The Hospital of the Future: The Vision, the Journey, the Reality

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SUMMARY • Palomar Medical Center, like many California healthcare institutions in the 1990s, faced the challenge of needing to meet state building seismic requirements. As a result of the mandate and infrastructure demands that would need to be made to accommodate the new standards, the health system set out to assess the larger needs of the communities served, evaluate the medical and technological changes that would be part of future clinical care delivery systems, and assess our capability to meet the financial impact such changes would have on the organization.

This article shares our journey to build a new hospital—one that could be studied by other health systems facing the same or similar challenges. It incorporates elements associated with the concept of “Fable Hospital”—a design promulgated by leading architects and designers from around the world and researched by the Center for Health Design—which considers the use of evidenced-based principles gathered over the past 20 years that, when incorporated, can lead to the creation of buildings that enhance the quality of care, provide safety for patients and staff, and meet the needs of patients and families in meaningful ways.

Finally, Palomar Medical Center is an environment that allows for effective, flexible integration of technology and expansion of staff while improving the efficiency of operations that are critical to the management of the hospital in a changing healthcare delivery world.
I N T R O D U C T I O N

Despite the shifting landscape of healthcare delivery, the need to manage complex patient care in hospital settings will remain strong to accommodate an aging baby boomer population, but it will require the replacement of older, outmoded physical plants. Those organizations that choose to build new or replace these buildings will need to anticipate future care delivery models by embedding flexibility and sustainability into the design. How do we ensure that we make the right decisions for our communities now and yet maintain our financial viability, whether as a stand-alone organization or as part of a system?

These are the questions Palomar Health attempted to address when building a new tertiary care hospital in northern San Diego County.

T H E J O U R N E Y

The journey began in 2003 with the recognition that the facilities on our downtown tertiary campus would not meet the seismic building mandate set forth in legislation passed after the January 17, 1994 Northridge, California earthquake. Hospitals that did not already meet the standards were required to upgrade their facilities by 2008—a challenge at best for the hundreds of hospitals throughout the state that did not meet the requirements. Funds were not to be appropriated through state resources to support the modifications.

At Palomar Health, funding and several other factors influenced us to develop a greenfield site for a new facility rather than upgrade our existing infrastructure. For example, the physical plant was built in the early 1960s and deteriorating. The power plant supporting the campus no longer had the capacity to meet the utility needs of the facility. Any alterations would require bringing the facilities up to the latest building fire standards and codes and reducing bed capacity to comply with new square footage standards. The campus was too small to build a new structure adjacent to the existing building without the additional purchase of land and rezoning of space. The area’s population growth

P A L O M A R H E A L T H S N A P S H O T

Largest public health district in California
- 850-square-mile area

Three acute care hospitals
- Palomar Medical Center
  - 298 acute care beds
  - Trauma center for 2,204-square-mile area
- Pomerado Hospital
  - 95 acute care beds and 12 acute psychiatric beds
- Palomar Health Downtown Campus
  - 42 perinatal beds, 18 acute rehab beds, 26 acute psychiatric beds

Other Services
- 1 skilled nursing facility, 2 ambulatory surgery centers, wound care, rehab, occupational medicine, behavioral health, San Diego Radiosurgery, 4 Expresscare centers, home health agency, and medical foundation

4,500 employees
850 physicians
700 volunteers
$1.8 billion gross revenue
222,500 weighted patient days
119,484 emergency visits
49,191 home health visits
and shifts in demographics in our hospital district and the surrounding areas demanded a stronger and expanded response for service—both ambulatory and hospital based. Finally, the community was coming to expect private patient rooms, increased individuality and involvement in their care, and hotel amenities.

Design Principles
Notwithstanding the organization’s ability to finance a new building project and find an appropriate property, the hospital’s stakeholders generally agreed on several key needs that the new hospital would have to meet, all of which needed to center on the organization’s mission and vision.

