Rethinking the Use of Intensive Care Beds in California Hospitals

California HealthCare Foundation

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Introduction

Intensive care units (ICUs) have become an increasingly important part of the American health care delivery system. In 2000, critical care cost $55.5 billion—13.3 percent of total hospital costs and half a percent of the United States' gross domestic product.[1] As the population continues to age and the severity of hospital cases continues to increase, the role of the intensive care in hospital economics and in patients' lives is expected to become even more important.

Now is an appropriate time to review the utilization of intensive care units (ICUs) in California, as many of the state's hospitals have yet to begin construction to meet new seismic standards.[2] With experts projecting greater demand for critical care beds, many hospitals may be considering adding more ICU capacity as part of their construction plans. However, before launching such projects, it is important to consider whether there is an opportunity to improve the utilization of existing critical care beds.

Compounding the problem, California is facing a severe shortage of nurses over the next 25 years. Experts estimate that the state already lacks 14,000 nurses. Given that ICUs are heavy users of nursing staff—commonly maintaining a ratio of one nurse to two patients compared to one nurse to five patients on regular medical/surgical floors—reducing ICU utilization could have a beneficial impact on the demand for nurses.

This issue brief will address the following questions:

- How do the costs of critical care compare to the prevailing reimbursement amounts?
- How does utilization of critical care in California compare to the national rate?
- Is there an opportunity to reduce utilization of intensive care in California's hospitals?
- What benefits could California's hospitals realize from such a reduction, either in terms of lower costs, eased demand for nurses, or lessened pressure for additional ICU beds?

The data suggest that California hospitals may have the opportunity to make more efficient use of an expensive resource. Improving the utilization of ICU beds has the potential to save both money and labor, enhancing the financial viability of critical care and freeing hundreds of nurses for duties in other departments.

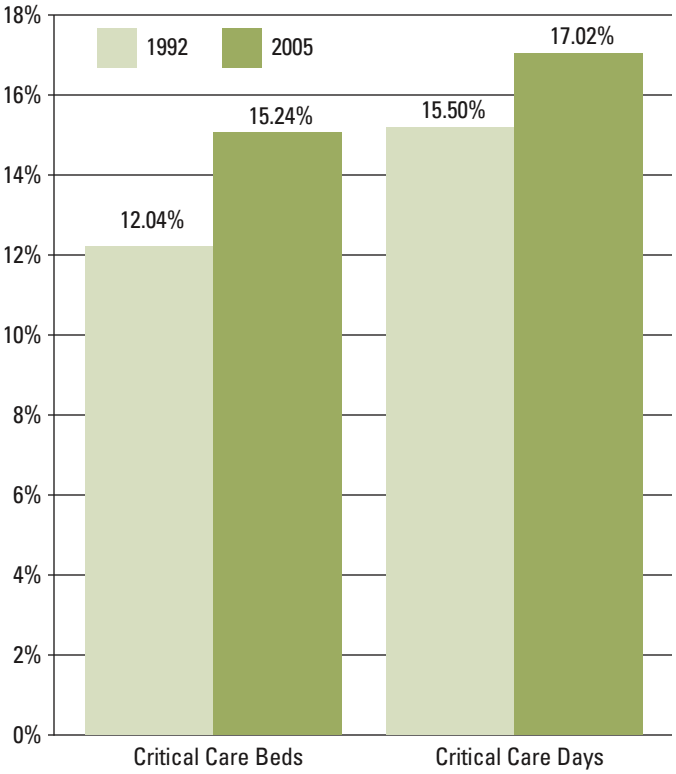
Hospital Reliance on Intensive Care Is Growing

Over the past two decades, hospitals across the United States have successfully changed their role in many ways, shortening the average length of stay for most conditions and moving numerous surgical procedures out of the hospital and into outpatient settings. One consequence of these cost-cutting strategies is that the population of patients at the average hospital is now made up of sicker people presenting more complicated cases.

The composition of hospital beds reflects this trend as hospitals across the country and in California now devote a higher portion of their total beds to critical care than they did 15 years ago.[3] During this period, the supply of non-critical care beds in the United States shrunk by 31 percent, while the supply of critical care beds increased 26 percent. As a result, the nationwide portion of total beds devoted to critical care grew from 7.8 percent to 13.4 percent.[4] In California, the portion of total beds devoted to critical care has grown from 12 percent in 1992 to 15.2 percent in 2005.

