

***NEW MODELS IN ICU DESIGN:  
TRANSFORMATION AND TACTICS; TEAMWORK AND TRADEOFFS***

**Philip LiBassi, AIA, ACHA, Principal and Project Director, Westlake Reed Leskosky**

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The physical design of the ICU can directly improve quality of care, workplace effectiveness, and bottom-line efficiency. New innovative models in ICU design are restructuring resources, workflow, and communication for optimum outcomes. These paradigms are increasing operational and cost efficiencies beyond traditional models. But the benefits of transformational design must also be accompanied by teamwork, cooperation, and openness to change.

The shift to Decentralized Intensive Care Units has been developed by collaborations of leading healthcare providers, planners and designers who are in the forefront of these new trends. Westlake Reed Leskosky, national healthcare architect and engineer, has explored decentralized concepts over the past fourteen years, resulting in innovative concepts, including a two-bed model for Saint Vincent Health Center in Erie, Pennsylvania and a four-bed model for South Pointe Hospital of the Cleveland Clinic Health System in Warrensville, Ohio.

Decentralized models such as the Saint Vincent and South Pointe concepts address the key challenges of providing critical care today:

- how to best deliver direct care to patients that require constant attention,
- how to improve the workplace environment in an intensive care unit,
- how to create an environment that merges the medical with the medicinal,
- how to take advantage of the best technology has to offer, and
- how to create a healing environment that benefits patient, family, and healthcare providers alike.

***The Complexity of the ICU***

Any discussion of new models of ICUs must begin with an examination of the intensive care unit and why the shift to decentralized units should be considered.

The ICU is a complex and dynamic organism that focuses the needs and relationships of patient, family/visitors, nurses, physicians, and hospital support staff and functions to the benefit of the patient's care. All aspects of the ICU – the components and settings of the room and the activities of the nurse's station as support – all relate to the interface between the various user groups.

The ICU has a number of functional components in addition to the patient room, procedure area, nursing station, RT and pharmacy. Soiled and clean materials, equipment, supplies and storage are constantly flowing in and out of the unit. Waiting areas, vending, consultation rooms, quiet rooms and social work offices are spaces in the ICU dedicated to the important family and visitor

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experiences. Staff workplace areas accommodated in the ICU typically include a lounge, lockers, conference room, toilets, and offices.

Design infuses each of these areas with a character and quality that have a direct impact on the delivery of care and healthcare experience from the perspective of each of the various users. The amount of lighting and natural daylight, the orientation and circulation of the unit, its palette of colors, ambience and views to the outdoors, are all critical design elements that can create and modulate a soothing, healing and yet efficient healthcare environment.

The ICU patient room must contain a number of “objects” in its domain, from the bed, medical equipment, and medical services supplied through the headwall, power column and boom, to the patient services of toilet, dialysis, bedpan, soiled sink, charting, personal effects and family-related furniture or accessories.

The ICU room, and all of its accoutrements, must then function in various “settings” according to the different uses: at rest, examination, nursing, critical event, changeover.

Finally, the activities that take place at the nursing station are critical components within the ICU. These encompass charting, interaction with physicians, orders, medicines, and interaction with family and visitors.

### ***Why a Decentralized Approach should be Considered***

The understanding of the ICU as a vital organization allows the comparison of the centralized and newer, decentralized models.

The traditional centralized model places the nursing station at the center of the ICU, with patient rooms lining the perimeter. Family members and visitors arrive at the nursing desk, and are directed to the patient rooms along corridors that pass by glass-fronted ICU rooms. Waiting areas terminate the corridors; materials and supplies arrive at the central core.

In the centralized model, the ICU provides access by all users. While providing convenience for nurses, physicians and hospital services, the experience for patients, families and visitors may become unpleasant, filled with distracting and upsetting sounds and sights and lack of privacy.

