Examining the Opportunity for Tele-ICUs in California

Report to the California HealthCare Foundation

October 2011

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Contributors: NEHI would like to thank the staff of the California Center for Connected Health Policy for their collaboration on this project.

This report was made possible through financial support from the California HealthCare Foundation.

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Executive Summary

A project of the California HealthCare Foundation, *Planning for Tele-ICUs in California* examined the need and opportunity for tele-ICUs in California through an environmental scan of critical care in California. Goals of the project were to (1) identify regions of the State with the greatest need for critical care capacity, improvement of ICU outcomes or efficiency, and (2) identify (and where possible, address) financial, regulatory and policy barriers to tele-ICU in California.

Tele-ICU, a telemedicine technology, has the potential to address critical care challenges by enabling intensivists in one tele-ICU "command center" or "hub" to remotely monitor, consult and care for ICU patients in multiple and distant locations. By increasing the number of ICU patients that critical care teams can manage, tele-ICUs effectively extend and leverage both the productivity and the reach of the specialists.

Planning for Tele-ICUs in California was conducted by NEHI in collaboration with the Center for Connected Health Policy (CCHP) from December 2010 through October 2011. Key findings are summarized below.

Finding #1: Critical care in California faces significant challenges

California's high ICU mortality rate of 20.6 percent is the greatest and most urgent challenge facing critical care in California. Steps must be taken to reduce mortality and improve ICU outcomes. Other major challenges include:

- Insufficient supply of intensivists and critical care nurses statewide;
- Insufficient access to critical care particularly in rural areas; and
- In some urban areas, ICUs have strained capacity. In these areas there may be opportunities for better ICU care management, more efficient throughput and lower overall ICU costs.

Evidence suggests that tele-ICU technology could help address these challenges and provide benefit in the following ways:

- Improve ICU outcomes through greater use of intensivists;
- Improve ICU capacity by leveraging intensivist and critical care nurse staffing to areas where there is insufficient supply of critical care professionals or unmet need for critical care;
- Provide consultation, training and mentoring to nurses and physicians in satellite hospitals with less experience in critical care; and
- Support appropriate ICU processes of care, patient admission to the unit, and oversight of ICU cases for better care management and more efficient throughput of ICU cases.

Six percent of ICU beds in California are currently wired for tele-ICU and all existing tele-ICU installations are in northern California. Sutter Health and John Muir Health operate the only tele-ICU command centers (both in northern California). Both operate the VISICU tele-ICU system (*eICU*). Saint Joseph Health System has three satellite ICUs connected to the Sutter hub in San Francisco. Each hub system's experience with tele-ICU is summarized in Part 3 of this report.

Finding #2: Regional opportunities exist for improving critical care

Regional analyses suggest the following targets where tele-ICU-supported critical care might be beneficial:

- Rural areas with little or no access to critical care specialists; and
- Urban centers where many ICUs operate at high capacity (85-100 percent occupancy on average, and with higher ALOS and greater variation in ALOS compared to other ICUs in the region). Regions with high ICU occupancy present opportunities for better ICU throughput and better regional management of ICU care.

The following geographic regions were identified in need of expanding or improving critical care:

- Los Angeles County;
- San Bernardino County;
- Riverside County;
- Central Valley counties including San Joaquin, Stanislaus, Merced, Fresno, Kings, Tulare and Kern Counties; and
- The rural Eastern Sierra region: Inyo, Mono and Alpine Counties.

Feedback from experts and California hospital executives confirmed these regional findings and identified specific hospital systems for targeted outreach, including the University of California system, public hospitals, and systems with a large rural presence. Sutter Health which has already begun using tele-ICU effectively in a few rural areas of northern California.

Finding #3: Barriers to tele-ICU in California

Experts highlighted lack of capital available to hospitals as the number one barrier to tele-ICU adoption. The number two anticipated barrier is resistance among community-based and admitting physicians to sharing or relinquishing treatment decisions or control to tele-intensivists. This barrier highlights the importance of communications as well as strategies to reinforce shared decision making and cultural acceptance of tele-ICU as key components of effective planning for tele-ICU implementation.

A third barrier to tele-ICU adoption is competition for IT project financing within hospitals and health systems. Many California hospitals have EMR implementation or other significant IT projects already underway, and the concern is that tele-ICU EMR adoption will be delayed or not rise to the top of the priority list. Fourth, experts see lack of tele-ICU EMR interoperability with EPIC and legacy IT systems remaining a barrier to tele-ICU in California for some time. Vendors are working to resolve challenges with interoperability, therefore, this barrier will likely diminish over time.

A fifth barrier is uncertainty about revenue from tele-ICU, including concerns over reimbursement and inability to assess return on tele-ICU investment. Revenue from tele-ICU is primarily generated by reduction in ICU length of stay (Medicare case-based payment allows hospitals to benefit financially if patient length of stay can be reduced). The greater the potential for reduction in ICU length of stay, the greater the savings to be realized. Other savings from tele-ICU will result from fewer complications and shorter lengths of stay in Medical/Surgical units following discharge from ICUs managed or supported by tele-intensivists.

Reimbursement for tele-ICU is also a factor influencing tele-ICU adoption. In California, Medi-Cal will generally reimburse for telehealth services. Medicare reimburses for ICU care (higher acuity cases receive higher payment) but provides no additional reimbursement for tele-ICU service. Medicare does not pay for e-visits or consults even in rural areas where there is no other access to specialty care. As a result of Medicare's policy, California providers view reimbursement from telehealth (and tele-ICU) as improving but still insufficient. Helping hospitals accurately assess the potential revenue and return on investment from tele-ICU was a component of *Planning for Tele-ICUs in California* in Phase 2 (described in Part 4 of this report).

A sixth noted barrier is lack of connectivity and broadband access remaining in some rural areas of California. The statewide broadband expansion efforts of the California Telehealth Network are anticipated to eliminate this barrier in the near term.

A final noteworthy barrier to tele-ICU expansion is a general lack of awareness about this technology. It is surprising how many California health care executives were unaware of this technology and its clinical and financial potential.

In spite of the barriers noted above, experts believe that the use of telehealth-supported critical care will expand in California over the next five years in a variety of forms, including expansion of tele-ICU. Guidelines are needed for determining when tele-ICUs offer the best critical care solution versus in what circumstances other tele-intervention alternatives (like robotic telemedicine) are best suited or more cost effective for expanding critical care.

Research and expert interviews identified the following drivers of successful tele-ICU adoption. Attention must be paid to:

- Human factors: For tele-ICU to be successful, senior leaders must prioritize, support and reinforce - and physicians and nurses must accept and embrace - use of tele-ICU technology, particularly in satellite locations. Good communication and collaborative working relations must be established among providers in satellites and in hubs. Effective communication about the importance of "shared decision-making" between hub and satellite physicians is key.
- IT system interoperability is necessary for efficient, safe, optimal use of tele-ICUs. Current tele-ICU users in California underscored the importance of this point.
- Clarity about potential for tele-ICU return on investment.

Experts suggest that hospitals considering tele-ICU technology must answer three questions for their facilities:

1. Will tele-ICU adoption improve our ICU outcomes and quality of care?
2. Will tele-ICU adoption bring increased ICU market share?, and
3. If we incur the cost of tele-ICU adoption, will revenue from reduced ICU length of stay and increased ICU market share result in a positive ROI?

Guidelines for calculating revenue and return on investment from tele-ICU were developed in *Planning for Tele-ICUs in California*.

Finding #6: The policy environment is becoming more favorable for tele-ICU

Recent State and federal policy developments are advancing telehealth, physician credentialing, reimbursement, and the regulatory environment for tele-ICU in California. Other policy developments (such as the California TeleHealth Network) are creating the necessary infrastructure for tele-health across California. Together these policy developments create the technical infrastructure and a more favorable administrative, financial and regulatory environment for tele-ICU in California.

In *Planning for Tele-ICUs in California*, the project team addressed barriers to tele-ICU, focusing activities in areas of the State identified in Phase 1 as regional targets for critical care improvement. This was accomplished through four sets of activities:

1. Convened informational forums in Los Angeles, San Bernardino and Riverside Counties, and with targeted health systems to raise awareness about critical care challenges and tele-ICU technology as a potential solution to those challenges. A third forum in Sacramento in November 2011 will engage California health systems, health plans and purchasers statewide.
2. Worked with PriceWaterhouseCoopers to estimate the revenue and return on investment potential of tele-ICU in Southern California.