This expansion of critical care capacity has been closely matched by an increase in utilization. Critical care patient days in California climbed nearly 9 percent from 1992 to 2005, resulting in the growth of the portion of total patient days devoted to critical care from 15.5 percent in 1992 to 17 percent in 2005 (Figure 1).

Figure 1. Percent of Total General Acute Care Devoted to Critical Care, California Hospitals



Source: American Hospital Association

Barring significant changes in practice, experts anticipate that both the United States and California will see further increases in critical care patient days as the population ages. Patients aged 65 and older already consume over half of all critical care days, and the percentage of the population over 65 is projected to grow 10 percent from 2000 to 2020.[5] The Advisory Board Company estimates that ICU and coronary care unit (CCU) patient days will grow 10 percent from 2005 through 2015.[6]

ICUs as a Source of Financial Losses for Hospitals

An analysis of costs and reimbursements for Medicare patients admitted to United States hospitals in 2000 found that, on average, hospitals lose money on patients who spend at least one day in an ICU or a CCU, while they make money on patients who do not spend any time in such units.[7] Medicare pays, on average, 83 percent of costs for cases with an ICU stay compared to 105 percent of costs for cases without an ICU or CCU stay. For the average Medicare discharge with an ICU stay, hospital costs are $14,135, while reimbursement is only $11,704, resulting in a $2,431 loss on the average case. In 2000, hospitals across the nation lost an aggregate $5.8 billion on Medicare patients who spent at least a day in the ICU, while they made $2 billion on patients who spent no time in the ICU or CCU.[8]

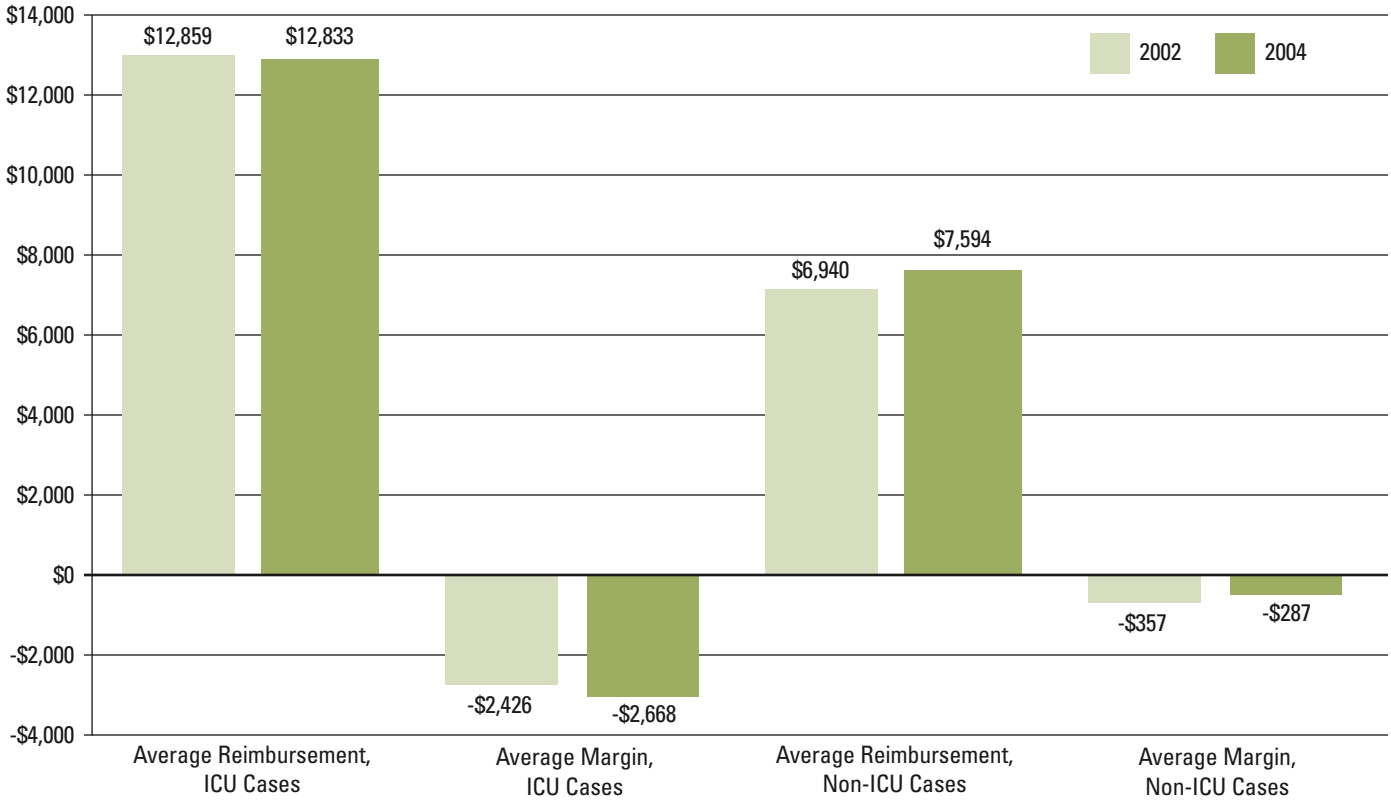
A more recent study confirmed the finding that hospitals lose money on Medicare ICU cases and suggested that the economics may be getting worse as the average Medicare reimbursement for admissions requiring an ICU stay has decreased, as it did from 2002 to 2004. In contrast, Medicare reimbursement for admissions not requiring an ICU stay increased over the same time period. (See Figure 2 for the average margin and reimbursement details.[9])

