

Study	Savings/Efficiencies/Outcomes Achieved	Additional Information
<p><b>Home Telehealth in High-Risk Dialysis Patients: A 3-Year Study</b> Dayna E. Minatodani, Steven J. Berman <i>Telemedicine and e-Health</i>; Jul. 2013</p> <p>This is a continuation of a previous pilot project that demonstrated improved health outcomes and significant cost savings using home telehealth over a 21 month period. This study used the same method, with a larger sample size over a longer period of time, (3 years), in order to verify the results. They examined long term effects of nurse oversight on home telehealth monitoring in a population of high-risk dialysis patients. They had a sample size of 99. The study compares the outcomes and costs associated with a “usual care” (UC) and “remote technology” (RT) group. The results indicate that outcomes are better and cost is significantly lower in the “remote technology” group.</p>	<p>Findings support an earlier study which found that nurse oversight can improve health outcomes and reduce the cost of hospitalizations and ER visits in high risk dialysis patients.</p> <p>Number of hospitalizations and hospital days are significantly lower in the RT group than in the UC group.</p> <ul style="list-style-type: none"> <li>• Hospitalizations: RT, 1.8; UC, 3.0</li> <li>• Hospital days: RT, 11.6; UC, 25</li> <li>• Hospital and ER Charges: RT, \$66,000; UC, \$157,000</li> <li>• Hospital and ER charges per study day: RT, \$159; UC, \$317</li> </ul>	<ul style="list-style-type: none"> <li>• 43 patients were included in the remote technology group and 56 patients were in the usual care group. All patients were similar based on their qualifying risk scores.</li> <li>• Data collected included number of hospitalizations and ER visits, number of hospital days, total charges for inpatient and emergency room services for all patients.</li> <li>• Study measured cost through economic analysis.</li> <li>• Patients in RT group were asked to submit physiological measurements and answer 10 health questions on their non-dialysis days.</li> <li>• Nurse initiated telephone contacts required in response to medical issues totaled 82 and 88 for technical issues. That decreased to 0 at the end of the data collection period.</li> </ul>
<p><b>Telemedicine-Based Digital Retinal Imaging vs. Standard Ophthalmologic Evaluation for the Assessment of Diabetic Retinopathy</b> Zhijian Li, Chengquing Wu, et al <i>Connecticut Medicine</i> 76(2): 85-90; Feb. 2012</p> <p>This study looked at diabetic patients from a large multi-site FQHC who were evaluated using teleophthalmology and performed a cost benefit analysis.</p>	<ul style="list-style-type: none"> <li>• Telemedicine based digital retinopathy screening cost less (\$49.95 vs. \$77.80) than conventional retinal examination.</li> <li>• 611 patients’ digital retinal images were screened in the first year.</li> <li>• 166 cases of diabetic retinopathy were identified.</li> <li>• 75 patients screened positive for a clinically significant disease and were referred to ophthalmological evaluation and treatment.</li> </ul>	<ul style="list-style-type: none"> <li>• Patients had various forms of healthcare insurance, while some didn’t have insurance.</li> <li>• The study finds that store and forward diabetic retinopathy is cheaper than usual care. It also provides greater convenience and access.</li> <li>• Research Period: July 1, 2009-June 30, 2010</li> </ul>

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<p><b>Evaluation of Telemedicine for Screening of Diabetic Retinopathy in the Veterans Health Administration</b> Eser Kirkizlar, Nicoleta Serban, et al <i>Ophthalmology</i>; Sep. 28, 2013</p> <p>This study explores the cost-effectiveness of telemedicine for the screening of diabetic retinopathy and identifies changes within the demographics of a patient population after telemedicine implementation.</p>	<ul style="list-style-type: none"> <li>• Cost effective for patient populations of more than 3500, and patients younger than 80 years old.</li> <li>• The average miles traveled by patients to receive a screening decreased.</li> <li>• Tele-retinal screening participation increased.</li> </ul>	<ul style="list-style-type: none"> <li>• Examined 900 randomly chosen records of patients with type 1 or 2 diabetes, who were enrolled in the medical center before or after the tele-retinal screening program was instituted in 2005.</li> <li>• The study included the costs associated with blindness in their model.</li> </ul>
<p><b>Cost Utility Analysis of Telemedicine Ophthalmoscopy for Retinopathy</b> Kevin Jackson, Karen Scott, Joshua Graff Zivin, David Bateman, John Flynn, Jeremy Keenan, Michael Chiang <i>Archive of Ophthalmology</i> 126(4): 493-9 ; Apr. 2008</p> <p>This study evaluates the cost effectiveness of telemedicine and standard ophthalmoscopy for retinopathy of prematurity management.</p>	<ul style="list-style-type: none"> <li>• For infants with birth weight less than 1500 g using a 3% discount rate for costs and outcomes, the costs per quality adjusted life year gained were \$3193 with telemedicine and \$5617 with standard ophthalmoscopy.</li> <li>• Sensitivity analysis resulted in ranges of costs per quality adjusted life year from \$1235 to \$18898 for telemedicine and from \$2171 to \$27215 for ophthalmoscopy.</li> <li>• Telemedicine is more cost effective.</li> </ul>	<ul style="list-style-type: none"> <li>• Cost utility analysis was performed using decision analysis, evidence based outcome data from published literature and present value modeling.</li> <li>• Visual outcome data were converted to patient preference-based time trade-off utility values based on published literature.</li> <li>• Costs of disease management were determined based on 2006 Medicare reimbursement rates.</li> </ul>