3. Fostered communication with and among providers, payers and purchasers about the clinical and financial potential of tele-ICU, and
4. Examined policy and regulatory barriers and opportunities for tele-ICU, and addressed those barriers where possible.

Planning for Tele-ICUs in California made considerable progress in highlighting and addressing barriers to tele-ICU expansion in California. Nevertheless, barriers still remain, including lack of capital for tele-ICU implementation, potential physician resistance to tele-ICU, and IT interoperability in some settings. Important research questions also remain. Experts recommend research and dissemination of best practices in models for tele-ICU implementation, and best practices for human factor engineering and communications strategies to support successful tele-ICU installation.

Intensivist and critical care shortages in California and the U.S. will reach crisis levels unless solutions are created now. Growing evidence suggests that tele-ICU is a regional solution that will leverage intensivist reach and access to critical care, while improving ICU capacity, efficiency, quality, outcomes and cost of ICU care. Interested providers can benefit from timely policies at the State and federal level that are creating opportunity for tele-ICU adoption in California. Barriers addressed through *Planning for Tele-ICUs in California* will minimize roadblocks to creating tele-intensivist supported regional solutions to California's critical care crisis.

Part One. Tele-ICU Technology: Background

The Intensive Care Dilemma

Intensive care units (ICUs) are a vitally important component of health care in the U.S., providing treatment for six million of the sickest and oldest patients in the country each year. The choices about how to manage ICUs carry high stakes: ICUs have both the highest mortality (10-20 percent in most hospitals) and the highest costs in health care. ICU mortality in the U.S. averages 17 percent. California's ICU mortality rate - nearly 21 percent - is the second highest in the nation among the 50 states.[x] ICU costs account for 30 percent of acute care hospital costs, amounting to $180 billion annually in the U.S.[x] Adding to the complexity of ICU management decisions is the collision of two major trends: the increasing number and severity of critical care patients population ages, and the decreasing supply of critical care physicians (intensivists) available to manage this growing number of patients.

Why Intensivists?

Physicians and nurses who are **not** certified in critical care medicine also work in ICUs and, in fact, represent the majority of the clinicians in those units. However, research indicates that ICU patients have lower risks of death and shorter ICU and hospital stays when an intensivist physician is on duty in the ICU and oversees patient care.[i] The presumption is that where intensivists are available to manage and monitor ICU care, patients' problems are identified sooner, leading to more rapid and complete interventions and lower mortality rates. The mortality reduction attributed to intensivist staffing varies among research findings, ranging from 15 to 60 percent lower than in ICUs where there are no intensivists.[ii] Similarly, average ICU and total hospital length of stay for ICU patients have been observed to be shorter (estimated 30 percent shorter) in units staffed by intensivists.[iii]

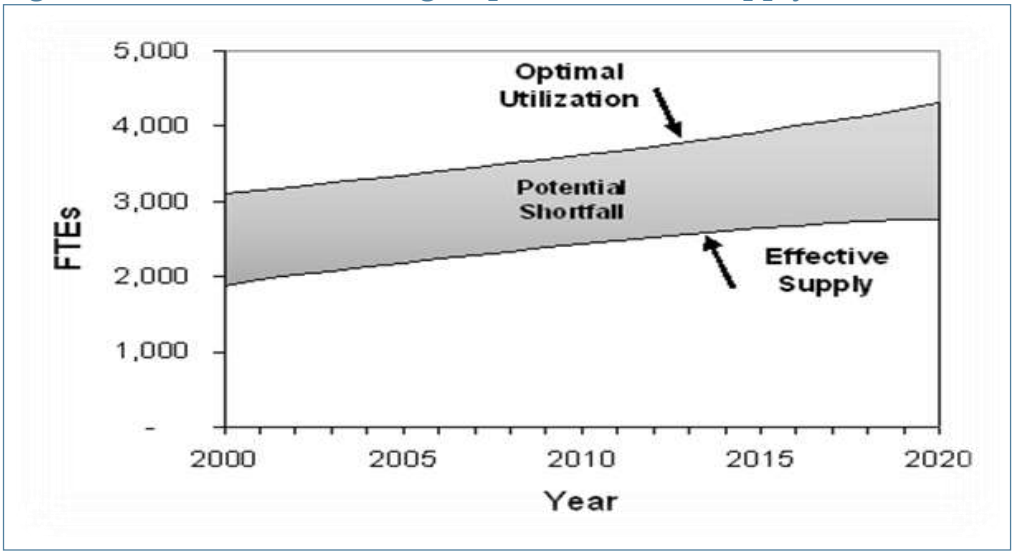
The Society for Critical Care Medicine (SCCM) reports there were 8,100 board certified intensivists practicing in the U.S. in 2010. SCCM estimates that by 2020, only 35 percent of intensivist demand in the U.S. will be met by the supply of intensivists. SCCM forecasts a growing shortfall between the numbers of specialists needed by ICUs and those available to work there (see Figure 1).

Who Are Intensivists?

Intensivists are physicians who are board-certified to practice critical care medicine. They may also be physicians trained as emergency physicians, pulmonologists or anesthesiologists. Critical care medicine became a recognized and certified specialty in most states during the 1980s.

In addition to physicians, intensivist nurses also specialize in the delivery of ICU care. Intensivist nurses generally take additional graduate level training to qualify for ICU assignments.

Figure 1: ICUs – The Growing Gap Between the Supply and Demand of Intensivists



Source: HRSA Report, 2006, "The Critical Care Workforce: A Study of the Supply and Demand for Critical Care Physicians."

Rapid Increase in Adult ICU Patients. The need for ICU care increases exponentially as the population of aging Americans grows. For example,

- More than half of ICU patients in the U.S. are over 65;
- A patient 65 to 74 years of age is more than three times as likely to use critical care units as a middle-aged patient; and
- A patient over 85 is six times as likely to use critical care units as a middle aged patient. [iv]

With the extension of U.S. life expectancy, the over-65 population has grown steadily in recent years and is projected to grow even more rapidly in the future. The U.S. Census projects nearly 72 million over-65 residents by 2030, and the over-85 age group is projected to triple from a reported three million in 2008 to over 9 million in 2030.[v] In California, the census projects that by 2030, one in five Californians will be over age 65.

By 2030, the U.S. is predicted to need an ICU capacity to care for 54 million ICU case days per year. That will represent a tripling of capacity of ICU case days from 2006.[vi] U.S. hospitals are currently adding ICU capacity at a pace of roughly two percent growth per year.[vii] More ICU beds and new units are added to hospitals each year than in any other clinical specialty unit. ICU beds cost roughly $1.5 million per bed. More cost effective solutions are needed to expand ICU capacity and meet growing ICU demand in an aging population.

More Patients, Not Enough Intensivists. At present, there is a need for four times as many full-time intensivists than are currently practicing to provide around-the-clock staffing at more than 6,000 ICUs nationwide. Despite the growing demand for ICU specialty care, experts predict a comparatively slow rate of growth of intensivists in the coming years in California and nationally. This shortage is compounded by the fact that many hospitals are successful at recruiting intensivists. The combination of financial constraints, other care settings (such as the Emergency Department) drawing critical care physicians away from the ICU setting, and a shortage of intensivists presents major obstacles in California - particularly in rural areas - to achieving recommended levels of intensivist staffing. The supply of critical care nurses (estimated at 400,000 nationwide) also represents a substantial shortfall against the needs of ICU staffing.[viii]

The Leapfrog Group is one of the leading national associations of health care purchasers and employers focused on health care quality, safety and value. The data supporting the improved quality of care provided by intensivists led The Leapfrog Group to add a standard for intensivist care in ICUs to their hospital quality rating system. Leapfrog's hospital quality ratings call for full-time intensivist staffing as a way to reduce ICU deaths by 30 percent or by an estimated 50,000 lives per year. The Leapfrog standard requires that:

- Intensivists are dedicated to provide care in the ICU during daytime hours.
- When intensivists are neither on site nor available via telemedicine, they must return pages at least 95 percent of the time within five minutes and also arrange for a FCCS-certified physician or physician extender to reach ICU patients within five minutes.[ix]

In 2010, 40 percent of eligible U.S. hospitals reported that they met the Leapfrog standard for intensivist staffing in ICUs. In California, only 20 percent of hospitals reported that they met the Leapfrog standard. Recognizing that there is a shortage of intensivists, The Leapfrog Group has indicated that intensivist coverage of a distant ICU from a command center or "hub" facilitated by tele-ICU technology meets their standards for intensivist staffing.