First, it needed to accommodate growth of any kind in the population. Second, any site needed to have the capacity for growth such that the space could be reworked or remodeled easily to meet new needs or changes in clinical care delivery. Expandability and flexibility would be the keys to the new facility’s performance. Third, the building needed to be sustainable and operate efficiently and economically. In particular, we needed to be able to manage the cost of care under the capitated environment in Southern California at that time. Fourth, in accordance with evidence gleaned by the Center for Health Design (2014) through its Pebble Project, Palomar Health was encouraged to create facilities and use technologies that would markedly improve the quality of care rendered in measurable ways while creating a softer, more caring environment for patients, families, and staff. Fifth, any physical or structural changes from the older hospital’s design were to transform the system’s culture, which had been hierarchical and often clannish, into a more patient-centric, market-driven, and innovative climate. Sixth, the facility needed to be one that the communities could be proud of and identify with and serve as a landmark or beacon for them. Seventh, we needed to ensure that principles employed in the designs, equipment, technology, and processes could be applied to renovation and remodeling projects and be translated across all areas of the system as well as to other organizations that wished to learn from our experience.

Involvement
We had only one opportunity to get the design and use right. Therefore, we sought to create a standard of meaningful involvement. And we did: By the time the new hospital was built, more than 3,000 of the system’s 4,500 employees had been intimately connected to the establishment of the new facility.

The first step was to select the right architectural firm—one that understood our needs and limitations, appreciated the need for flexibility, valued active participation from the owner, and demonstrated a willingness to change direction. Additional requirements were an in-depth knowledge of and experience with federal and California regulations and codes for healthcare facilities, and the ability to work with state regulatory bodies toward approval of design elements that might not meet the strict confines of the codes today but would meet the “code of tomorrow” such
that quality and safety outcomes would not be compromised—and in many instances would be enhanced—by them.

Next, to hit on a design that could accommodate the future needs of the hospital at the time the new facility opened its doors—some five years from the time the planning was complete—we looked at not only how healthcare was being delivered and paid for as of 2005 but also how it could and should be delivered 15, 20, or 25 years into the future. To that end, a series of charettes (a term usually associated with architecture students making an intense effort to solve an architectural problem in a specified time frame) were held with leaders from inside and outside the health system to craft the basic vision of how hospitals and healthcare facilities might operate in the future.

The system board’s oversight committee assumed responsibility for the creation of the hospital and renovation of the other facilities with the understanding that the downtown campus would no longer serve as the main tertiary site.

An executive group led by the CEO was responsible for the management of the projects whereby each administrator managed the design of specific aspects of the project and operations. Groups met weekly with representatives of the architectural firm and the strategic planning staff of Palomar Health.

As designs were being developed, panels of employees, identified as champion teams—selected for their expertise, ability to influence peers, and positive attitude—were created to determine—and sometimes challenge—design teams as to whether their plans included operational elements that could be measured in terms of performance. The balanced scorecard concept was used to gauge the plans’ financial, quality, safety, workplace, and workforce performance (Exhibit 1).

The first team reviewed the impact that a design might have on the financial operation of that specific area of the organization on the basis of full-time equivalents, costs, and revenues. They focused on productivity as measured by appropriate

**Exhibit 1** Balanced Scorecard Structure
maximization of labor hours required to provide the clinical service; reduction of waste in use of equipment, supplies, and time; and optimization of support delivery models across all the system’s facilities.

A second team was developed to challenge how the design improved quality of care and promoted improved patient and staff safety. It analyzed processes to reduce medical errors, lower infection rates, reduce patient falls, and reduce errors from handoffs; leverage systems and protocols to increase the interaction time between medical and clinical staff and patients; improve standardization, consistency, and reliability with the goal of equitable care; and help the organization meet regulatory requirements.

A third team focused on enhancing the customer service orientation and patient-centeredness. This group assessed efforts to enable patients and families to have preferences honored, be involved, be ensured privacy, and experience less fear; to welcome all ages; to provide for a culturally sensitive experience; to reduce the environmental stresses—noise, smells, distractions—that are common in many institutions; and to create a user-friendly experience featuring intuitive wayfinding.

A fourth team looked specifically at how the newly created environment could benefit the workforce and its ability to deliver care while supporting staff emotionally and physically. It pursued the optimization of flexibility and modularity and the provision of greater service amenities for staff to reduce stress and increase productivity both on a large scale and at the granular level. Human factors analysis played a large role in this group’s work.