In the ICU room of a centralized plan, the presence of nurse and patient are constant, with physicians, services, and family periodic. Any of the conveniences for nurses and staff is more than offset by the disadvantages of a lack of patient privacy, compromised family interactions with the patient, and less interactions of family members with physicians and staff.

The centralized nursing station places all of the nurses together, which allows for simpler paths of communication and easier staff interaction. The presence of the nurse is constant and the physician is able to do multiple charts at one time. However, nurse and charts are more remote from the bedside; the delivery of healthcare is distanced from the patient.

### ***Transformation by Physical Design of Decentralization***

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One of the leading questions in critical care medicine today is:

***How can we best deliver direct care to a patient that requires constant attention?***

Decentralized ICU design answers that challenge:

***Put the people that provide that care as close to the patient as possible.***

The decentralized model moves the nurse and services closer to the patient. Like the centralized unit, the decentralized ICU also provides access by all users, but in a quiet, soothing experience that is reassuring to patients, families, and visitors.

In the decentralized ICU, nurse and patient continue to be constant, with physicians, services and family periodic. But, departing from the centralized model, the decentralized room provides optimal patient privacy and enhances private family interactions with patient, nurse and physician.

The nurse is still the predominant user of the nursing station, but, in this case, the nurse is next to the patient, available to monitor patient needs, interact with the physician and support staff. For the physician and nurse, charting is bedside. And from an administrative perspective, the decentralized model optimizes efficiencies through the sharing of resources and the elimination of redundancies.

The decentralized nursing station does raise common concerns of remoteness from other nurses and distances from the staff perspective. Any transformational change requires management and adjustment and a “new way of thinking.” The tradeoff to those issues and inconveniences is measurable differences in the increased quality of 24/7 patient care in a one-stop delivery modality.

### ***The Two-Bed Model: Saint Vincent Health Center’s Flexible and Efficient Pods***

The new 20-bed ICU and 20-bed CCU were part of the 160,000 square foot addition and renovation for Saint Vincent Health Center in Erie, Pennsylvania in 1992-1995 that replaced obsolete units with state-of-the-art flexibility, aesthetics, comfort, simplified circulation, and operational efficiencies. Based on early planning studies, the demolition of a cluster of outdated, interconnected structures of the hospital’s complex, close to the heart of the city’s downtown area, opened up the opportunity to enhance visibility with a forward-looking provider image, and eliminate bed units that were physically and economically prohibitive to renovate. The project emphasized critical care and outpatient care – the two ends of the spectrum that responded to the then current trends in the healthcare industry.

The Saint Vincent project was the result of the close collaboration between the hospital, architect/engineer Westlake Reed Leskosky, planning consultant Robert H. Levine, and construction manager Barton Malow. User input was key throughout the design process, and nurses, physicians, technicians and users were significantly involved, resulting in enhanced staff productivity and satisfaction. Team members and user groups benchmarked and visited numerous facilities to understand “best practices” and learn from other examples. Full-scale mock-ups were constructed to gain user input.

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***The result was a pioneering model for critical care that established a new national standard: an optimum, two-bed layout for a new, decentralized ICU that placed the nurses closer the patient.***

Departing from the traditional centralized nursing stations of the existing facilities, localized nursing stations were placed between pairs of patient rooms to offer the advantage of a favorable nurse to patient ratio, continuity of staff, and increased efficiencies. Continuous circulation spines paralleling the rooms create effective traffic patterns for nursing staff and permit supervision of adjacent suites.

Ronald A. Reed, FAIA, IIDA, principal of Westlake Reed Leskosky and designer for the project states, “We designed the pod module with optimal flexibility. The critical care units adjust to volume demands and convert from critical care to medical surgical care, avoiding the cost of moving patients again through step-down care.”