ICU care in California presents some unique challenges. A 2007 California HealthCare Foundation report by Kurt Salmon Associates (KSA), *Rethinking the Use of Intensive Care Beds in California Hospitals*, found a higher than national average ICU utilization for patients at the end of life; no correlation between ICU case mix and utilization; a wide degree of variation in ICU average length of stay (ALOS) among California hospitals that could not be explained by variation in severity of patient illness (30 percent of California hospitals had excessive ICU lengths of stay relative to their ICU case mix score); and regions of very high ICU utilization including Los Angeles and Orange County. *Rethinking the Use of ICU Beds in California Hospitals* concluded that efforts to reduce variation in ICU utilization and improve the use of existing ICU beds could increase ICU capacity in markets with high utilization, make better use of scarce nursing resources and

reduce costs. The report concluded with the recommendation that remote intensivist monitoring through tele-ICUs is a "quality-driven initiative that could result in ICU utilization savings".[x]

What Are Tele-ICUs and How and Why Do They Work? Tele-ICU, a telemedicine technology specifically designed to improve health care delivery in ICUs, offers a potential solution to the shortfall of intensivists: Use technologies to increase the numbers of critically ill patients that an intensivist can manage effectively. Tele-ICUs are an enabling technology that monitor ICU patients and leverage doctors and nurses who are specialists in critical care medicine to manage the care of patients in multiple distant units. Tele-ICUs hold great promise to improve the care of ICU patients, save lives, and increase both the productivity and the reach of specialists in critical care medicine. As noted above, these specialists are in very short supply, and without telemedicine there are few options for expanding their coverage of ICUs.

Tele-ICUs connect a central command center (or hub) staffed by intensivists with patients in distant ICUs. Continuous, real-time two-way audio, video, and electronic reports of vital signs connect the command center to the patients' bedsides. Computer-managed decision support systems track each patient's status and give alerts when negative trends are detected and when changes in treatment patterns are scheduled or indicated.[x]

Overview of the Technology. A tele-ICU system contains hardware that collects and assembles patient data and transmits it (including video and voice) from the remote ICU to the hub. The patient data include physiological status (e.g., vital signs and blood oxygenation), treatment (e.g., the infusion rate for a specific medicine or the results of laboratory tests and radiological images and interpretations), and medical records. The hardware is designed to provide the clinicians in the hub and the ICU with the same patient data. The software for a tele-ICU includes the programs that make all the monitoring and information transmission hardware function properly and efficiently.

"Tele-intensivists" are critical care physicians who practice medicine via interactive audio-visual equipment, using computers to track data trends and access best-practice protocols for patient care. One tele-ICU hub can provide care for up to 500 patients, with staffing constellations of one tele-intensivist, four advanced practice nurses and a pharmacist to care for 75 patients. Satellite hospitals can wire a few ICU beds or many ICU beds for tele-ICU technology depending on need. By increasing the number of ICU patients that critical care teams can manage, tele-ICU technology can effectively extend both the productivity and the reach of intensivists, other critical care specialists and nursing staff.

What Are Tele-ICUs?

Tele-ICUs are audio-visual and patient monitoring systems that link physicians and nurses who specialize in critical medicine—"intensivists" – in a command center (or "hub") to ICU patients in multiple, distant units. The key components of tele-ICUs include:

- **Tele-intensivists** (physicians and nurses) who manage care from the hub **(**which may also be referred to as a **"**support center**")**;
- **Monitoring systems** that track patients' status, send alarms when a patient's status changes and permit full audio-visual communication between clinicians at the hub and in the ICU;
- **Protocols and treatment reviews** for patient management that are built into the monitoring and alert systems to indicate when changes in care should take place.

Where and How Widely Used Are Tele-ICUs? The first tele-ICU was implemented in 2000 by the Sentara hospital system in Norfolk, Virginia, to manage two adult ICUs. This tele-ICU hub was installed by VISICU, at that time the only commercial firm offering tele-ICU installations and support services in the U.S. market. Since then, iMDsoft, Cerner, and REACH Health have entered the U.S. market, and other firms (such as EPIC) are developing tele-ICU add-ons to their EMR products. In 2008, VISICU was acquired by Philips Electronics North American Corporation. Philips VISICU remains the leading tele-ICU vendor with 90 percent of market share.

Since the first tele-ICU installation, 44 new hubs have been installed throughout the U.S. Tele-ICUs are now scattered from coast to coast, however the portion of adult ICU beds covered by tele-ICU remains at roughly six percent of U.S. adult ICU beds. In California, 28 hospitals with about six percent of California ICU beds currently have tele-ICU

capability (roughly equivalent to the national average). More information about California's tele-ICU experience is included in Part 3 of this report.

Given the pressures discussed above — increasing numbers and severity of ICU patients combined with limited supplies of intensivists to care for those patients — the stalled adoption rates of tele-ICUs is puzzling. Clearly, there are barriers to the full adoption of tele-ICUs, keeping current dissemination of this technology at six percent of total adult ICU beds.

Barriers to Adoption of Tele-ICUs

Broader adoption of tele-ICUs is impeded by five commonly cited, pervasive barriers: high capital and operating costs, clinician resistance, unproven return on investment, lack of documented clinical outcomes, and lack of interoperability with legacy or electronic medical record systems (EMRs). These barriers are summarized below.

Costs of Tele-ICUs. While tele-ICUs provide technology platforms that allow ICU specialists to support the care of greater numbers of ICU patients, the initial capital costs can be expensive.

Capital and Acquisition Costs. It is estimated that it costs from $4 million to $6 million in one-time capital costs to set up a command center, acquire and install the tele-ICU systems for 120 beds, and pay the initial salaries for the tele-ICU staff. This estimate will vary depending on the number of ICUs and number of ICU beds (for example, the start up cost for a hospital with three ICUs and 60 beds is estimated at $2.9 million, whereas a hospital with eight ICUs and 190 beds will incur about $5.7 in one time start up costs). Capital implementation costs for a satellite hospital to acquire and install tele-ICU technology range from $300,000 to $1 million, also dependent upon ICU size and complexity. These costs may be a challenge for hospitals that lack significant financial reserves or borrowing capacity for capital.

Operating Costs. Annual operating costs of command centers themselves are not publicly reported and vary with the number of distant hospitals (satellites) and beds covered. Informal reports from hospitals maintaining command centers have estimated operating costs varying from $1 to $4 million per year. Operating and maintenance costs include expenses for staffing the tele-ICU command center, licensing fees for the software, and periodic upgrades to the hardware or software. For satellite hospitals, there is typically an annual contracting fee paid to the hub for providing ICU care to satellite locations (this fee can range from $23,000 to $40,000 per bed per year). Additional costs could also be associated with implementing new standardized care processes with the health care professionals in the ICU and the tele-ICU.[xi]

Lack of Clinical Outcome Data for Tele-ICUs. Hospitals considering investing in tele-ICUs must balance their substantial capital and operating costs against unknown returns on improved patient outcomes. While the number of published tele-ICU outcomes assessments is growing, the findings vary in terms of what outcomes are measured and what settings and conditions attend the tele-ICU use. The findings available to date strongly suggest that a hospital and its ICUs' particular circumstances influence the outcomes that may result post tele-ICU coverage. But hospital management giving careful consideration to what it might gain from tele-ICU coverage would be hard-pressed to project the patient and financial outcomes most likely to result for their hospital. Hospital managers would also have little indication of how to adjust for their hospital's particular practice patterns, ICU patient mix, hospital staffing, referral and transfer patterns, and ICU occupancy rates if they were to adopt tele-ICU.

Limited Data on Financial Return on Investment. Another barrier has been the lack of studies evaluating the financial return on investment for tele-ICU. As a result, hospitals have had few research findings to guide them when considering whether they can afford tele-ICUs, whether they can offset their costs with savings, whether the technology would allow them to care for more ICU patients. The tele-ICU demonstration study conducted by NEHI and partners in Massachusetts (attached as Appendix A, summarized below and in a subsequent article in *JAMA* (May 2011) provides evidence of the clinical and financial benefits of tele-ICU.[x]

Clinician Resistance. It has long been known that physician leadership is a critical factor in enabling change in health care. This is especially true when innovations disrupt the normal patterns of care or threaten traditional and familiar health care provider roles. The tele-ICU technology, when implemented in a community hospital setting, can displace the local physician because the responsibility for care is shared with the clinical staff at the tele-ICU hub. Although each tele-ICU hub can establish different levels of support for the satellite hospitals, the end result is that the physicians at the community hospitals must relinquish some element of autonomy in order for the technology to be successful. In situations where the hospital leadership has failed to address these issues of autonomy and independence, physicians have at times refused to participate in the tele-ICU process. In the long run, enthusiastic physician leadership and participation is critical to the adoption of tele-ICU. Hospitals might also benefit from paying physicians directly for their tele-ICU participation. As public and private payers move to global service fees or bundled payments, revenue-sharing models between the hospitals and the physicians may emerge that eliminate or at least decrease the problem of clinician resistance.