That hospitals lose money on Medicare ICU cases is of particular concern to California providers, given that 60 percent of California's ICU discharges in 2004 involved Medicare patients. An additional 16 percent of ICU cases involved payers with the lowest reimbursement rates: 11 percent of ICU cases are Medi-Cal patients and 5 percent are uninsured patients.[10] Even if the remaining cases, which are paid by private health plans, cover some of these losses through cost shifting, it still appears there would be significant financial benefit to hospitals if they could reduce ICU utilization.

ICU Utilization in California

While California is often one of the states with the lowest overall hospital utilization, recent research suggests that in terms of critical care at the end of life, California physicians and hospitals are providing more care than their counterparts in other states. The Dartmouth Atlas of Health Care has collected data on hospital utilization for Medicare patients who died (for each of the years 1999 through 2003). The Atlas data set includes a number of metrics for intensive care utilization during the last six months of life and during hospitalizations in which death occurred. For each of these measures, California exceeded the national average in 2003. In addition, for each of these measures, California ranks among the states with the highest utilization rates for the year 2003 (Table 1).[11]

Figure 2. Economics of Medicare Cases, 2002 vs. 2004



Source: Cooper, L. and Linde-Zwirble. "Medicare intensive care unit use: Analysis of incidence, cost, and payment." *Critical Care Medicine*. 32(11): 2247-2253, November 2004.

Within California, there is considerable variation at both the regional and the hospital level in terms of how much critical care is used at the end of life. Looking at the number of ICU/CCU days per decedent during the last six months of life, 11 of California's 24 hospital referral regions (HRRs) performed at or below the national average of 3.25 days in 2003, while the majority of regions used more days than the national average (Table 2). A few regions stand out due to their high utilization: Los Angeles at 7.05 ICU/CCU days per decedent and Orange County at 5.41 ICU/CCU days per decedent.[12]

As a group, California's 358 hospitals exceed the national average, providing more than four ICU/CCU days per Medicare decedent within the last six months of life. Fifty-nine, or about 16 percent, perform near the national average of 3.6 days for the years 1999 through 2003, using between three and four days. And 90 (25 percent) of California hospitals provide less than three days of care per decedent.

No Correlation between ICU Case Mix and Utilization

The California HealthCare Foundation commissioned Kurt Salmon Associates (KSA) to analyze the variance in ICU length-of-stay across California hospitals. Using 2004 ICU utilization data from 302 California hospitals, KSA compared ICU average length of stay (ALOS) against case mix index (CMI) scores, which are used as a measure of severity of

Table 1. Use of Intensive Care for Medicare Beneficiaries at the End of Life, 2003

	U.S. Average	California Average	Percent Difference
Percent of Medicare decedents admitted to ICU/CCU during the hospitalization in which death occurred	17.8%	20.9%	+17.4%
ICU/CCU days per decedent during the hospitalization in which death occurred	1.21	1.62	+33.8%
ICU/CCU allowed charges per decedent during the hospitalization in which death occurred	$2,759.15	$6,542.21	+137.1%
Percent of Medicare decedents admitted to ICU/CCU at least once during the last six months of life	37.4%	43.8%	+17.1%
ICU/CCU days per decedent during the last six months of life	3.25	4.52	+39.0%
Percent of decedents spending 7 or more days in ICU/CCU during the last six months of life	13.4%	18.7%	+39.5%
ICU/CCU charges per decedent during the last six months of life	$6,581.44	$15,869.94	+141.1%

Source: The Dartmouth Atlas of Health Care (www.dartmouthatlas.org)