The decision to decentralize was made by the users through dialogue with the team. Team members were all involved in the benchmarking and analyzing the best critical care units in the healthcare market. ***While typical units placed nurses out at bedsides with 30-50% supervision, the team set the goal at 100% supervision at a time – a break-through goal that was achieved.***

The site visits to other units resulted in another key aspect of this paradigmatic design: on one tour, a nurse had placed her chair in the doorway and held the door open between rooms to give her the visibility she needed to do her job. ***This expression of the need for visibility became a fundamental criterion of the design. The team listened to the users and paid attention to the people working in a unit.*** Work space was placed for nursing staff to straddle two rooms – thus meeting the goals of 100% visibility of both patients while doing work, yet also allowing for separation and privacy.

The team had also analyzed every movement of all users through the units. The perceptions of recovering patients, for example, dictated colors on a focus wall. Ample light was brought through large windows with views, replacing typical dismal critical care rooms with rooms that are an asset to patients, families, and staff. Supporting family interaction in the delivery of care at the patient bedside, the design included comfortable seating, tack space, warm lighting and a home-like atmosphere, even in the confines of the small room space. Material handling and storage was strategically located to avoid disruptions and the need to have support staff walk through patient areas, contributing to improved infection control. Each functional operation was scrutinized for better solutions supported by the physical design, such as separating wet work areas from dry work areas.

In tandem with increased operational efficiencies, the design aesthetics created a contemporary healing environment and pleasant work environment. Interior color palette and finishes convey a sense of warmth and stability without indulging in excess. A judicious use of light colored wood veneers combine with terrazzo, broadloom carpeting, tinted concrete and a full spectrum of vinyl wall coverings and upholstery for an attractive non-institutional atmosphere. Permanent materials favor neutral colors, accented by saturated hues, allowing flexibility and maintainability for the future.

As Graham C. Lund, Senior Vice President of Saint Vincent Health Center looked back on the outcomes, he remarked, “Everyone was willing to think outside traditional approaches and to

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look at new ways at arriving at solutions...Listening to our users was key to design excellence. We had multiple user input throughout the process.”

### ***The Four-Bed Model: South Pointe’s Shared Efficiencies***

Based on the success of the decentralized ICU design at Saint Vincent’s, and continuing its exploration of critical care concepts, Westlake Reed Leskosky focused on further development ideas in the design of the 100,000 square foot West Wing expansion to the Cleveland Clinic Health System’s South Pointe Hospital in Warrensville Heights, Ohio. With surgery as the cornerstone, the distinctive and highly visible \$25 million hospital addition includes a technologically advanced surgery center and intensive care unit with an innovative 4-bed intensive care module. As the culmination of a master facility planning process to transform the campus for future healthcare, the West Wing integrates cutting edge technology, functional efficiency, and attractive aesthetics in a comprehensive healing environment.

Opening in the fall of 2003, the project brings together South Pointe’s surgical and intensive care services. Operating efficiencies are gained through the consolidation of surgical services formerly located in two outmoded facilities on the same campus, resulting in the avoidance of duplication of equipment and supplies required to maintain the two physically separate facilities, as well as the constant rotation of physicians and staff.

A key feature of the design is the ***development of the surgery and ICU units in collaboration with nurses, physicians, and administrators*** following considerable research and study of numerous alternatives, generating a prototype for effective patient care delivery. Managing principal Paul E. Westlake, Jr., FAIA, FACHA, emphasizes the strategic value of the project. “This is a transformational project for South Pointe Hospital, one that expresses a new image and direction. In one bold stroke, and with surgery as the cornerstone, the critical care expansion physically resolves the previous merger of Meridia Suburban Hospital with the original Brentwood teaching hospital for operational efficiency.”

The project evolved from a planning study conducted in 1996 by programming consultant Frank Zilm & Associates Inc. to support the hospital’s goal of consolidating inpatient and outpatient surgery services to achieve operational efficiency and to improve physician referrals.

While implementation of the design concept waited for funding from the health system, the need in the community for expanded surgery and bed services grew rapidly with the closure of other nearby hospitals not affiliated with South Pointe Hospital, adding to demand. The project was ultimately approved by the regional system in 1999 and was reinforced by a new master plan completed for this campus in 2000. Groundbreaking was held in June 2001, with Panzica Construction Co. as construction manager.