Lack of Technical Interoperability. One challenge in developing tele-ICU software is to enable it to interface with and electronically accept data from other electronic information systems that serve the ICU (e.g., laboratory results, medications, nursing flow sheets, physicians' notes, etc.). As with many sophisticated software products, building

connectivity with initially incompatible systems is possible but can take time and money. Furthermore, any tele-ICU systems do not yet connect seamlessly with electronic medical records used on patient floors. This systems incompatibility may require unit personnel to scan tele-ICU records into the EMR or require the purchase of additional software to connect the two systems. Interoperability of EMR systems is improving as tele-ICU vendors and EMR vendors both endeavor to address this challenge.

Part 2. Building the Evidence-Base for Tele-ICU

Over the past year, several important studies and calls for research on tele-ICU technology have been released. Recent developments adding to the evidence base for tele-ICU are highlighted below.

(1) A Tele-ICU Demonstration in Massachusetts

A pre and post tele-ICU coverage study conducted by NEHI and the Massachusetts Technology Collaborative between 2008-2010 aimed to test the clinical and financial benefits of tele-ICU technology on two important outcomes: ICU mortality and ICU length of stay. Data for this study were collected from three sites in Massachusetts: an academic medical center with seven adult ICUs (University of Massachusetts Memorial Medical Center, referred to as UMMMC) and two community hospitals. Results are detailed in NEHI's 2010 report, *Critical Care, Critical Choices: The Case for Tele-ICUs in Intensive Care* (attached as Appendix A) and in a JAMA article published in May 2011.

A summary of the results of this demonstration are as follows:

1. *Significant declines in ICU mortality were observed in two of the three hospitals.*
    - There was a 20 percent decline in ICU mortality at UMMMC at the same time that the APACHE III scores increased by 13 points; and
    - There was a 36 percent decline (after severity adjustment) at one of the two community hospitals.
2. *There was an increase in mortality at the second community hospital.* In the pre-implementation period, this hospital had an abnormally low ICU mortality rate of 2.1 percent, as it transferred most of its critically ill patients to UMMMC. After implementation of tele-ICUs, it retained 23 percent more of the acute patients that presented to the Emergency Department and its mortality rate rose to a more average 7.3 percent.
3. *The patient length of stay in the ICU decreased.* There was a 30 percent shorter average length of stay at UMMMC, and 16 percent and 42 percent decreases in ICU length of stay at the two community hospitals.
4. *There was a rapid payback period for the financial investments of participating hospitals.* The up-front investments of $7.1M at UMMMC and $400,000 at each community hospital were paid back in full within one year. Hospitals realized a significant return on their investment.
5. *Tele-ICUs resulted in financial benefit to payers.* Patients treated in community hospitals using tele-ICUs were less expensive ($10,000 less per patient) than the same patients treated in the academic medical center ICUs. In addition, the average cost per case in the academic medical center was reduced by $2,600.

6. *There were fewer patient complications with tele-ICU care.* There were significant decreases in hospital-acquired infections associated with the use of ventilators and central lines in the ICU.

(2) Meta-analysis

In the *Archives of Internal Medicine (*March 28, 2011), Young et. al. published the findings of a meta-analysis conducted to examine the impact of tele-ICU coverage on mortality and length of stay. The meta-analysis involved a systematic review of studies published from 1950 through September 2010 that reported data on the primary outcomes of ICU and in-hospital mortality or on the secondary outcomes of ICU and hospital length of stay. The authors identified 13 eligible studies involving 35 ICUs and 41,374 patients. All of the studies used a before-and-after tele-ICU design. Young et al. concluded that tele-ICU coverage is associated with lower ICU mortality and ICU length of stay, however, they did not observe lower in-hospital mortality or length of stay with tele-ICU. The authors noted that tele-ICU is a multi-faceted intervention and across the 13 studies there was great variation in how tele-ICU coverage was defined, implemented and evaluated. They concluded that more rigorous evaluation of tele-ICU coverage is needed to accurately assess the clinical impacts of tele-ICU, particularly in care settings outside of the ICU.

(3) Other Research on Tele-ICU

Other relevant ongoing research on use of tele-ICU includes a national study funded by the Health Resources and Services Administration (HRSA), *Analysis and Evaluation of Electronic Intensive Care Services that Are Being Utilized in Rural Areas*, conducted by Walter R. McDonald & Associates. In funding this research, HRSA recognized that one of the greatest potential benefits of tele-ICUs may be the prospect of providing more advanced care in rural areas. The findings and recommendations of this evaluation of three rural tele-ICU programs will provide HRSA and the field with useful information regarding the effectiveness, benefits and barriers to using tele-ICUs to provide high quality health care services in rural areas.

Another noteworthy ongoing study is the American Association of Critical Care Nurses' examination of the impact of tele-ICUs on ICU nursing care. This study will inform the development of guidelines for critical care nursing on the adoption, staffing and deployment of tele-ICU technology by hospitals. The study is a collaboration among investigators at Rush University Medical Center, Baptist Health South Florida, Resurrection Health Care, the University of Massachusetts Memorial Medical Center and Eastern Maine Medical Center.

Other recent research demonstrates a few health systems seeing added benefits from tele-ICU adoption even in circumstances where hospitals have sufficient intensivist staffing. For example, Maine Medical Center - a 600-bed academic medical center with a strong

critical care program - has had 24-hour attending-level, critical care intensivist coverage since 1995. Maine Medical Center installed tele-ICU care in 2005 in medical, surgical and neurological ICUs and measured the changes in mortality for seven weeks prior to and seven weeks after tele-ICU implementation. Even with full intensivist coverage, Maine Medical Center achieved a 20 percent reduction in mortality with tele-ICU care, primarily due to increased patient monitoring and earlier clinical interventions that prevented complications and adverse events.

(4) Expert Testimony

A February 2011 article in *Becker's Hospital Review* derived from expert interviews highlights ways in which tele-ICU technology has been shown to help hospitals improve ICU outcomes, reduce ICU costs, improve physician relationships, and provide more efficient patient care. The following observations are made:

- *Tele-ICUs reduce patient mortality, complications and costs.* Hospitals that adopt tele-ICU technology typically see a 40 percent reduction in mortality and 25 percent reduction in ICU length of stay. Decrease in length of stay also reduces complications and lowers the cost of ICU care.
- *Tele-ICUs increase ICU patient volume and allow better patient retention by community hospitals.* A tele-ICU program allows hospitals to retain as many ICU patients in the community as possible. Community hospitals that adopt tele-ICU technology and the 24/7 intensivist support provided, typically see a 17 percent patient volume growth in the ICU.
- *Tele-ICUs improve physician recruitment capabilities.* Continuous monitoring by intensivists (made possible through tele-ICUs) reduces the need for physicians in community hospitals to respond to emergency calls at all hours, improves physician work-life balance and increases satisfaction.
- *Tele-ICUs free up resources and physicians for coordinated care.* With health reform and the emergence of Accountable Care Organizations (ACOs), hospitals are shifting their focus to the continuum of care, improved quality and lower costs. Tele-ICUs allow hospitals to better deploy physician resources in the community which better enables ACOs to meet new Medicare ACO performance goals.
- *Unlike most healthcare affiliations or partnerships, tele-ICU programs are not limited by geographic restrictions.*

(5) A Research Agenda for ICU Telemedicine - A Statement from the Critical Care Societies Collaborative

Published in CHEST (June 2011) is a statement from an interdisciplinary group of critical care experts: the Critical Care Societies Collaborative. In this Statement, the Collaborative concludes that tele-ICU has significant potential to improve critical care delivery but that high quality research is needed to best inform its use. The workgroup proposed a research framework and Agenda to advance the science of ICU telemedicine. The goal of this Agenda is to generate tele-ICU research with the greatest potential to

improve patient care. According to the authors, future research on tele-ICU should attempt to address causation instead of simply associations and elucidate the mechanism of action in order to determine exactly how tele-ICU achieves its effects.[x] This research framework and Agenda will shed further light on the optimal uses of tele-ICU and its potential to improve patient care.