Table 2. California Regional Variation, 2003

Hospital Referral Region	ICU/CCU allowed charges per decedent during the hospitalization in which death occurred (2003)	ICU/CCU days per decedent during the last six months of life (2003)
Los Angeles	10,395.83	7.05
Orange County	5,208.58	5.41
Palm Springs/Rancho	6,248.33	5.20
Ventura	5,756.59	4.81
San Bernardino	5,068.15	4.61
San Diego	4,621.76	4.44
Bakersfield	4,647.54	4.29
Salinas	3,810.98	4.05
San Jose	8,629.81	3.91
San Mateo County	6,668.78	3.61
Modesto	6,741.29	3.50
Alameda County	6,927.90	3.46
Redding	4,308.62	3.26
Santa Cruz	4,473.75	3.25
San Luis Obispo	5,416.62	3.24
Fresno	3,644.36	3.20
Contra Costa County	7,461.74	3.14
San Francisco	7,588.68	3.07
Chico	6,284.33	3.05
Sacramento	4,568.02	2.91
Stockton	6,302.95	2.85
Santa Barbara	3,308.17	2.85
Napa	4,438.05	2.37
Santa Rosa	3,148.19	1.74

Source: The Dartmouth Atlas of Health Care (www.dartmouthatlas.org)

patient illness. Their analysis segmented hospitals into three groups based on the number of ICU beds:

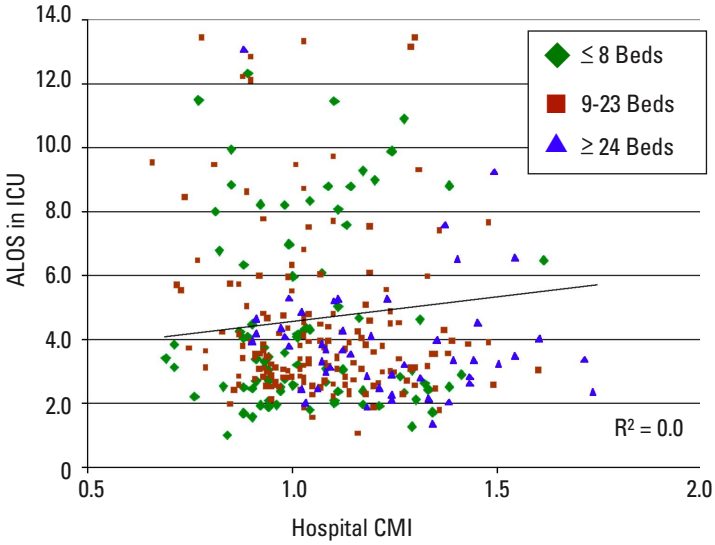
- 2 to 8 beds, typically critical access and other small community hospitals;
- 9 to 23 beds, typically mid- to large-sized community hospitals; and
- 24 or more beds, typically large-sized community hospitals, regional referral centers, and academic medical centers.

In addition, KSA excluded outlier hospitals, those facilities with CMI or ALOS values beyond two standard deviations from the mean in each bed size segment.[13]

KSA's analysis reveals a wide degree of variation in ICU ALOS among California's hospitals that cannot be explained by variation in severity of patient illness (as measured by CMI). California's average ICU length of stay for 2004 was four days, but individual hospital performance ranged from one day to over 13 days.

Figure 3 plots the ICU ALOS and CMI for each of the 302 hospitals in the sample. One would expect to see a fairly linear relationship between severity of illness and length of stay in the ICU, but the graphic demonstrates the lack of a meaningful correlation in California.[14] A significant correlation did not exist for any of the three hospital groups based on size.[15] It is particularly notable that 89 California hospitals—nearly 30 percent of all the hospitals analyzed—have excessive ICU length of stays relative to their ICU CMI scores.

Figure 3: Linear Regression of CMI and ICU ALOS for CA Hospitals



Source: Kurt Salmon Associates

Reducing Variation in Utilization Would Produce Significant ICU Savings

The variation in utilization of critical care units revealed by the Dartmouth Atlas data on end-of-life care for Medicare beneficiaries, along with the KSA data on ICU utilization for all California patients, suggests a significant opportunity to reduce patient days in critical care units. Looking first at the opportunity presented by reducing ICU and CCU use during the last six months of Medicare patients' lives, California hospitals could save 130,557 ICU and CCU days if they could reduce their days per decedent to the national average.