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<p><b>The Benefits of Preventive Dental Care: Estimating the Fiscal Impact of the Virtual Dental Home Project</b> Blue Sky Consulting Group Jan. 14, 2013</p> <p>This report is an analysis of a telehealth-enabled community-based, prevention focused oral health delivery model called the Virtual Dental Home model of care.</p>	<p>The study predicted ongoing and targeted preventive dental care could save Medi-Cal:</p> <ul style="list-style-type: none"> <li>• \$0.20 per patient visit in a skilled nursing facility</li> <li>• \$18 per disabled adult visit</li> <li>• \$2 per Head Start patient visit.</li> </ul>	<ul style="list-style-type: none"> <li>• The study used a simulation model that relies on published literature to establish the clinical effectiveness of various dental care interventions and then applies CA specific costs for the Medi-Cal program to arrive at an overall estimated fiscal impact.</li> <li>• The model suggested that preventive services for school-aged children return a majority of Medi-Cal expenditures in future benefits even though they do not produce a short-term overall savings per patient, but instead would result in a net cost of \$36 per patient visit.</li> </ul>
<p><b>Post discharge Monitoring Using Interactive Voice Response System Reduces 30-Day Readmission Rates in a Case-managed Medicare Population</b> Jove Graham, Janet Tomcavage, Doreen Salek, Joann Sciandra, Duane Davis, Walter Stewart <i>Medical Care</i> 50(1): 50-7; 2012</p> <p>This study looked at whether the Geisinger Monitoring Program (GMP) interactive voice response protocol, which is a post hospital discharge telemonitoring system used as an adjunct to existing case management in the primary care Medicare population, was effective in reducing 30 day hospital readmission rates among case-managed patients.</p>	<ul style="list-style-type: none"> <li>• GMP was associated with a 44% reduction in 30-day readmissions in the study cohort, when using the control group to control for secular trends.</li> <li>• The mean inpatient expenses per patient-month was \$338.93 in the GMP group and \$353.93 in the control group.</li> <li>• The mean total expenses (excluding prescriptions) per patient-month was \$1253.94 in the GMP group and \$1371.37 in the control group.</li> </ul>	<ul style="list-style-type: none"> <li>• GMP is a telemonitoring voice response system that allows patients to answer survey questions about medication adherence, side effects, etc.</li> <li>• A total of 875 Medicare patients were enrolled in the combined case management and GMP program, and were compared with 2420 matched control patients who were only case managed.</li> <li>• Claims data was used to document an acute care admission followed by a readmission within 30 days in the pre-intervention and post-intervention periods.</li> <li>• Regression modeling was used to estimate the within-patient effect of the intervention on readmission rates.</li> </ul>