As the four domain teams were populated, we quickly realized that several other groups needed to be established for the design process to move forward: groups of staff to work with our chief innovation and technology officer and chief information officer in the testing of new equipment and technologies, teams to work with the leaders responsible for evaluating new dimensions of care, and groups to explore ways to incorporate Center for Health Design research into our architectural plans. Exhibit 2 provides a basic illustration of the teams and their functions.

Although each team took on a life of its own, collectively they felt empowered to communicate and make recommendations on design, compared notes with other groups, sought information from inside and outside the health system, and challenged each other’s thinking.

Medical Leadership
A separate team of champions was created to work closely with our physician leaders and members of our medical staff. They would face many of the same challenges as our employees and other clinicians while also transitioning to a new way of managing care processes—using a new electronic health record system (EHR). Our goal was to educate them and facilitate their use of the EHR at least one year prior to moving into the new facility.

Medical staff leaders throughout the system were involved in establishing the strategic clinical direction of Palomar Health, which would have an impact on the ultimate use of facilities. As expected, we encountered disagreement on how care should be provided in the future and
consternation that physicians would no longer be able to use work-arounds with the new technology. The process opened up a dialogue that continues today.

**Expert Advisory Panel**
To expand feedback beyond the hospital, we brought in leadership on the cutting edge of surgery and medicine, an architect noted for the development of museums around the world, patient safety leaders testing new ways of care delivery, experts on aging, device manufacturers that opened up their innovation centers to our team, a management engineering leader who directs one of the foremost performance improvement graduate education programs in the United States, financial experts who were modeling what the healthcare financial landscape would look like, healthcare futurists noted for their work in projecting what the environment might be, and informaticists looking at the convergence of technology and information management.

This group of experts had a synergistic and positive impact on the entire process, energizing the participants in their sessions as well as themselves. Many of our expert panelists are involved with the health system today.
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Financial Support for the Project
To meet the costs associated with the design, construction, equipment necessary for operation, and the “fit-up” and move into the new facility, work was undertaken to validate the ability of the health system to financially manage such a project over a 10- to 15-year period while maintaining operations; paying off existing debt; and planning for population growth, which depended on the hospital district’s cash flow. We determined that the dollars invested at the time, the philanthropic support available, and the ability to borrow against operational capability (in the form of traditional revenue bonds) would pay for one-half of the total estimated cost to complete the hospital building project as it then stood on the drawing board.

To cover the shortfall, the health system needed the support of district residents to pass a tax levy that could generate up to $500 million. An undertaking of that magnitude had never been attempted in the history of California’s hospital districts. It demanded that at least 66 2/3 percent of eligible voters be willing to tax themselves to generate the funding level necessary. And it meant that funds would have to be obtained to support an initiative campaign that year, amid stiff competition with 27 other measures on the ballot.

Other than traditional survey and focus group activity, one of our most successful campaign strategies was to place, with our architectural partner, a visualization of the entire facility on the Palomar Health website and launch a three-dimensional virtual world using Second Life (Linden Lab 2014). Anyone with an avatar and audio capability could “walk” through every area of the new building and provide feedback on features they liked, disliked, or would change. Imagine the possibilities when individuals from around the world can give their thoughts on the layout and design. It proved to be a tremendous success in terms of information requests, reactions, and perspectives put forth. It also yielded results that allowed the leadership team to modify some of our thinking, the spatial placement of equipment, and the organization of rooms and the layouts of nursing units.

Design Elements Incorporated into the New Facility
Patient Rooms and Inpatient Floors
In a traditional setting, changes in care might mandate the movement of patients from the medical/surgical unit to an intensive care unit (ICU), a step-down or telemetry unit, an observation unit, or even a discharge unit. In our experience, it would not have been unusual to move patients four or five times during their brief stay. In the new facility, all patient rooms were designed to be acuity adaptable, depending on the level of support required for the patient. We can now easily increase or decrease the number of intensive care or step-down beds at a moment’s notice. Similarly, caregiving can be increased or decreased in intensity without moving the patient to or from a specialized unit, minimizing handoffs.

All rooms are considered oversized, at 320 to 325 square feet. They have double-wide bathroom entrances and handrails immediately adjacent to the bed to offer general support and ease of access to the bathroom facilities. The ceiling and floor materials absorb sound; technologically, all patients have access to controls that allow them to manage lighting, television
viewing, room service, and screen adjustments and to alert staff should they need assistance. In support of the employee, all of the rooms have patient lifts, and supply cabinets were installed adjacent to each room to house 90 percent of the supplies and medications required to function on a day-to-day basis to eliminate the traditional hunting and gathering activities.