A new third floor of the addition combines the former medical and surgical intensive care units into one with ***25 private patient rooms in an innovative and prototypical module design of nursing stations***, located adjacent to the medical/surgical beds in the existing hospital bed tower.

Principal Ronald A. Reed, FAIA, IIDA of Westlake Reed Leskosky, who designed the new intensive care module with Philip LiBassi, AIA, ACHA, describes its benefits. “Unlike traditional, noisy central nursing stations, this decentralized module distributes units in six pods

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with four beds each, bringing teams of nurses closer to the patients. The hospital gains the efficiencies of shared resources; patients and visitors get the reassurance of privacy and attention.”

The design of this new module works on a number of levels. In terms of patient care, it places a *team of nurses at a pod of four rooms*. From a business perspective, this collaborative arrangement allows South Pointe to *attract top quality nursing staff* and take advantage of *shared resources*. From an environmental standpoint, it replaces the institutionalized, noisy effect with a *quieter, private healing environment* for patients and families.

While the Saint Vincent ICU used a 28’ module with 14’ rooms stacked consistently in its tower, the stacking of the ICU over the surgery floor necessitated a 20’ module, with 14’ rooms. Patient rooms line the perimeter of the floor, providing each patient with a window, offering views to the outside and enhancing the sense of spaciousness and openness. Nursing stations provide visual contact with each room at all times. The flexibility of the four-bed pod allows for a staffing ratio of two teams of 2:1, or different loading for less-acute care patients. One of the twenty-five rooms was designated for use as a skills lab and training room when available.

All critical equipment is located in the headwall, away from the patient’s view. A boom system hooks equipment through a column, allowing nurses to move easily around the bed without negotiating wires on the floor. Each room has a supply cart, exemplifying the convenience of placing everything within reach at the patient’s side. All lighting is supplied from the ceilings, lighting surfaces evenly.

Corridors terminate with views to the outside, admitting additional natural light into the interior circulation of the unit, adding to the sense of openness and a pleasant environment. As on the first and second floors, an inviting and comfortable waiting area for the ICU on the third floor provides full glass views to the northern landscape, reflecting the emphasis placed on creating a comforting healing environment. The ample size of the waiting area – one and one-half times the standard – addresses the needs of families during extended stays.

Central processing and distribution is located on the ground floor. Separate elevators isolate clean, sterilized surgical instruments and equipment, a further example of the efficient processes built into the new addition. As part of the integrated engineering services provided by the Westlake Reed Leskosky, new mechanical and electrical systems design addressed upgraded systems and increased standby and emergency capacities.

As with the example of Saint Vincent’s Health Center, the South Pointe project was achieved through close collaboration with the client, in this case, an interactive process involving a cross-sectional steering committee.

Susan Collier, RN, MSN, Vice President of Nursing for South Pointe Hospital, Cleveland Clinic Health System, recalls the exhaustive process of developing the four-bed module with the architects, “We looked at two-, three-, and four-bed concepts. Our vision was a unit that offered both efficiency and cost-effectiveness. We did not want to have to transfer patients intra-departmentally to deal with occupancy swings. We determined that the four-bed concept would be the most efficient, and foster teamwork.”

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### ***Tactics to Achieve Transformation***

As shown by the case studies of Saint Vincent and South Pointe, innovations in ICU design are only achievable through the commitment of the collaborative teams of hospital and architect to explore and embrace new ideas, think “out-of-the-box,” and to exceed performance measures. These efforts result in bottom-line efficiencies, staff recruitment and retention, and increased satisfaction on the part of all of the various stakeholder-users in the ICU.

As healthcare providers begin to embrace the physical concepts of placing care at the patient bedside, they are faced with a series of challenges that require tactics of transformation: preparing for change, envisioning the future, changing the workplace, and changing the process.

