

Table 1: Benefits and Organizational Barriers of Tele-ICU Implementation and Utilization

BENEFITS	Details (citation)
Decreased LOS in ICU	<ul style="list-style-type: none"> • Decreased LOS from 4.35 days to 3.63 days after Tele-ICU implementation⁴³ • In a large healthcare facility, decreased LOS was significantly related to increased staffing with Tele-ICU utilization²⁸ • Decreased LOS from 4.35 days to 3.80 days after Tele-ICU implementation^{44,55} • Decreased in LOS from 2.7 to 2.2 days after Tele-ICU implementation⁴⁵ • LOS was decreased by 17% with Tele-ICU utilization³¹ • LOS decreased from 1.18 additional days to 0.96 days after one year of Tele-ICU utilization⁴⁶
Decreased Mortality in ICU	<ul style="list-style-type: none"> • Decreased mortality rate from 12.9% to 9.4% after Tele-ICU implementation^{43,55} • Relative mortality risk decreased a total of 23% with utilization of Tele-ICU⁴⁴ • Mortality rate decreased from 7.9% to 3.8% after Tele-ICU implementation⁴⁵ • Mortality decreased by 27% with Tele-ICU implementation and utilization³¹ • Mortality rate decreased in ICU from 1.0 to 0.65 after one year of Tele-ICU utilization⁴⁶
Improved Staff Interaction	<ul style="list-style-type: none"> • Tele-ICU improved staff teamwork and communication was found with Tele-ICU utilization^{35,58} • Staff communication, teamwork and supervision were improved via Tele-ICU⁴⁷
Improved Quality of Care	<ul style="list-style-type: none"> • Tele-ICU implementation increased response times to critical events, decreased patient falls and extubation³⁷ • Decreased intervention times due to Tele-ICU utilization improved patient outcomes⁴⁸ • Tele-ICU utilization led to a reduction in unnecessary transportation to hospitals with a large ICU, allowing patients to recover close to home and with family support nearby¹⁹ • Improved patient safety and care was found with Tele-ICU utilization³⁵ Adherence to best practices and decrease of medication errors with Tele-ICU utilization^{26,54,56}
Patient and Provider Satisfaction	<ul style="list-style-type: none"> • Tele-ICU technology has been shown to improve patient and provider satisfaction^{36,57}
BARRIER	
Organizational Challenges	<ul style="list-style-type: none"> • Tele-ICU implementation requires significant changes to the organizational culture which are challenges for implementation²⁸ • Resistance to change / failure to get buy in from personnel^{33,37,53} • Physicians view Tele-ICU and providers as a threat to autonomy in practice^{39,57} • Providers report significant lack of understanding of the technology use in Tele-ICU, as well as doubt about the efficacy of this technology to provide effective intensive care⁴⁰

ICU: Intensive Care Unit; LOS: Length of Stay

Table 2: Cost of Tele-ICU: Implementation and Utilization

Author, Year	Study Design	Outcome
Breslow et al., 2004	Multiple site pre/post-test of Tele-ICU utilization	24.6% reduction in costs per case, post utilizations (savings of \$2556 per case) ⁴³
Cummings et al., 2007	Literature review	Total cost, including initial and maintenance costs, were identified as a significant barrier to the implementation and utilization of Tele-ICU technology ⁴¹
Kohl et al., 2007	3 year pre/post-test of Tele-ICU implementation	10% Reduction in costs, post implementation ³⁴
Groves et al., 2008	Pre/post-test of Tele-ICU implementation and utilization	\$920,000 savings in one ICU, one year post implementation ³³
Zawada et al., 2009	8 year pre/post-test of Tele-ICU utilization in a rural healthcare system	\$8 million saved over 8 years, post implementation ³²
Berenson et al., 2009	Examination of the start-up costs in several rural Tele-ICUs	Cost of Tele-ICU hardware and software ranged from \$30,000 to \$50,000 per bed ⁴⁷
Franzini et al., 2011	Pre/post-test of Tele-ICU implementation in 6 ICUs in a large health care system	No significant savings were found, except when Tele-ICU was used for the most acutely ill patients in a large ICU ⁴⁹
Lilly et al., 2011	Pre/post examination of Tele-ICU implementation at UMASS Memorial Health Care	Tele-ICU implementation led to a savings of \$5000 per case ⁵⁵
Morrison et al., 2010	Pre/post examination of Tele-ICU in two rural hospitals	No significant cost savings were identified with Tele-ICU implementation and utilization ⁵²
Hulshoff et al., 2011	Literature review	Large ICUs, with 50 to 60 beds, requiring 8-12 satellite ICUs have found Tele-ICU utilization to be cost effective ³⁸

ICU: Intensive Care Unit

Table 3: Pre and Post Tele-ICU Implementation Outcomes

Author, Year	Study Design	Outcome
Breslow et al., 2004	Multiple site pre/post-test of Tele-ICU utilization	Mortality rate decreased from 12.9% to 9.4% post Tele-ICU implementation, and LOS was decreased from 4.35 days to 3.63 days post implementation ⁴³
Leong et al., 2005	Single site pre/post-test examination of Tele-ICU implementation	Mortality rate decreased by 3.5% ²⁹
Howell et al., 2007	Pre/post examination of Tele-ICU implementation in a rural ICU	Mortality rate decreased from 1.0% to 0.65% 1 year post implementation, and LOS was decreased from 1.18 additional days to 0.96 days over non ICU patients ⁴⁶
Chu-Weininger et al., 2010	Pre and post-test of Tele-ICU implementation using Teamwork Climate Scales and Safety Scores to examine the effect on staff	Teamwork Climate Scores increased by 12% ³⁵
Health First, 2012	Pre/post-test of Tele-ICU implementation and utilization in a large healthcare system in Florida	Mortality rate decreased 27% post implementation, and LOS was decreased 17% post Tele-ICU implementation ³¹
Willmitch et al., 2012	Pre/post-test of Tele-ICU implementation and utilization in a large health care setting	Relative mortality risk decreased a total of 23% 1 year post implementation, and LOS decreased from 4.35 days to 3.80 days 1 year post implementation ⁴⁴
Sadaka et al., 2013	Pre/post-test of Tele-ICU implementation and utilization in a rural hospital ICU	Mortality rate decreased from 7.9% to 3.8% 1 year after Tele-ICU implementation, and LOS decreased from 2.7 days to 2.2 days post implementation ⁴⁵

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