Each patient room was also designed on the same-handed room concept. Because all the patient rooms were oriented the same way, rather than in mirror-image form, staff is always familiar with the layout regardless of the room location.

Importantly, all rooms were designed around the patient and family experience in anticipation that family could remain with their loved ones 24/7—a policy that has since been adopted through the entire health system. For example, space was made available for pullout beds, separate lighting was installed for visitors, and each room features a large picture window. Lighting for the patient could be set for ambiance or as directed by physicians (remotely controlled) for expanded use should observation or procedures at the bedside need to occur.

The monitoring of patients is still accomplished with fixed equipment. However, Palomar Health is the first hospital in the world to use wireless vital signs monitoring equipment that is worn by the patient on his or her arm, as a wristwatch. This technology has eliminated the need for this particular equipment near the bedside and allows the physician to monitor the patient’s vital signs in real time through a tablet computer or smartphone.

On the floors and units, the traditional nurses’ station is decentralized, with work stations located between each room. Nurses can more easily and readily view the patient and his or her movements, and patients’ calls to nursing staff have been reduced by 33 percent since the system was implemented. In addition to enclosed support areas, the distributed nursing stations have resulted in less or no noise associated with movement of equipment and conversations around nurses’ stations. Patients have noted on their patient engagement surveys how quiet their floors and rooms are, with scores varying from 4 percent prior to the move to 82 percent in the new facility.

Another important feature for the new facility was easy access to nature and natural lighting throughout the facility. Gardens and atriums were developed and placed at each end of the respective nursing units, and an atrium tower runs through the core of the towers as a central theme. Trees and artwork that reflect this sensibility provide strong wayfinding capability. Major light-wells and gardens on the ground floor are embedded inside the interventional platform that houses the emergency department (ED), trauma unit, surgery, catheterization lab, and interventional radiology suites as well as in the lower level of the building, which houses the support services, such as the laboratory, the facilities department, and environmental services. This design scheme has helped orient individuals to the time of day and weather and connect them with the outside world.

**Interventional Platform**

The organization established an interventional platform, made up of operating rooms, catheterization labs, and interventional radiology developed as hybrid suites, to increase flexibility in the use of rooms; promote interaction among specialists; allow for patient pre- and postprocedure recovery in a common setting, which makes the best use of staff skills without
duplication of staff or equipment; and ease our ability to make technological changes to transform areas depending on future demands of care. To accommodate patients’ expectation of privacy, all of the pre- and postprocedure rooms were designed as private spaces. This platform was built using the same types of structural components as would be found in a large sports arena. They include long-spanned beams to eliminate the need for load-bearing walls.

**Sustainability**

Sustainability for the space was a primary consideration in the design and ultimate operation of the hospital. Energy efficiency and conservation initiatives were built into the facility, from the materials used to the equipment and technology that would support the structures. The organization followed the *Green Guide for Health Care* checklist (HCWC and CMPBS 2007), applying it to the development of the space. Palomar Health commissioned an evaluation of the new facility, from design to utilization, testing all facets of the operation, such as water efficiency, indoor air, and environmental quality. Indoor and outdoor gardens and roofs minimized site disturbance; restoration of open-space landscaping helped eliminate heat islands; and the use of natural, indigenous vegetation ensured its self-sustainment during changes in weather. In building the facility, we included the capability for solar power generation, used recycled materials, reclaimed water for irrigation and cooling towers; created alternate, efficient variable air volume systems, and included high-efficiency chillers and fans and low-flow fixtures.

To date, sustainability measures resulted in reduced cost of operations of more than 12.5 percent compared to the original building. The organization has saved more than $1 million a year since opening.