The first steps in readying the healthcare organization for the new direction ahead keep in focus the desired outcome of placing care near the patient. Physically, this goal translates into the proximity of the nurse, the easy visibility of the patient, and having medications and supplies readily at hand.

Decentralization requires that the interaction and communication among nursing staff that was simple and obvious at a central station now be handled in new ways. The cohesion of today’s multidisciplinary team can be increased through spaces for interaction with large desks, classrooms with satellite access, offices and work space for key staff, including a satellite pharmacy and a blood gas analysis lab.

It is through envisioning the future that the short-term challenges to accepting change can be confronted: staff shortages, aging staff, changing reimbursement patterns, physicians’ demands, expectations of informed consumers (especially customer service-oriented baby-boomers), the new focus on patient safety, and the integration of rapidly changing technological advancements.

The physical design must account for new and competitive standards of the healthcare workplace: issues such as ample space, sufficient and accessible computers, phones and nurse call systems, large windows and natural light, sound containment and quiet, communication systems, and the proximity of healthcare team members to the patient.

In applying these tactics at South Pointe, Susan Collier not only addressed the physical co-location of two operating units, but also the change process and merger of two cultures. “We had a medical ICU and a surgical ICU on different floors, and saw non-productive rivalries between them. We knew we wanted one ICU. The task before us was to merge two staffs to work as one, building cooperation, not competition.”

“We involved staff from both units in the planning process, in benchmarking trips and analyzing physical mockups the architects had prepared. We floated staff, assigned one manager, used a targeted education program and established policy and procedural changes prior to the new unit beginning operations.”

### **Does the Decentralized Model Work?**

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Assessing the impact of new ICU design on quality of care, workplace effectiveness in terms of cost and operations, patient satisfaction and staff recruitment and retention ultimately determines whether the direction toward decentralized care truly meets its goals.

Comparing the six months previous to the opening of the new ICU with the first six months of operations, South Pointe's ICU has recorded measurable improvement in quality care issues, including, a 10% decrease in restraint use, and 100% improvement in self-extubations. Patient satisfaction measures of the following statements: Overall Quality of Intensive Care, Overall Quality of ICU Nurse Care, ICU Explained Medical Condition to Family, Visitation Policy for ICU, Dignity/Respect by ICU, and Helpfulness of ICU to Reduce Pain, demonstrated increases between 2 and 8%. The new ICU also had an impact on staff recruitment and retention: staff position vacancy rates dropped from close to 25% in September 2003 to less than 5% in June of 2004, and turnover through resignations decreased by 50%. And finally, ICU volume in patient days increased by 16%.

Collier comments on the results, "We needed to learn how to adapt to a different work flow process. Socialization opportunities have changed. But we now have the availability to be right there for the patient. The chart stays with the nurse and the patient. Our clinical manager, clinical nurse specialist, case manager and social worker all have offices right in the middle of the unit, providing their support. The linen chute, trash chute and tube system for lab work is close at hand in the unit, freeing us from otherwise labor intensive activities. We have grown to twenty-five beds and have more functional space. New technology for voice communication allows nurses to page doctors on wireless phones or call for urgent items without leaving the patient's bedside. Orders are faxed to the pharmacy, and then delivered right to each nursing station. The communication that needs to occur can happen effortlessly. Collaboration has increased. All this leads to better care of our patients."

"We have a technologically advanced and aesthetically pleasing, new unit that will allow us to attract and retain staff."

Clearly, decentralized design can make a positive impact on all aspects of the ICU – from the constant attention to the patient, to the effectiveness of nursing, to the cost implications of increased efficiency and satisfaction. But moving a healthcare organization to new models of care has its tradeoffs. Through the on-going development of tools to support change, communication and collaboration, and evaluation, these directions can be continually adjusted to meet the challenges that arise.

South Pointe's Susan Collier summarizes, "I see what we have done in this ICU as the future. Everything points to the fact that the best kind of care can be given when the nurse is as close to the patient as possible. We are still learning, but we are also embracing the change."

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