
with plants and nature. The study when on to show that 93 percent of patients said
that bio-phalli access was the single most important amenity in a hospital room.
Additionally, having a quality heating, ventilation, and air conditioning (HVAC) and
natural ventilation reduces communicable respiratory illnesses, short-term
absences, cases of sick building syndrome (SBS), and has a positive psychological
effect on the user, staff and patients. [ASHRAE] Moreover, the green rating system
can decrease environmental impacts by reducing the use of Volatile Organic
Compounds (VOC), CO2 emission, energy and water demands. The green rating
system will also set maintenance programs such in LEED-EB, making a healthier
community during construction and operation, which is a fundamental goal of the
holistic process of the healthcare village.

Green Rating System Program

14 (Joseph 2006, 3/15/2012-14)
2002): 56
The table below shows four distinct certification programs that are health care project appropriate within the United States: Energy Star, Leadership in Energy and Environmental Design (LEED), Living Building Challenge, and ASHE-GGH. Energy Star and LEED are the most commonly used. However, Living Building Challenge is the most rigorous and has the most efficient outcome.

<table>
<thead>
<tr>
<th>Building Rating or Certification System</th>
<th>Single or Multi-Attribute</th>
<th>Type of Standard or Certification</th>
<th>Managing Organization</th>
<th>Issues / Areas of Focus</th>
</tr>
</thead>
</table>

Green Rating System Building Case Study: The Living Building Challenge

The Cascadia Region Green Building Council rating system, the Living Building Challenge derived from LEED and is considered a partner not a competitor. It can be thought of as a stricter version of LEED and often certifies building that would qualify for LEED PLATINUM and more. The rating parameters take into account the

16 (Gregg D. Ander 2011, 1)
current market limitations and are based on real rather than projected modeled
performance, which is a great benefit to owners and business operators. The typical
time for monitoring building performance before certification in the Living Building
Challenge is approximately 12 months. The key goals are net zero water and energy,
materials, site, beauty, and health that address the components of civilized
environment, healthy air, and bio-philia—all area that are important to healthcare
villages.17

*The Peace Health Peace Island Medical Center in Washington State on the San Juan Islands*

The Peace Health Peace Island Medical Center is a medical center in
Friday Harbor, on the San Juan Islands, in Washington State. Nestled
in the interior of the San Juan Islands sits a 20-acre medical site and
the first hospital to go through the commissioning stages of
certification and become the first to be built to Living Building
Challenge hospital standards. Living Building Challenge is the most
advance measure of sustainability possible in today’s buildings,
striving to diminish the gap between current limits and ideal
solutions. It is the most dynamic and sustainable program an operator
can implement. It promotes energy and water independence, which is
vitaly important to a community medical center that is placed on an
island. Peace Health’s operational senses are already heightened by
the remoteness of its location. By reducing energy costs, healthcare is
more affordable for the island residents and makes it a healthier place
to recover in times of medical need.

The idea of Peace Health is to fit within its current surroundings on
the island and to be affordable and accessible to all the island’s
residents. Although it currently stands as an individual medical center
or hospital, it is a great example of how a community can support a
certification program more than LEED or Energy Star because of the
environment and future costs of energy.18

---

17 McLennan, Jason F., ed. 2010. *Living building challenge 2.0: A visionary to a
restorative future*, ed. Jason F. McLennan, Eden Brukman. 2.0th ed. The
International Living Building Institute

Part III- Green Certification Programs and its Effect on the Bottom Line

Green rating systems have financial benefits from energy and water conservation to improving health for employees by reducing incidence of asthma, colds, and flu; thereby lowering absentee rates and enhancing employee productivity. This allows for many operational benefits like retaining high quality staff members and recruiting stronger employees. A green building also has a longer economic life, higher sale price premiums, faster lease-ups, and higher occupancy rates.