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<p><b>A Randomized Trial of Telemonitoring Heart Failure Patients</b> Christopher Tompkins, John Orwat <i>Journal of Healthcare Management</i> 55(5): 312-22; Sept. 2010</p> <p>The purpose of this study was to measure the ability of telemonitoring to reduce hospital days and total costs for Medicare managed care enrollees diagnosed with heart failure.</p>	<ul style="list-style-type: none"> <li>Total cost was 12 percent lower in the intervention group compared to the control group, controlling for sex, age, co-occurring Diabetes Mellitus and COPD, and geographic region.</li> </ul>	<ul style="list-style-type: none"> <li>The study found that within a managed care environment, telemonitoring appears to facilitate better ambulatory management of heart failure patients, including fewer ED visits.</li> <li>Data collection period: April 2007-November 2007.</li> <li>Sample size = 390. Intervention group = 193; control group = 197.</li> </ul>
<p><b>Telehealth and Remote Patient Monitoring Provider Case Studies 2013: Centura Health at Home</b> <i>Leading Age</i>; 2013</p> <p>The purpose of the Centura Health at Home project in Colorado was to decrease 30-day rehospitalization rates and to increase older adult quality of life by augmenting the current telehealth continuum by merging the two independently successful call center and telehealth programs.</p>	<ul style="list-style-type: none"> <li>Over a 30-day period following the initial hospital stay, hospitalizations related to heart failure, chronic obstructive pulmonary disease (COPD) and diabetes were reduced by 62%.</li> <li>Rehospitalization rates for patients receiving telehealth home care (6.28%) were significantly lower than those for traditional home care patients (18%).</li> <li>During the project period, emergency department (ED) utilization decreased from 283 visits in the year preceding the study to 21 ED visits.</li> <li>Cost savings were between \$1,000 and \$1,500 per patient per episode.</li> </ul>	<ul style="list-style-type: none"> <li>200 patients participated in the telehealth program.</li> <li>The typical participant was an older adult, living in his or her own home, managing co-morbid conditions who had just experienced a hospitalization related to an exacerbation of his or her chronic health condition.</li> <li>Centura Health at Home included store and forward biometric RPM telehealth services.</li> </ul>

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<p><b>Telehealth and Remote Patient Monitoring Provider Case Studies 2013: Lee Memorial Health System</b> <i>Leading Age; 2013</i></p> <p>The purpose of this Florida study was to improve patient care transitions with a telehealth solution that can monitor patient biometrics with an RPM device after hospital discharge.</p>	<ul style="list-style-type: none"> <li>In the two years since its inception, the Lee Memorial Health System telehealth program has helped the system avoid 950 readmissions to the hospital, resulting in an estimated savings of more than \$5.3 million, based on average hospital system costs of \$5,600 per hospital admission or readmission.</li> </ul>	<ul style="list-style-type: none"> <li>The telehealth program began with 50 remote patient monitors, and has since grown to more than 250, with more than 6,000 patients monitored.</li> <li>The patient population included discharged cardiac patients.</li> </ul>
<p><b>Telehealth and Remote Patient Monitoring Provider Case Studies 2013: Vidant Health Hospital</b> <i>Leading Age; 2013</i></p> <p>Vidant Health in North Carolina implemented a post-hospital discharge telehealth program to increase patient access to care, lower hospitalizations and bed days, enhance patient and provider communication and engage high-risk, high-cost, low-engagement cardiovascular and pulmonary disease patients. Patients were monitored for a three-month period and evaluated for discharge from the program or a three month extension.</p>	<ul style="list-style-type: none"> <li>During the first year, hospitalizations were decreased by a total of 550 admissions. This was a 67% reduction in hospitalizations as a result of the use of telehealth.</li> <li>The number of patients hospitalized decreased by 341 during the telehealth program.</li> <li>Hospital bed days during the telehealth program decreased by 2,596 as compared to before the telehealth program.</li> <li>Hospitalization costs to payers were 68% lower as a result of the telehealth program.</li> </ul>	<ul style="list-style-type: none"> <li>Vidant Health provided in-home monitoring equipment and wireless peripherals.</li> <li>Daily, patients collected their blood pressure, pulse, weight and oxygen saturation level, which were encrypted and sent to a secure cloud server. Data was reviewed by a nurse and actions or interventions were taken as needed.</li> <li>During the first year of the telehealth program, Vidant Health enrolled 1,323 cardiovascular and pulmonary disease patients.</li> <li>Fifty-four percent had a primary diagnosis of hypertension and thirty-three percent had a primary diagnosis of heart failure.</li> </ul>