Likewise, if all of the hospitals with ICU ALOS in excess of their CMI-predicted figure reduced their LOS to conform with that value, California hospitals would reduce ICU utilization by 130,364 patient days. This would represent a reduction in average ICU length of stay from 3.71 days to 3 days.

Reduced ICU patient days should enable California hospitals to achieve significant financial benefits through:

- Improved utilization of existing ICU beds, allowing a hospital to accommodate additional ICU volume without adding capacity;
- Better use of scarce nursing resources; and
- Reduced costs.

Because the potential reduction in ICU days achieved using Dartmouth Atlas data and the KSA data is similar, this brief models the benefits of California

hospitals reducing their ICU patient days by 130,000. This would represent a 9 percent reduction in total ICU patient days, and nearly a half a day reduction in ICU ALOS (3.5 days vs. 3.9 days). Payoffs from implementing such a strategy could include:

- ***Better use of existing ICU beds.*** Reducing ICU utilization by 9 percent yields a savings of 356 ICU beds, just over 6 percent of the total licensed ICU beds in California. If these beds were used as an alternative to building new ICU capacity, this would save California hospitals $356 million in capital expenses.[16]
- ***ICU cost savings.*** Substituting medical/surgical floor days for 130,000 ICU patient days would yield $159 million in operating cost savings for California hospitals.[17] For Medicare patients and other patients under case rate payments, the benefit of this reduction would accrue to the hospitals, at least in the short run.
- ***Better utilization of nursing resources.*** One of the potential benefits of reduced ICU days is the reduction in nurses needed in the ICU. Given the nursing shortage in California, any efforts to "create" additional nurse supply are valuable. Based on the 2000 California average of 15.3 registered nurse hours per patient day in the ICU, a reduction of 130,000 ICU patient days would free up nearly two million critical care nursing hours. The net savings in annual nursing hours, after accounting for additional floor staffing, would be 1.4 million nursing hours.[18] Viewed in terms of nurses, the reduction in ICU patient days would save a modest but still significant number of critical care nurses: 828 in total. The net savings, after accounting for additional medical/surgical unit nurses, would be 601 nurses.[19]

Quality-Driven Initiatives Produce ICU Utilization Savings

While many may worry that efforts to reduce ICU utilization will harm patients, evidence suggests that reducing utilization and improving care quality are compatible. Often, patient stays in critical care units are extended due to adverse events such as a hospital-acquired infection or medication error, many of which are preventable. A recent observational study of patients in two critical care units in an academic medical center found that 20 percent of critical care patients experienced an adverse event, 45 percent of which were considered preventable.[20] Hospitals directly addressing quality problems in critical care units often achieve significant reductions in length of stay and costs. Examples of successful quality initiatives are presented below.

- ***Remote intensivist monitoring.*** In 2000, Sentara Health System implemented eICU, a telemedicine

Understanding the Paradox

In the face of significant financial benefit of reducing ICU utilization, why does so much variation persist among hospitals? There are many factors:

- Individual physician judgment differs regarding patient acuity and need for higher levels of care. The existence of hospitalist and intensivist programs may help reduce this difference.
- Service mix contributes to differences, as hospitals with high surgical volumes and programs such as trauma, transplant, and burn units will have higher ICU utilization rates. Case mix adjustment cannot completely account for these differences.
- Hospitals with high occupancy rates may have more difficulty transferring patients to step-down units.
- Patient and family preferences plays a role. The availability of hospice and palliative care can reduce ICU utilization if patients and family members desire this type of care.

Additional research in these areas may help to identify opportunities to use expensive ICU resources more efficiently.

program that provides remote intensivist monitoring of hospital critical care units, to reduce ICU mortality and improve quality. The eICU helped Sentara reduce its ICU and hospital mortality rates by 26.7 and 26.4 percent, respectively. At the same time, the average length of stay decreased by 16 percent and variable costs per ICU case declined by 24.6 percent.[21]

- ***Addressing ventilator-associated pneumonia.*** VHA, Inc.'s "transformation of the ICU" initiative focused on reducing ventilator-associated pneumonia (VAP), which affects many ICU patients and leads to extended stays and high costs in the ICU. Nineteen ICUs participating in the first round of the initiative reduced their rates of VAP 29 percent, from 7.5 to 5.3 cases per 1,000 ventilator days. Average length of stay for these 19 ICUs dropped 15 percent, from 4.0 to 3.4 days. One participating hospital estimated that it saved $700,000 annually from reduced LOS in its two ICUs.[22]

In addition, efforts addressing end-of-life care can produce reductions in ICU utilization. While this subject is sometimes controversial, the reality is that most people do not want to die in the hospital, let alone in an ICU. Approximately 90 percent of Americans would prefer to die at home, but researchers at the University of Pittsburgh found that over 20 percent of deaths occur after admission to an ICU and 38 percent of deaths occur in the hospital.[23] Well-conceived efforts focused on reducing intensive care at the end of life, such as palliative care programs and do-not-resuscitate orders, should be able to both reduce critical care utilization and improve patient and family satisfaction.