The Misperception of Cost Premium Green Rating Systems

"Green doesn’t have to cost more money, green design is a comprehensive team effort that brings benefits both to the environment and to the bottom." - Michelle Halle Stern, AIA, P.E., LEED AP, Project Manager for Perkins+Will (greenspacetoday.com cite bookmark)

It is commonly believed by industry leaders such as Perkins + Will that LEED, Star Energy Star, and GGHC will have no cost premium to total development cost if there integrated design process and construction companies are seasoned green builder such as Shanska. There are countless studies on cost premium over the last decade that shows steady reductions in cost premium as more professionals become accustom with LEED and other rating systems. The Living Build Challenge cost premium range 4-9 percent depending on climatic zone, but
only has a two-year payback due to the net zero energy and water components of the certification process.\textsuperscript{19}

Important characteristic of healthcare buildings are the built lifespan 50-100 years much longer than other form of development. Having additional costs incurred during development can be justified over the pay-back period if it save on operations. Owners and operators of a healthcare village should analysis all cost saving area within green rating system to generate additional long term revenue from operational efficacy.

\textbf{Increasing Employee Productivity}

\textbf{By Enhanced Environmental Quality}

\textbf{Of The Work Place}

In healthcare operations 90 percent of all operational costs are employee salaries by improving productivity and keeping staff healthy hospital and healthcare village advances the bottom line. Professor Vivian Loftness from the Architecture Quality Assurance Team at Carnegie Mellon University studied sustainable design for health and productivity. Data shows that building consciously with a rating system can improve the overall health of the users, in this case medical staff, patients, and their family. Absenteeism is one of the most costly operational costs to employers. Private sector employees are on average 1.7

percent are absent from work over a year, in the public sector it’s even more at 2.2 percent which is equivalent to 42 hours lost and private 35 hours lost. Annual costs per employee are $765 for private and $1,100 for public employers. Furthermore, building related illnesses and health conditions cost employers on average $750 per employee, the equivalent of 14 percent of the annual health insurance cost incurred by businesses.  

**The Economic Value of the Real Estate**

Research done by Piet Eichholtz, Nils, from Maastricht University in the Netherlands in conjunction with the well-respected economist John Quigley from UC Berkeley produced systematic evidence that design and building rating systems produced a value to U.S. economy. After empirical annalists' Eichholtz, Nils, and Quigley conclude green label certification from environmental design and build rating system can command three percent more per square foot than to a comparable building without certification; the effective rent is about six percent per square foot. Furthermore, the research indication as much as 16 percent premium on the sale price.

The research also indicates labeling matters, marketing a building or projects such as healthcare village as “sustainable” will have little effect on tenants leasing or

---


investors commitment, but labeling a building as energy-efficient will bring far more value associated with project. It is important when using a green labeling system on a project to focus on heating and cooling expenses which are the larger part of total occupancy cost.

**Part IV-Energy Efficiency and Independence The Future of Healthcare**

When analyzing healthcare villages it is important to take into account operational costs. Hospitals and clinics have low profit margins between 2 to 4%, energy savings form efficiency and independence from design and operations is critical for the financial feasibility of healthcare village and universally important to America’s healthcare system. Affordability of healthcare is directly tied to day-to-day operations of the healthcare provider therefore energy modeling is the most important design element; therefore, Healthcare built-environment professionals need to understand and promote energy efficiency and independence. In America, last decade energy costs coming decades energy will be exponential more expense.

---

**Smart Efficiency Investment Yields Returns**

Smart efficiency investment yields a return in operational saving, but it literally makes money from saving on energy costs for the healthcare village. There are many ways to reduce energy demands, but green rating systems are key and important to scoring of the certification process. Designing the building for the right climatic zone and insulating a building with proper type insulation and amount is necessary as a beginning. Site orientation can maximize efficiency through day-lighting and heat gain or loss; one is a benefit over another depending on climatic zone. Mechanical systems play an important role, lighting type and controls can be a big cost saver; additionally, HVAC systems are not only critical to health for staff and chronic illness patients, particularly those with asthma, and cancer patients and infections; it can be critical energy efficiency measures.