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<p><b>Telehealth and Remote Patient Monitoring Provider Case Studies 2013: Windsor Place Leading Age; 2013</b></p> <p>The Medicaid Home and Community-Based Services/Frail Elder (HCBS/FE) pilot study in Kansas is the first known longitudinal assessment of home telehealth on emergency department (ED) visits, hospital visits, nursing home placements and the associated costs of these services for elders with a variety of chronic conditions and multiple co-morbidities.</p>	<ul style="list-style-type: none"> <li>• Telehealth reduced the rate of emergency department utilization, inpatient hospitalizations and the associated Medicare costs for HCBS/FE clients.</li> <li>• The cost savings of a hospitalization was \$26,298 per patient annually.</li> <li>• The cost of the telehealth equipment, labor, and program was \$2,160 total per patient annually.</li> </ul>	<ul style="list-style-type: none"> <li>• The telehealth system used was a store-and-forward biometric RPM approach. The patient provided vital readings each morning, prompted by the telehealth central station.</li> <li>• The HCBS/FE clients chosen for the study all had at least one hospitalization in the 12 months prior to their enrollment.</li> <li>• The study group consisted of 85 women and 22 men. Ages ranged from 65 to 96 years, with an average age of 79.</li> <li>• 19 participants had hypertension, 10 participants had congestive heart failure (CHF), 9 had diabetes and 5 had chronic obstructive pulmonary disorder. The remaining 64 participants had multiple co-morbidities of these four illnesses.</li> <li>• 3-year study.</li> </ul>

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<p><b>Partners HealthCare: Connecting Heart Failure Patients to Providers Through Remote Monitoring</b> Andrew Broderick <i>The Commonwealth Fund</i>; January 2013</p> <p>Partners HealthCare’s home telehealth Connected Cardiac Care Program (CCCCP) has resulted in successes for the health system. Their results are shared in this report.</p>	<ul style="list-style-type: none"> <li>• The program has consistently experienced an approximate 50 percent reduction in heart failure–related readmission rates for enrolled patients.</li> <li>• Non–heart failure readmissions have declined by 44 percent.</li> <li>• In-house analysis estimates that the program has generated total cost savings of more than \$10 million since 2006 for the more than 1,200 enrolled patients.</li> </ul>	<ul style="list-style-type: none"> <li>• CCCP’s core components are care coordination, education, and development of self-management skills through telemonitoring.</li> <li>• Provides a centralized telemonitoring model: home telemonitoring and patient education over a four-month period to enable patients to collect frequent readings and become more engaged in their care.</li> <li>• Patients use equipment: a home monitoring device with peripherals to collect weight, blood pressure, and heart rate measurements, and a touch-screen computer to answer questions about symptoms—on a daily basis for four months.</li> <li>• Telemonitoring nurses monitor these vitals, respond to out-of-parameter alerts, and guide patients through structured biweekly heart failure education.</li> </ul>

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<p><b>Essentia Health Heart and Vascular Center: Heart Failure Disease Management Improves Outcomes and Reduces Costs</b> Agency for Healthcare Research and Quality; Apr. 24, 2008</p> <p>This is an Innovation profile chronicling how Essentia Health Heart and Vascular Center in northern Minnesota and northern Wisconsin restructured outpatient care for heart failure patients by incorporating a combination of chronic care and disease management principles and providing home telemonitoring for high-risk patients.</p>	<ul style="list-style-type: none"> <li>• The Center has increased use of appropriate medications; improved outcomes and functional status; and reduced readmission rates, length of stay, and overall costs of care for the health system.</li> <li>• Essentia's sickest heart failure patients, who use the telescale, have readmission rates from 0 to 2 percent.</li> <li>• Readmission rates for all patients in the program have hovered around 3 to 7 percent.</li> <li>• Pilot study in 2009 shows \$1.25 million in savings for just 29 patients over six months.</li> <li>• Financial analysis of program in 2009 showed the program saved more than \$1 million by cost avoidance to the hospital.</li> </ul>	<ul style="list-style-type: none"> <li>• The intervention included a telemonitoring scale that records patient weight, asks questions about their health, and transmits the vital information to a cardiac nurse, who can make changes to medications and track patient condition on a daily basis.</li> <li>• 92% of the patients treated in the Center have Medicare.</li> <li>• The program currently coordinates care for 1,400 patients.</li> </ul>