**Technology**

We considered the erection of a new building an opportunity to make better use of the time and efforts of staff through technology to enhance the quality of the experience for patients and families. In addition to several technology applications to increase accuracy, enhance workflow, and offer convenience to patients and visitors, the new hospital features the following noteworthy technological enhancements:

- Patients who in the past had to fill out myriad forms, even for routine revisits for outpatient activity, are now screened using biometric scanners that acknowledge the patient and automatically populate the admission record in seconds.
- Nursing staff use a specially designed phone that connects them with physicians through a mobile application on the smartphones to effectively manage alarms.
- We now have interactive visualization capabilities for patients and families using computer screens and portable robots. These tools operate much like Skype or similar technologies.
- Wayfinding in the facility is improved through use of mobile application capability.
- Environmental services now uses an ultraviolet-operated disinfection robot that can destroy within seven minutes all of the difficult pathogens that remain in a room after traditional cleaning.
Many other technologies, including expanded robotics, have been built into the new hospital, all with the intent to leverage staff’s time and energy to focus on the patient rather than on extraneous activities that take them away from direct care delivery. This is not to suggest that with increased space and equipment there is not a need to expand support efforts. But by leveraging available technology, we are building a culture whereby we manage aspects of care and support without adding staff to solve issues, develop work-arounds to get the job done, or implement new systems of care. The organization has eliminated several hundred positions throughout the system as part of this effort.

Emergency Department
Staff spent considerable time studying the best ED designs from around the world. Research on how to accommodate triage needs without the traditional dysfunction and traffic coordination requirements led to the design of a seamless venue featuring intuitive visual cues and spatial placements and enhanced communication technology.

The ED in the older facility, which was built to meet the needs of a population of 250,000 in the 1960s, now was expected to serve nearly 650,000 residents. The new ED space was designed to greatly ease the limitations of the older ED. It contains four pods with 12 individual rooms in each and a trauma center, equipped with imaging and surgical capability, that can expand to treat up to 12 major cases at a moment’s notice and then deescalate just as quickly.

As in the rest of the new hospital, all ED rooms were designed with the patient and family in mind, from triage at the entrance to use of consultation space beyond the bedrooms. Magnetic resonance imaging equipment and computed tomography scanners are built adjacent to the ED for ease of use without having to leave the emergency space. Noise, a traditional challenge, has been contained by the design and use of enclosed glass spaces for staff and physicians, which allow them to complete their caregiving activities without the frenetic pace of a typical ED environment while still being able to view all the patients in their respective rooms. Critical treatment rooms measure 150 square feet each. Emergency medical technician staff now have the ability to connect with the ED personnel and know in advance where to take patients upon arrival, minimizing the need to check in and reducing transfers to a different location. The design of the ambulance space allows for quick patient drop-off and return to the field in the event of mass-casualty situations, much as an airport features easy drop-off and pickup of passengers.

Site Development
A unique approach was undertaken to stabilize the building infrastructure to the granite that existed on the site, one of the major reasons for the particular site selection. With this stabilization, the new hospital met California mandates for seismic requirements. Today, the new facility can withstand a 9.0 magnitude earthquake.

To modularize the design, create bedroom spaces, and place infrastructure and equipment under an extremely tight time frame, we adopted a Lean approach that allowed the health system, architects, general construction firm, and subcontractors to plan the use of subcontractors and trade groups. Serving as evidence of our success in the area is the fact that minimal change orders were placed in the completion of the project and the projects contingency fund was not tapped excessively.
The Reality—Results and Lessons Learned

As noted earlier in this article, certain goals were articulated as being critical to the successful completion of the new tertiary center.

- The project needed to serve as a catalyst for change. As such, it has achieved its purpose.
- Planning goals and principles were met. Documentation and reference tools for institutional “future memory” have been created.
- Evidence-based design features were actively incorporated and are in use throughout the facility.
- Nurses’ satisfaction with the design and building of spaces and the introduction of technology that supports them professionally and personally has dramatically improved.
- Building readiness for the move proved to be effective. The planning for and actual transfer of patients into the new hospital was accomplished in four months, faster than any previous project approved and overseen by the State of California.
- Specific organizational and cultural changes have been adopted throughout the system, and the entire project served as a touch point for everyone involved. The need for exceptional teamwork, focus, and interaction produced a design that, within the first two years, has demanded minimal disruptions to support care and caregivers. An employee survey found that at the go-live date, 89 percent of the staff believed in the direction of the organization and their involvement in the design process. These outcomes place Palomar Health at the 94th percentile of health systems nationally.
- Champion teams remain an active part of the strategy.
- Palomar Health’s focus on patient-centric behavior has been demonstrated through significantly improved top-box HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) scores. High scores on questions related to staff interaction, physician interaction, and provision of amenities and physical environment have placed the new hospital in the top quartile of hospitals surveyed around the country.
- From a financial perspective, the project was brought in on budget and on time, with a reserve contingency fund of $30 million. The fund has been used to purchase equipment or to support other capital projects around the system. The number of labor hours and productivity, which spiked early on in the use of the facility, have returned to expected levels, as evidenced by the operational performance of the hospital.
- Among the accolades we have received, the project was recognized by the American Institute of Architects (AIA) for its design award as the best healthcare project in California and nationally in 2013, and in that same year, Palomar Medical Center was recognized as one of the 50 Greenest Hospitals in America. These recognitions in turn have supported our achievement of Magnet status in 2009 and twice receiving the Best Place to Work Award in San Diego.