**Day-lighting and Fenestration**

Day-lighting can be a huge cost saving in energy and make it more profitable for the owners of healthcare buildings. Older healthcare building have little access to natural light, waiting rooms are often interior space and examination rooms regularly have small opaque windows. A lost opportunity for operational saving and including design elements such as courtyards can increase natural light fenestration and help with green rating systems as well as improve the quality of the work environment for doctors and nurses. The using day-lighting reduces the need to expel energy to cool the buildings through air-conditioning. The cost saving can
vary by regions and type of design. The overall reduction in energy use is between 10-20%. For a hospital using day-lighting can be the different between of being a net negative revenue business or being a profitable business.  

**Lighting Controls**

During the integrated design process designing electrical light within healthcare villages it would be important to consider the uses; operating rooms will have specific lighting compared to recovery room or the retail spaces. Occupancy based controls are a good way to handle spaces within medical facilities and dimming switches are a great lighting control for energy saving. Furthermore, training staff can be efficient way of control the lighting demand within healthcare village. Having direct control at the bedside for patients in recovery rooms can helps comfort and safety. Day-light harvesting controls use software and sensors to monitor the natural sunlight penetrating interior spaces and adjust shades to maximize thermal comfort. 

**HVAC System**

---


In the United States, 39 percent of total energy uses in commercial buildings come from HVAC system. When considering an HVAC system a high-performance can greatly reduce energy and has the potential to expand to 40 to 70% in its savings if it is coupled with proper design elements. Fundamentals of energy and resource efficiency in HVAC is to consider all the operations of a buildings and deciding on the performance goal in the design phase, green rating system can assist with. It is important to size the HVAC appropriately to ensure efficiency, engineers commonly oversize system for making the system inefficient and more expensive to purchase. A high-performance HVAC system will need be maintained by staff to prevent inefficiency and train program for staff is need for best performance.

Part V-Prototypical Healthcare Village Energy Model

In section the author developed a prototypical healthcare village energy model by using EnergyStar’s Target Finder. Target Finder is a tool to help built-environment professionals develop baseline EPA energy performance score. A 75


percent more efficient building compared to the baseline for building type qualifies for EnergyStar certification. The building types that Target Finder provides EPA energy performance score are as follow:

- Bank/Financial Institutions
- Courthouses
- Data Centers
- Hospitals (General Medical and Surgical)
- Hotels/Motels
- Houses of Worship
- K–12 Schools
- Medical Offices
- Offices
- Residence Halls/Dormitories
- Retail Stores
- Senior Care
- Supermarkets/Grocery Stores
- Warehouses (Refrigerated and Unrefrigerated)

This prototypical healthcare village model includes: 440,000 square-foot hospital, 80,000 square-foot senior apartment complex, 100,000 square-foot hotel, 20,000 square-foot central power plant, 75,000 square-foot of medical office, and a 10,000 square-foot wellness center. Key components that were included in the development of this energy model is to include the key hospital inputs such as bed count, number of employees, and number of machines that demand high energy uses such as MRI machines. Additionally other buildings have key inputs as well and need to be included in overall energy model.

In analyzing this prototypical healthcare village in four distinct regions of the United States being New Orleans Louisiana, Seattle Washington, Chicago Illinois, and New York New York. The energy costs are different in regions; baseline cost will reflects
the average energy use for the healthcare village as if the buildings were in operation day. Furthermore, the Energy Reduction Savings points at 30, 50, and 95 percents are key goals for energy efficiency. Meaning a retrofit of building can reasonably reach a goal of 30 percent more efficient during remodel. The 50 percent goal can realistically be meant for new construction for all buildings in healthcare village. The ultimate of 95 percent can be accomplished by using green rating system Living Building Challenge or installation and owning a power plant to supply the energy the healthcare village possible reaching net-zero.

Figure 5.1
Table 5.1

<table>
<thead>
<tr>
<th></th>
<th>New Orleans, LA</th>
<th>Seattle, WA</th>
<th>Chicago, IL</th>
<th>New York, NY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Cost-Total Dependency on Power Grid</td>
<td>$(2,808,436)</td>
<td>$(2,944,729)</td>
<td>$(2,268,814)</td>
<td>$(3,909,164)</td>
</tr>
<tr>
<td>Energy Reduction Savings 30%</td>
<td>840,899</td>
<td>679,612</td>
<td>708,652</td>
<td>1,168,120</td>
</tr>
<tr>
<td>Energy Reduction Savings 50%</td>
<td>1,494,218</td>
<td>1,222,365</td>
<td>1,164,406</td>
<td>1,954,565</td>
</tr>
<tr>
<td>Energy Reduction Savings 95%</td>
<td>2,668,004</td>
<td>2,132,493</td>
<td>2,250,373</td>
<td>3,713,706</td>
</tr>
</tbody>
</table>