Part Three. Planning for Tele-ICUs in California: Examining Opportunities and Barriers for Tele-ICU

A project of the California HealthCare Foundation, *Planning for Tele-ICUs in California* examined the need and opportunity for tele-ICUs in California through an environmental scan of critical care in California. Goals of the project were to (1) identify regions of the State with the greatest need for critical care capacity, improvement of ICU outcomes or efficiency, and (2) identify (and where possible, address) financial, regulatory and policy barriers to tele-ICU in California. Tele-ICU, a telemedicine technology, has the potential to address critical care challenges by enabling intensivists in one tele-ICU "command center" or "hub" to remotely monitor , consult and care for ICU patients in multiple and distant locations. By increasing the number of ICU patients that critical care teams can manage, tele-ICUs effectively extend and leverage both the productivity and the reach of the specialists. *Planning for Tele-ICUs in California* was conducted by NEHI in collaboration with the Center for Connected Health Policy (CCHP) from December 2010 through October 2011.

A first phase of *Planning for Tele-ICUs in California* featured an environmental scan of critical care and tele-ICU operations in the State. Goals of this phase were to examine:

1. Adult ICU utilization in California hospitals to identify regions of unmet need for critical care, and regional opportunities for improving ICU capacity, quality and efficiency; and
2. Stakeholder perceptions of critical care in California, including challenges facing critical care, the potential role of tele-ICUs in addressing these challenges, other recommended solutions, and perceived benefits of and barriers to tele-ICU expansion.

Data to inform the environmental scan included CHART 2011 ICU outcomes; ICU utilization data from the Office of Statewide Health Planning & Development (OSHPD) and from the Dartmouth Atlas of Health Care; data on intensivist staffing levels from The Leapfrog Group; and input from 36 state and national experts and from California hospital executives (see Appendix B for a List of Phase 1 Contributors).

Key findings from *Planning for Tele-ICUs in California* are summarized below.

Tele-ICU Presence in California

Six percent of ICU beds in California are currently wired for tele-ICU and all tele-ICU installations are in northern California (see Figure 2, Tele-ICU Presence in California). As shown in Figure 2, Sutter Health (Sutter) and John Muir Health (JM) operate the only tele-ICU command centers (both in northern California). Both have implemented the VISICU tele-ICU system (*eICU*). Saint Joseph Health System has three satellite ICUs connected to

the Sutter hub in San Francisco. Banner Health operates a small tele-intensivist hub in Los Angeles County that supports Banner hospitals outside of California. In stakeholder interviews, representatives from Sutter and JM described their experiences with tele-ICU implementation, how these systems are currently used in their hospitals, and the challenges and benefits of tele-ICUs that have been observed at each system.

Sutter Health

The first health system to adopt tele-ICU technology in California, Sutter operates two tele-ICU hubs (one in Sacramento and a second in San Francisco) with 26 satellite hospitals, including three non-Sutter affiliates. Sutter reports that it took several years to fully implement across all 26 satellite locations, and that they have had a good experience with tele-ICUs overall. While tele-ICU is working well at most satellite locations, Sutter reports some challenges. For example, at a few satellites, tele-ICU has been met with ambivalence and, in some sites, lack of connectivity of the tele-ICU EMR to the hospital EMR has meant delays in treatments and increased burden on the nursing staff.

An early tele-ICU adopter, Sutter reports that human factors proved more important than the technology in determining tele-ICU's success at Sutter. In particular, getting physicians on board with the technology has been key. At some satellite locations, ICU physicians were initially resistant and felt threatened that tele-ICU technology would take away their autonomy and decrease their revenues. Sutter reports, once tele-ICUs were implemented, physicians found that this was generally not the case. Physicians in satellite locations also found that tele-ICUs reduced the amount of time they needed to be on call, especially overnight. Nevertheless, Sutter reports a bi-modal distribution of satellite physician satisfaction with tele-ICUs: physicians either appreciate the expert intensivist consultation or they dislike what they perceive as a loss of independence. In summary, Sutter has learned that tele-ICU technology enables better patient care, but addressing human factors (such as trust, strong leadership and willingness to embrace shared decision making) is far more important in successful tele-ICU implementation than the technology. In spite of these challenges, the benefits of tele-ICU at Sutter have been strong. Sutter reports reduced ICU length of stay associated with tele-ICUs and positive financial returns.

Sutter reports that its existing tele-ICU hub capacity can be deployed or readily expanded to handle a large number of additional ICU beds. Sutter is interested in expanding its tele-ICU program to additional satellite ICUs where there is medical need, clinical buy-in and sufficient financial support to defray costs. Experts outside of Sutter identified Sutter's tele-ICU service price, competitive factors, and a general lack of awareness in California of the potential benefit of tele-ICUs as key reasons why Sutter's tele-ICU service has not grown faster. Sutter is currently adding other applications to its tele-ICU network, including tele-hospitalists and specialty tele-consultation.

John Muir Health

Since 2006, JM has operated the *eICU* system at two California sites - in Concord and in Walnut Creek. JM also has 12 board certified intensivists at these sites. JM reports that the first year of tele-ICU implementation at JM was challenging on three fronts: getting physicians aligned to use the new system, prioritizing tele-ICU implementation among other IT needs, and financing the cost of the system. After "a tough first year," JM reports a high level of satisfaction with the results of *e-ICU*. JM reports physicians and nurses are willing to use the system and they report strong satisfaction with tele-intensivist support.

Since 2008, JM has seen a 36 percent reduction in mortality at Concord and an 18 percent reduction at Walnut Creek. Also during this period, ICU length of stay has declined 31 percent at Concord and 16 percent at Walnut Creek. The number of cardiac arrests declined by 31 percent overall, sepsis mortality decreased, and ICU bundle compliance for ventilator and central line use increased with e-ICU. Similar to the Maine Medical Center experience, JM notes that these improvements were realized with 12 intensivists already covering JM ICUs. JM also reports a positive financial return on its tele-ICU investment.

JM has successfully deployed this technology beyond the ICU to connect emergency and neurology departments to its intensivist hubs. In 2011, JM is preparing to expand its satellite network to sites outside of the JM network. JM's expansion targets include hospitals that: are located within the same region of the state; have a similar IT platform as JM; do not have board certified intensivists on staff; seek to improve ICU length of stay and outcomes; and are financially solvent and able to afford a tele-ICU satellite solution.

An Environmental Scan of Critical Care in California: Summary of Key Findings

In *Planning for Tele-ICUs in California*, NEHI examined California ICU outcomes and utilization to identify regions of the state where additional ICU capacity, quality improvement or efficiency may be warranted. Evidence suggests that in these regions, tele-ICU technology could be a way to address critical care needs. Environmental scan observations are summarized below.

ICU Outcomes

The Dartmouth Atlas ranks California 49th out of 50 states on ICU mortality among Medicare patients. In 2005, California's ICU mortality rate was 20.6 percent, compared to 17 percent nationally. Risk-adjusted ICU mortality data from CHART in 2011 (as shown in www.calhospitalcompare.org) compares California hospital ICU mortality rates against the statewide average ICU mortality rate. CHART data revealed that many counties present opportunities for ICU mortality improvement. For example: CHART identified Los Angeles County as having 3 hospitals with superior (above average) performance on ICU mortality; 37 hospitals with average performance; 11 hospitals with below average performance; and one hospital with poor performance compared to the

California average ICU mortality rate. Also, 31 Los Angeles County ICUs declined to report ICU mortality. In San Bernadino County, CHART data revealed four hospitals with below average ICU mortality performance and four with average performance compared to the California average ICU mortality rate. Both of these Counties demonstrate significant regional opportunities to improve ICU mortality against a statewide average that ranks second to last in the nation.