As with any project of this magnitude, it is important to understand what
objectives we did not achieve as quickly as anticipated so that others can learn from our experience. Several are mentioned here.

First and foremost, the State of California Department of Health, responsible for licensure of the new facility and alteration of the downtown campus that remained, based its review and approval process on regulations adopted 30 years ago that have not significantly changed since. As a result, introducing new concepts for consideration in the care of patients required either extensive discussion with state personnel to demonstrate proof of concept or required accommodation in ways familiar to them from other situations. Examples include placement and visualization of monitoring equipment and proof of the effectiveness of the acuity-adaptable approach to care. This roadblock in particular has led the organization, in conjunction with the other health systems in the state and the California Hospital Association, to challenge present rules and serve on a statewide task force to update regulations. It is our hope that this effort will usher in changes that enhance flexibility for hospitals moving forward with their design concepts as they complete their building and seismic compliance journey.

In addition, the effectiveness of the distributed work spaces on the patient units was challenged by the inability to put RFID (radiofrequency identification) tags on all equipment. Therefore, the goal of eliminating “hunting and gathering” was not totally achieved. This situation is being rectified as of the writing of this article.

The organization’s move to the new hospital meant that the decommissioned downtown space needed to be purposefully reallocated. The situation surrounding this process required the development of a disciplined approach to space allocation and the creation of a new administration and leadership team among executives and medical staff to help create a “new village” campus structure.

In terms of staff needs, in anticipation of the move, we neglected to make a deliberate and visible effort to allow staff to grieve and say goodbye, which would have helped staff cherish their memories while creating excitement for the move and the rebirth of the downtown campus. Though events were planned and held, a more definitive approach by specific area should have been developed by leaders to address these emotional needs. In reality, such events were held episodically and depended on the leaders’ recognition of and sensitivity to the needs of their people. The time, energy, and capacity they had available were focused on their responsibility for the move to their new department or on day-to-day operations.

All of the above have been recognized as fixable and are being addressed. They are presented here as cautions for others who follow in our footsteps.

**Conclusion**

As we look to the future of healthcare reform, those who are contemplating the building of a new facility or remodeling an older one—though taxing on the balance sheet—are encouraged to give thought to the ideas we embedded into our effort. The ability to create flexible use of space based on a sustainable approach, the use of technology, the extension of staff capability, the prioritization of patients’ and families’ safety in an environment that focuses on them, the engagement of staff and clinicians in meaningful ways, and the ability to emphasize the importance of culture and the understanding that culture does not have to conflict with the limited resources and finances available will help
organizations truly position themselves well for whatever lies ahead.

Palomar Health opened up several of its meetings that took place early in the development process to other healthcare leaders and organizations in the region. A number of ideas and takeaways from these sessions have been applied to other facilities being built by those organizations today. Furthermore, they provided valuable input to our design process—a side benefit from our establishment of the expert panel we convened, as discussed earlier.

We believe the residents of our district are better served by this effort, now and in the years to come, than they were in the past. We also believe that those who read this article will be as well, and we challenge others to build on what we have learned.

Note
1. The leadership of the health system, in discussion with the board, had committed to achieving LEED (Leadership in Energy & Environmental Design) Gold certification, conferred by the US Green Building Council, as a minimum performance threshold. However, due to the cost, time, and internal support necessary to complete the documentation for the application, we decided not to pursue the certification and focus instead on using those resources on the project itself.

References