Figure 5.2
### Table 5.2

<table>
<thead>
<tr>
<th>All Healthcare Village Buildings Pollution Emissions-metric tons/year (Median Healthcare Village)</th>
<th>New Orleans, LA</th>
<th>Seattle, WA</th>
<th>Chicago, IL, New York, NY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 Pollution Emissions-metric tons/year</td>
<td>13,869</td>
<td>11,140</td>
<td>17,369</td>
</tr>
<tr>
<td>CO2-Reduction 30%</td>
<td>9,716</td>
<td>7,812</td>
<td>12,178</td>
</tr>
<tr>
<td>CO2-Reduction 50%</td>
<td>6,934</td>
<td>5,570</td>
<td>8,685</td>
</tr>
<tr>
<td>CO2-Reduction 95%</td>
<td>693</td>
<td>557</td>
<td>868</td>
</tr>
</tbody>
</table>

**Case Example: Gundersen Lutheran Health Network**

The premier example is Gundersen Lutheran Health Network in Lacrosse, WI. The Gundersen Lutheran network is model for healthcare operates and is driving force behind alternative means of revenue sources.

The premier example is Gundersen Lutheran Health Network in Lacrosse, WI. The Gundersen Lutheran network is model for healthcare operates and is driving force behind alternative means of revenue sources.

**Case Study**

The Gundersen Lutheran healthcare network in La Crosse Wisconsin is the foremost of innovative green design when it comes to healthcare villages. They exemplify the triple bottom line of strategy of social, economical, and environmental responsibility. As a healthcare network has over 48 buildings and clinics with 15,000 inpatient admissions and 1.3 million clinics visits annually. They employ 6600 employees including 453 physicians. It effectively is the primary healthcare network for 550,000 people in urban and rural Wisconsin. Gundersen Lutheran is a nonprofit integrated delivery system.

The uniqueness of the healthcare network is by 2014 there will be energy neutral generating 100%. All energy for all 48 facilities by implementing the strategic plan that will retrofits of the existing facilities reducing demand by 30%, new construction will be 50% more energy efficient, and remaining energy demand will be offset by renewable energy sources such as wind and
cogeneration plants such as the city brewery plant.

The renewable energy plant that will waste methane gas from a local brewery will be capture and energy will be add to the electrical to the grid. The power plant will generate 3,000,000 kW hours per year are equivalent of removing 670 cars from use or the equivalent of 280 homes energy demand one year.27

Future research

Additional research is needed to expand and promote the idea that the built environment can affect chronic illnesses by changing the overall platform of the way that medicine is delivered to individuals by the implementation the new holistic approach of design and planning of healthcare villages. In the long run public-policy and public funds will be need to back healthcare infrastructure, particularly for rural and community-based hospitals that lack the economic support and overall demand for a profitable business, but necessary for local people and society.

Future areas that need to be investigated are the rising cost of water and how it relates to the overall perspective of healthcare affordability. An investigation architectural engineering design insurance "errors and omissions" and the role that it plays in the design process and the problems that it may cause by oversized or outdated mechanical system that are proven to protect from liability.

Comprehensive financial follows up on healthcare villages of the full financial feasibility and analysis in operation.

**Conclusion**

Healthcare villages will help in alleviate the burden on the current system due to chronic illnesses, while retaining the superior acute illness care that the US has mastered. There are societal, financial, and environmental factors contribute to the argument that healthcare villages provide an economically sound model for hospitals in the US. Healthcare villages propagate the idea energy efficiency and green building improves health outcomes and reduced operational costs argument.

In closing, built-environment professionals, owners, and operators of healthcare villages whether it is public, nonprofit, or for-profit entity can be the “architects” and “developers” of new healthcare delivery system that can address America’s systematic problem of chronic illness.