ICU Utilization

California hospital utilization data (the OSHPD 2009 Annual Utilization Report of Hospitals Database) was used to examine adult ICU capacity (OSHPD captures ICU and cardiac care unit beds combined). All California hospitals with six or more ICU beds were examined on the following variables*: number of ICU beds, number of bed days, number of ICU discharges, number of ICU transfers, number of patient census days, ICU average length of stay (ALOS), ICU occupancy rate, and whether the hospital is located in a predominantly rural or urban area. ICU data were sorted by county, by county groupings (according to the map in Figure 4) and by health system. All major health systems operating in California were included in the analysis: Kaiser Permanente, Catholic Healthcare West, Sutter Health, Adventist Health System, Hospital Corporation of America, Tenet Healthcare, University of California, Scripps Health, Sharp Health System, University of Southern California, and Providence Health and Services. There was also a large category of unaffiliated hospitals.

* Industry sources identify six beds as the lower limit for cost-effective tele-ICU implementation. (add this as a footnote at bottom of page)

These data revealed 293 hospitals in California with six or more ICU beds. In 2009, these 293 hospitals had a total of 7,091 ICU beds, over 2.5 million bed days, an average ICU occupancy rate of 64 percent, an average length of stay (ALOS) of 3.7 days, and an ALOS upward range as high as 19 days.

Data from The Dartmouth Atlas (2009) was used to determine the number of critical care physicians in regions of California. Figure 3 (Supply of Critical Care Physicians in California) illustrates an overall short supply of intensivists and some areas of severe shortage. California hospital executives confirmed this overall shortage of intensivists is particularly acute in rural areas.

Leapfrog ratings of hospital intensivist staffing were also examined. In 2010, many California hospitals declined to report intensivist staffing data to Leapfrog. Only 58 hospitals (less than 20 percent of California's ICUs) reported levels of intensivist staffing that fully met the Leapfrog standard for intensivist staffing in the ICU. These findings highlight the need for new approaches that will enable scarce intensivist resources to be leveraged.

Planning for Tele-ICUs in California's environmental scan revealed the following key findings:

Finding #1: Critical care in California faces significant challenges

California's high ICU mortality rate of 20.6 percent is the greatest and most urgent challenge facing critical care in California. Steps must be taken to reduce mortality and improve ICU outcomes. Other important challenges include:

- Insufficient supply of intensivists and critical care nurses statewide;
- Insufficient access to critical care particularly in rural areas; and
- In some urban areas where ICUs have strained capacity. In these areas there may be opportunity for better ICU care management, more efficient throughput and lower ICU costs.

Evidence suggests that tele-ICU technology could help address these challenges and provide benefit in the following ways:

- Improving ICU outcomes through greater use of intensivists;
- Improving ICU capacity by leveraging intensivist and critical care nurse staffing to areas where there is insufficient supply of critical care professionals or unmet need for critical care;
- Providing consultation, training and mentoring to nurses and physicians in satellite hospitals with less experience in critical care; and
- Supporting appropriate ICU processes of care, patient admission to the unit, and oversight of ICU cases for better ICU care management and more efficient throughput of ICU cases.

Finding #2: Regional opportunities exist for improving critical care

Regional analyses suggest the following targets where tele-ICU-supported critical care might be beneficial:

- Rural areas with little or no access to critical care specialists; and
- Urban centers where many ICUs operate at high capacity (at 85-100 percent occupancy on average and with higher ALOS and greater variation in ALOS compared to other ICUs in the region). Regions with high ICU occupancy may present opportunities for better ICU throughput and better, more efficient regional management of ICU care through tele-ICU.

ICU throughput can be stalled for many reasons, such as when patients who medically do not need to be in the ICU are cared for in the ICU, when patients remain in the ICU longer than needed because the physician wants them to be observed more closely or to have more skilled nursing care than they might get on a patient floor, or when payers are willing to cover the cost of additional ICU care. In a 2007 study of California ICUs, KSA found a wide degree of variation in ICU ALOS among California hospitals that could not

be explained by variation in severity of patient illness (30 percent of California hospitals had excessive ICU lengths of stay relative to their ICU case mix score). KSA found geographic regions with very high ICU utilization, including Los Angeles and Orange Counties. Tele-ICU technology has been shown to help high occupancy ICUs reduce length of stay, improve throughput and increase capacity.

In Planning for Tele-ICUs in California, the following geographic regions were identified in need of expanding or improving critical care (see also Figure 4. Target Regions for Tele-ICU Adoption):

- Los Angeles County;
- San Bernardino County;
- Riverside County;
- Central Valley counties including San Joaquin, Stanislaus, Merced, Fresno, Kings, Tulare and Kern Counties; and
- The rural Eastern Sierra region: Inyo, Mono and Alpine Counties.

Feedback from experts and California hospital executives confirmed these regional findings and identified specific hospital systems for targeted outreach, including the University of California system, public hospitals, and systems with a large rural presence such as Catholic HealthCare West and Adventist Health (in addition to Sutter Health which has already begun using tele-ICU effectively in a few rural areas of northern California).

Tele-ICU command centers can typically manage 500 ICU beds in a tele-ICU network. Regions with unmet needs for critical care could be served by health systems interested in operating or expanding tele-ICU care in California.

Finding #3: Barriers to tele-ICU in California

Many of the barriers to tele-ICU adoption outlined in Part 1 of this report are present in California. *In Planning for Tele-ICUs in California,* NEHI asked experts to identify and rank barriers to tele-ICU adoption in California.

Experts highlighted lack of capital available to hospitals as the number one barrier to tele-ICU adoption. The number two anticipated barrier is resistance among community-based and admitting physicians to sharing or relinquishing treatment decisions and control to tele-intensivists. This barrier highlights the importance of communications as well as strategies to reinforce shared decision making and cultural acceptance of tele-ICU as key components of effective tele-ICU implementation. The following expert quotes illustrate the importance of communications and fostering physician acceptance when implementing tele-ICU:

- "Communication prior to tele-ICU launch is critical. It is important to establish good physician relations, good two-way communication, and clear expectations regarding what tele-ICU will offer, how it will work, and what's needed for it to succeed."
- "Human factors can play a big role in successful adoption: Are nurses and physicians on board with tele-ICU? Is the eICU fully implemented? Are satellites sending data to the command center? These factors will determine success."

Several interviewees noted that resistance to intensivist support among admitting physicians in rural areas is less likely than in urban areas. "Rural providers appreciate having access to ICU expertise that is not available in their communities."

A third barrier to tele-ICU adoption in California is competition for IT project financing within hospitals and health systems. Many California hospitals have EMR implementation or other significant IT projects already underway, and the concern is that tele-ICU EMR adoption will be delayed or not rise to the top of the priority list. Fourth, experts see lack of tele-ICU EMR interoperability with EPIC and legacy IT systems remaining a barrier to tele-ICU in California for some time. Vendors are working to resolve challenges with interoperability, therefore, this barrier will likely diminish over time.

A fifth barrier is uncertainty about revenue from tele-ICU, including concerns over reimbursement and inability to assess return on tele-ICU investment. Research indicates that revenue from tele-ICU is primarily generated by reduction in ICU length of stay (Medicare case-based payment allows hospitals to benefit financially if patient length of stay can be reduced).[x] The greater the potential for reduction in ICU length of stay, the greater the savings to be realized. Other savings from tele-ICU can result from fewer complications and shorter lengths of stay in Medical/Surgical units following discharge from ICUs managed or supported by tele-intensivists. Helping hospitals accurately assess the potential revenue and return on investment from tele-ICU was a component of *Planning for Tele-ICUs in California* in Phase 2.

Reimbursement for tele-ICU is also a factor influencing its adoption. In California, Medi-Cal currently makes no reimbursement distinction between in-person and telehealth care/services provided. Medi-Cal will generally reimburse for telehealth services. Medicare reimburses for ICU care (higher acuity cases receive higher payment) but provides no additional hospital reimbursement for tele-ICU service. Medicare does not pay for e-visits or consults even in rural areas where there is no other access to specialty care. As a result of Medicare's policy, California providers view reimbursement from telehealth (and tele-ICU) as improving but still insufficient.

A sixth noted barrier is lack of connectivity and broadband access remaining in some rural areas of California. The statewide broadband expansion efforts of the California Telehealth Network are anticipated to eliminate this barrier in the near term.

A final noteworthy barrier to tele-ICU expansion is a general lack of awareness about this technology. It is surprising how many California health care executives were unaware of this technology and its clinical and financial potential.