Conclusion

Given the greater role critical care is playing and will continue to play in the health care system, hospital leaders and physicians should work together to examine whether their utilization of critical care beds is appropriate. Data suggest that a sizeable number of California hospitals could reduce ICU patient days. Doing so would create many benefits, including reducing hospital losses on ICU cases and "creating" additional supply of nurses. Most importantly, it would encourage more judicious use of the current supply of ICU beds. Finally, reducing ICU utilization does not come at the expense of patient quality or satisfaction, as preventable adverse events in the ICU lead to prolonged stays and overly intensive care at the end of life.

Endnotes

1. Halpern, N. et al. "Changes in Critical Care Beds and Occupancy in the United States 1985-2000: Differences Attributable to Hospital Size. *Critical Care Medicine*. 34(8): 2105-2111.
2. "Summary of Requests for Extensions to Seismic Safety Deadlines." California Office of Statewide Health Planning and Development. Updated 11/22/06.
3. Within this issue brief. For this data, "critical care" refers to the following units: intensive care units (ICUs), coronary care units (CCUs), acute respiratory care units, neonatal intensive care units (NICUs), and burn units.
4 . Halpern, N. et al. (See note 1.)
5. *The Critical Care Workforce: A Study of the Supply and Demand for Critical Care Physicians*. U.S. Department of Health and Human Services, Health Resources and Services Administration. (http://bhpr.hrsa.gov/healthworkforce/reports/criticalcare/default.htm)
6. Innovations Center Futures Database. The Advisory Board Company. 2006.
7. Cooper, L. and Linde-Zwirble. "Medicare intensive care unit use: Analysis of incidence, cost, and payment." *Critical Care Medicine*. 32(11): 2247-2253, November 2004.
8. Ibid.
9. "ICU stays having a significant impact on hospital margins." *Healthcare Financial Management*. July 2006.
10. California Office of Statewide Health Planning and Development. 2004 Hospital Utilization Data.

11. The Dartmouth Atlas of Health Care. (www.dartmouthatlas.org.)

12. Ibid.

13. Outliers constituted 31 out of 333 hospitals, or 9.3 percent of the original hospital population.

14. The regression yielded an R2 value of .01, which indicates that CMI lacks predictive ability for ALOS in the ICU. In other words, a high CMI value does not mean the ICU will have a high ALOS. An R2 of 1.00 or -1.00 would indicate perfect predictive ability.

15. Regressions yielded an R2 of 0.01 for small hospitals, 0.02 for medium hospitals, and 0.02 for large hospitals.

16. This assumes a cost of one million dollars in capital expenses for each new ICU bed built. Current estimates of the cost to build new beds in California range from one million to two million dollars.

17. The cost savings is based on a daily cost of $2,462 per ICU patient day compared to $1,236 per medical/surgical day (See note 7). If hospitals were able to reduce ICU LOS without increasing medical/surgical LOS, the total savings would increase to $320 million.

18. Donaldson, N. et al. "Nurse Staffing in California Hospitals 1998-2000: Findings from the California Nursing Outcome Coalition Database Project." *Policy, Politics, & Nursing Practice.* 2(1): 20-29. This article reports mean nursing hours per patient day of 16.7 for critical care units and 7.6 for medical/surgical units.

19. California Office of Statewide Health Planning and Development, 2005 Hospital Utilization Data.

20. Rothschild, J. et al. "The Critical Care Safety Study: The incidence and nature of adverse events and serious medical errors in intensive care." *Critical Care Medicine.* 33(8): 1694-1700.

21. Breslow, M. et al. "Effect of a multiple-site intensive care unit telemedicine program on clinical and economic outcomes: An alternative paradigm for intensivist staffing." *Critical Care Medicine.* 32(1): 31-38.

22. McCarthy, D. and Blumenthal D. "Committed to Safety: Ten Case Studies on Reducing Harm to Patients." The Commonwealth Fund. April 2006.

23. "End of Life ICU Utilization May Require Re-evaluation According to University of Pittsburgh-Led Study." *UPMC News Bureau.* April 6, 2004.

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