Finding #4: Perceptions on the future of tele-ICU technology in California and other approaches to critical care

In spite of the barriers noted above, experts believe that the use of tele-ICU (and other telehealth technologies in the ICU setting) will expand in California over the next five years. Experts anticipate the following:

- Growth of stand-alone, continuous monitoring tele-ICU systems like the Philips VISICU *eICU*.
- Expansion of hospital-wide e-record systems that possess or are developing specialized EMRs with audio-visual monitoring capabilities for ICU, such as the EPIC Level 7 EMR.
- Expansion of robotic telemedicine and smaller-scale tele-ICU installations (such as mobile tele-ICU carts) to support ICU care in small, rural community and critical-access hospitals. For example, in the North Coast region of California (including several Adventist Health hospitals), successful deployment of the OffsiteCare Solution provides intensivist and specialty care consultation aided through robotic telemedicine. Alternatively, experts suggest that in rural areas, wiring a few ICU beds for connection with a tele-ICU hub would provide sufficient intensivist coverage for a region.
- Expanding the use of hospitalists with access to intensivist consultation (through tele-ICUs, robotic telemedicine or other telehealth technologies) to staff ICUs. ICU staffing by hospitalists with intensivist consultation is now occurring at UCSF and Sutter Health.

Guidelines are needed for determining when tele-ICUs offer the best critical care solution versus in what circumstances other tele-intervention alternatives (like robotic telemedicine) are best suited or more cost effective for expanding critical care.

Finding #5: Drivers of successful tele-ICU implementation

Research and expert interviews identified the following drivers or determinants of successful tele-ICU adoption. Attention must be paid to:

- Human factors: For tele-ICU to be successful, senior leaders must prioritize, support and reinforce - and physicians and nurses must accept and embrace - use of tele-ICU technology, particularly in satellite locations. Good communication

and collaborative working relations must be established among providers in satellites and in hubs. Effective communication about the importance of "shared decision-making" between hub and satellite physicians is key. For example, physicians in satellite locations may be more receptive to working with a tele-ICU "hub" or "support center" as opposed to a tele-ICU "command center."

- IT system interoperability is necessary for efficient, safe, optimal use of tele-ICUs. Current tele-ICU users in California underscored the importance of this point.
- Clarity about tele-ICU return on investment. NEHI's Massachusetts demonstration revealed significant cost savings to hospitals and payers resulting from tele-ICU implementation, even in one hospital where the local physicians were unsupportive of the technology. The support center at UMMMC saved $20.4M in one year of tele-ICU operation, and the two community hospitals together saved $2.6M. In California, executives believe that the financial benefits of tele-ICUs would be strongest for hospitals in vertically integrated systems, and weakest for hospitals that already have tightly managed lengths of stay. Experts also noted that California hospitals considering tele-ICU would benefit from guidelines for estimating their potential revenue and return on investment from tele-ICU: "Right now hospitals have no way of knowing or estimating their returns from tele-ICU."

Experts suggest that hospitals considering tele-ICU technology must answer three questions for their facilities:

1. Will tele-ICU adoption improve our ICU outcomes and quality of care?
2. Will tele-ICU adoption bring increased ICU market share?, and
3. If we incur the cost of tele-ICU adoption, will revenue from reduced ICU length of stay and increased ICU market share result in a positive ROI? [Guidelines for calculating revenue and return on investment from tele-ICU were developed in Phase 2 of *Planning for Tele-ICUs in California*.]

In addition, among the 30 federally designated Critical Access Hospitals in California, a fourth question is: will tele-ICU adoption and the resulting expansion of ICU services, adversely impact this designation and their cost-based reimbursement rate?

Finding #6: The policy environment is becoming more favorable for tele-ICU

Recent State and federal policy developments are advancing telehealth, physician credentialing, reimbursement, and the regulatory environment for tele-ICU in California. These policy opportunities were interpreted and communicated to California providers in Phase 2 of *Planning for Tele-ICUs in California*. Other policy developments are creating the necessary infrastructure for tele-health across California. Statewide broadband deployment underway through the California TeleHealth Network (CTN) has dramatically increased rural access to telehealth statewide, making it possible for tele-ICU expansion into regions with limited critical care access. Other regional telehealth

efforts underway in California (such as the Broadband Technology Opportunities Program, BTOP) are also improving regional health care services. Together these policy developments create the technical infrastructure and a more favorable administrative, financial and regulatory environment for tele-ICU in California.

Part Four. Planning for Tele-ICUs in California: Addressing Barriers to Tele-ICU Expansion

In a second phase of *Planning for Tele-ICU in California* (April to October, 2011), the project team addressed barriers to tele-ICU, focusing activities in areas of the State identified in Phase 1 as regional targets for critical care improvement. This was accomplished through four sets of activities:

1. Convened forums in Los Angeles, San Bernardino and Riverside Counties, and with targeted health systems to raise awareness about local critical care challenges and tele-ICU technology as a potential solution to these challenges. A third convening in Sacramento in November 2011 will engage California health systems, health plans and purchasers in a statewide forum.
2. Worked with PriceWaterhouseCoopers to estimate the revenue and return on investment potential of tele-ICU in Southern California.
3. Fostered communication with and among providers, payers and purchasers about the clinical and financial potential of tele-ICU, and
4. Examined policy and regulatory barriers and opportunities for tele-ICU, and addressed those barriers where possible.

In collaboration with the California HealthCare Foundation, the Center for Connected Health Policy, and the Hospital Association of Southern California, NEHI convened sixty hospital stakeholders to attend informational forums on tele-ICU in September 2011 (one forum was held in Los Angeles County and a second in Riverside County). A list of participating organizations is shown in Figure 5. At these forums, information was shared about the regional opportunity for improving critical care in Los Angeles, San Bernardino and Riverside Counties; the clinical and financial benefits of tele-ICU; critical success factors for tele-ICU implementation; guidelines for calculating return on tele-ICU investment; and current information on the reimbursement, policy and regulatory environment to inform providers about the opportunities and requirements of tele-ICU operation in California. These forums featured local speakers and support from the regional hospital association, and fostered dialogue among providers to stimulate regional solutions to critical care challenges.

[Rushmie: please make this section on UCLA a text box or side bar presentation] UCLA's perspectives on the potential role of tele-ICU in Los Angeles County and the rationale for UCLA's interest in serving as a regional tele-ICU hub are summarized below. According to Dr. Molly Joel Coye, Chief Innovation Officer at UCLA, UCLA sees tele-ICU as a way to address four long-term regional goals: improving access to intensivists, meeting regional ICU coverage needs, improving outcomes, and supporting operations and financials for hospitals with ICUs. UCLA's current reality is chronic, full occupancy in ICUs and hospitals, coupled with State and County expectations for public institutions

and payor expectations regarding quality, cost and transparency of ICU care. Dr. Coye described UCLA's goal of "decompressing" its ICUs, and a scenario that would allow community partner hospitals (potential UCLA tele-ICU satellite locations) the opportunity to keep almost 50 percent of the patients they are now transferring to UCLA and other centers. UCLA sees tele-ICU as a way to reduce ICU mortality and complication rates, reduce discharges to long term acute care, and increase discharges to home. UCLA also sees tele-ICU technology providing research and innovation opportunities. Dr. Coye believes that tele-ICU represents an important opportunity for UCLA and for community hospitals interested in partnering with UCLA. She described the public health impact and role that tele-ICU technology might play in helping to meet ICU coverage needs in Los Angeles County.]

In addition to informational forums in southern California, outreach to California health systems was performed, including a session for all hospitals in the University of California system and outreach to leaders of the California Association of Public Hospital's Safety Net Institute and Kaiser Permanente.

To address financial barriers identified in *Planning for Tele-ICUs in California*, a tele-ICU revenue calculator was developed by PriceWaterhouseCoopers and NEHI for use by California hospitals (see Appendix 3. Estimating Revenue from Tele-ICU in Southern California). This tool was derived from the revenue and ROI model PriceWaterhouseCoopers developed for NEHI's Massachusetts tele-ICU demonstration. PriceWaterhouseCoopers modified the Massachusetts model to reflect southern California market conditions, taking into account local ICU average length of stay, reimbursement and other factors. Southern California forum participants received example scenarios of tele-ICU start up and operating costs, and an algorithm for estimating their own facilities' potential annualized revenue and return on investment from tele-ICU.

Also in Phase 2 of *Planning for Tele-ICUs in California*, the Center for Connected Health Policy (CCHP) and Health Management Associates conducted an in-depth analysis of policy and regulatory barriers and opportunities for tele-ICU in California. Some of the most significant barriers to tele-ICU adoption to date have been State and federal requirements for physician credentialing and lack of reimbursement for telehealth services. Policy developments over the past two years have come a long way in addressing these barriers. Highlights of CCHP's policy analysis are summarized below in a set of guidelines for hospitals considering tele-ICU operations.

Regulatory Implications of Tele-ICU

- Mario - this section is derived from CCHP's September 14 slides. Feel free to augment, edit or replace the text below...

Federal Medicare

- There are no identified regulatory barriers to implementing tele-ICU services in the Federal Medicare Conditions of Participation for hospitals, either in the requirements for intensive care services, or in the credentialing requirements.

- The federal hospital regulations (the Federal Medicare Conditions of Participation) were recently updated to provide more flexibility in credentialing of medical staff for telehealth purposes. This new option provides that the hospital receiving telehealth services for its patients may:
    - Enter into a written agreement with the hospital or entity providing telehealth services as long as the agreement specifies that the governing body of the distance-site hospital or entity attests that their credentialing processes meet federal Medicare requirements; and
    - Rely on information provided by the distance-site hospital or entity to make credentialing/privileging recommendations for physicians and other practitioners.

California Medi-Cal Policy and Telehealth

- Any health care service covered by Medi-Cal is reimbursed whether in-person or via synchronous (real-time) telehealth.
- The Telemedicine Act of 1996 provisions are outdated and have now created administrative and regulatory barriers. The Center for Connected Health Policy's Model Statute Report and Assembly Bill 415 (AB 415) seek to create legislative and administrative solutions.
- The benefits of AB 415 include:
    - A more expansive definition of telehealth
    - Eliminates the current Medi-Cal requirement to document a barrier to an in-person visit for coverage of services provide using telehealth
    - Eliminates the need for written informed consent for telehealth service
- Other benefits of AB 415 include that more attention has been drawn to telehealth and its potential to improve quality, access, efficiencies and reduce costs. Importantly, AB 415 aligns California law with federal regulations on credentialing and privileging by proxy. It resolves any potential conflict with California regulations and/or interpretation of those regulations. AB 415 also eliminates the need for written informed consent for telehealth services.

California Hospital Licensing Requirements for Medical Staff Credentialing

- There are no state hospital licensing regulatory barriers identified to implementing the federal option for credentialing medical staff.

- As of the date of issuance of this report (October 14, 2011), the California Department of Public Health, Licensing and Certification Program has chosen to interpret state regulations as prohibiting hospitals from implementing the new credentialing option for hospital telehealth services. A request for clarification is pending with the department.

- AB 415 (Logue) sponsored by the California State Rural Health Association was amended on 09/02/2011 to provide statutory clarification that the new Medicare credentialing option for hospital telehealth services is permitted in California. This bill is currently awaiting adoption by the state Legislature.

California Hospital Licensing Requirements for Tele-ICU

- There are no identified barriers to implementing tele-ICU in state licensing requirements if:

    - Patients who require intensive care unit level of care services are provided care in beds classified as intensive care beds;

    - The intensive care unit must meet state building standards for that category of bed;

    - The intensive care bedside nurse-to-patient ratio is maintained at all times; and

    - The patient has an attending physician or hospitalist who is onsite at the hospital.

- This would not preclude patients who require a level of care suitable for a step-down or telemetry unit from receiving "tele-ICU-like" services in a general acute care hospital bed.

Part Five. *Planning for Tele-ICUs in California:* Recommendations and Conclusions

Planning for Tele-ICUs in California accomplished the goal of identifying regions of the State where critical care access, capacity, quality and efficiency could be improved, and a second goal of fostering regional interest in tele-ICU as a strategy for improving critical care. Dialogue is now underway in Los Angeles, Riverside and San Bernardino Counties toward development of a tele-intensivist supported regional network of critical care, and in northern California, a third informational forum is planned. In northern California, one strategy for expanding critical care capacity may be to expand the Sutter Health and John Muir Health tele-ICU networks, increasing the number of satellites monitored by each hub. Rural areas of the State (such as the Eastern Sierra) and the Central Valley are also good targets for outreach about tele-ICU technology as a way to expand rural access to high quality, intensivist-supported ICU care.

Further support for tele-ICU adoption will come from policy and regulatory developments now underway. For example, as a result of recent revisions to the Medicare regulations for Conditions of Participation for hospitals, physician credentialing requirements for telehealth are far less onerous than before. The telehealth reimbursement environment is also improving. In addition, federal funds for rural tele-ICU expansion may soon be established by the Centers for Medicare and Medicaid Services (CMS), and the Center for Medicare and Medicaid Innovation (CMMI) has also been charged with exploration of tele-ICU expansion. Part III of the CMMI Agenda calls for programs "that will facilitate inpatient care, including intensive care, of hospitalized applicable individuals at their local hospital through the use of electronic monitoring by specialists, including intensivists and critical care specialists, based at integrated health systems." Funding available from CMS and CMMI would encourage more hospitals to explore implementation of tele-ICU technology. Lastly, emerging CMS policy creating bundled payment systems and reimbursement of Accountable Care Organizations will, by 2015, provide greater incentives to hospitals and other providers to adopt cost saving, quality enhancing strategies for regional management of critical care.

Planning for Tele-ICUs in California made considerable progress in highlighting and addressing barriers to tele-ICU expansion in California. Nevertheless, barriers still remain, including lack of capital for tele-ICU implementation, potential physician resistance to tele-ICU, and IT interoperability in some settings. Regarding lack of capital for tele-ICU, experts recommend the following possible sources of funding: State or foundation loan funds, bond initiatives, payor support, federal programs (potentially including CMS, CMMI, and the U.S. Department of Agriculture), or grants from hospital foundations or other private foundations. Regarding physician resistance and the human factors of tele-ICU implementation, experts recommend identification

and dissemination of best practices in human factor engineering and communication strategies to support successful tele-ICU installation.

Important research questions also remain. Some hospitals ask, what model of tele-ICU implementation is best suited to their hospital? Different models for tele-ICU implementation exist. A comparative description of the different models and guidelines for their implementation would benefit the field. In addition, hospitals considering tele-ICU hub status might ask: What is the patient profile or mix of ICU cases that will still be transferred to the hub (instead of receiving care locally at community hospitals)? These utilization patterns are not well understood. Prior studies have shown fewer cases transferred to tele-ICU hubs overall, but analysis of the kinds of cases that are likely to remain as hub transfers would help hospitals considering hub status to assess whether or not they would see a reduction in patient transfers resulting from tele-ICU.

Intensivist and critical care shortages in California and the U.S. will reach crisis levels unless solutions are created now. Growing evidence suggests that tele-ICU is a regional solution that will leverage intensivist reach and access to critical care, while improving ICU capacity, efficiency, quality, outcomes and cost of ICU care. Interested providers can benefit from timely policies at the State and federal level that are creating opportunity for tele-ICU adoption in California. Barriers addressed through *Planning for Tele-ICUs in California* will minimize roadblocks to creating tele-intensivist supported regional solutions to California's critical care crisis.

FOOTNOTES (partial list)

[i] Pronovost PJ, et al. Physician staffing patterns and clinical outcomes in critically ill patients: A systematic review. JAMA. 2002;288(17):2151-62.

[ii] Young (2000.)

[iii] Ibid.

[iv] Health Resources and Services Administration (HRSA). 2000. Report to Congress: The critical care workforce.

[v] U.S. Census Bureau. 2007. Decennial Report: Population estimates and projections.

[vi] HRSA. The critical care workforce: A study of the supply and demand for critical care physicians.

[vii] Halpern NA, Pastores SM, Greenstein RJ. Critical care medicine in the United States 1985–2000: An analysis of bed numbers, use, and costs. Crit Care Med. 2004;32(6):1254-9.

[viii] Oermann, MH. Effectiveness of a critical care nursing course: Preparing students for practice in critical care. Heart and Lung. 1991;20(3):278-83.

[ix] See the Leapfrog Group's fact sheet on ICU Physician Staffing, available at http://www.leapfroggroup.org/media/file/FactSheet_IPS.pdf.

[x] New England Healthcare Institute and Massachusetts Technology Collaborative. 2006. Tele-ICUs: Remote Management in Intensive Care Units.

[xi] Hospitals do not publish the costs of their tele-ICUs, but a few journal articles do offer examples: One published study of a tele-ICU managing two units calculated 6 month operating costs of $248,000 for hardware and software leasing, technical support, and operating expenses, with physician staffing costs adding an additional $624,000. Other hospitals and health systems have verbally reported higher operating costs of upwards of $1.5 million per year.