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<p><b>Mercy Medical Center: Reducing Readmissions through Clinical Excellence, Palliative Care, and Collaboration</b> Sharon Silow-Carroll and Aimee Lashbrook <i>The Commonwealth Fund</i>; Mar. 2011</p> <p>This case study describes the strategies and factors that appear to contribute to a low readmission rate among patients at Mercy Medical Center in Cedar Rapids, Iowa. Since Feb. 2008, the hospital has used telemonitoring for cardiac patients, which is outlined in the case study.</p>	<ul style="list-style-type: none"> <li>• Readmissions declined after use of telemonitoring devices.</li> <li>• The hospital credits the devices for reducing by 57 percent the average length of stay among patients using them.</li> <li>• The hospital has attributed a 47 percent decrease in hospitalization rates for its heart failure and COPD patients to the installation of telemonitoring devices, resulting in a more than \$600,000 reduction in costs.</li> <li>• Mercy estimates a cost reduction of more than \$1 million over the same period due to the decreased average length of stay among telemonitored patients.</li> </ul>	<ul style="list-style-type: none"> <li>• Study Period: Feb. 2008-Feb. 2010.</li> <li>• Mercy's telemonitoring device monitors patients' blood pressure, pulse, oxygen saturation, weight, and blood sugar.</li> <li>• Information is transmitted to the Mercy Home Care office on a daily basis for a nurse to review.</li> <li>• Approx. 60 cardiac patients using telemonitoring at time article was published.</li> <li>• The report information is based on interviews with hospital personnel, publicly available information and materials provided by the hospital.</li> </ul>

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<p><b>Cost-Savings Analysis of Telemedicine Use for Ophthalmic Screening in a Rural Appalachian Health Clinic</b> D. Russell Richardson, Russell Fry, Michael Krasnow <i>West Virginia Medical Journal</i> 109(4); Jul/Aug. 2013</p> <p>This article analyzes the financial impact of ophthalmic telemedicine in a mountainous, rural health clinic in West Virginia over a seven-year period from 2003-2009.</p>	<ul style="list-style-type: none"> <li>When taking into consideration the number of patients screened, travel costs, work missed, overhead and billing considerations, there was a savings of \$153.43 per patient visit.</li> <li>Under the same parameters, savings over 7 years is equal to \$71,189.28.</li> <li>When running the analysis with the scenario that every referral was a false positive, their analysis still yielded a 7 year net-savings of \$29,260.48 or \$44.40 per patient screened.</li> </ul>	<ul style="list-style-type: none"> <li>This cost analysis did not consider some components of the system which are co-opted from pre-existing uses which have fixed costs which would exist with or without a screening system.</li> <li>However, it does include costs and benefits associated with components of the system that have been created specifically for the screening system.</li> <li>At-risk patients are screened with a fundus camera during routine clinic visits, and the image is interpreted off-site by an ophthalmologist. Patients are either advised to follow up yearly or receive an immediate ophthalmic referral.</li> <li>Used the Medicare billing rate to come to their projections.</li> </ul>
<p><b>Impact of an Intensive Care Unit Telemedicine Program on a Rural Health Care System</b> Edward Zawada, Patricia Herr, Deanna Larson, et al. <i>Health Economics</i> 121(3); May 2009</p> <p>This article evaluates the impact of a 15-hospital, rural, multi-state intensive care unit (ICU) telemedicine program.</p>	<ul style="list-style-type: none"> <li>Survey respondents estimated a 37.5% reduction in the number of patients requiring transfer. The reported cost of transfer (primarily helicopter) ranged from \$5815 to \$10,889 per patient.</li> <li>In aggregate, there were 6825 fewer ICU days, and 821 fewer hospital days. Savings attributed to reduced ICU days was about \$8 million.</li> <li>They estimate that there was a \$1.25 million cost savings due to Length of Stay reductions.</li> </ul>	<ul style="list-style-type: none"> <li>Study period: 2005-2007.</li> <li>The study used performance data obtained from patient charts to calculate reduced length of stays in ICUs and hospitals to figure out cost savings.</li> <li>Start-up costs were estimated at \$2,757,000.</li> <li>Operating costs were \$2,018,000, \$2,307,000, and \$1,163,000 (half year).</li> </ul>

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<p><b>Use of Telemedicine Can Reduce Hospitalizations of Nursing Home Residents and Generate Savings for Medicare</b> David Grabowski, A. James O'Malley <i>Health Affairs</i> 33(2); Feb. 2014</p> <p>This article reviews the findings of a controlled study of eleven nursing homes, which provides evidence that switching from on-call to telemedicine physician coverage during off hours in nursing homes could reduce hospitalizations and generate cost savings to Medicare in excess of the facility's investment in the service.</p>	<ul style="list-style-type: none"> <li>• The rate of hospitalizations declined, resulting in an average savings to Medicare of \$151,000 per nursing home per year.</li> <li>• The annual cost of telemedicine service in this study was \$30,000.</li> <li>• There was a net savings of \$120,000 per nursing home per year in the more engaged facilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Study period: Oct. 2009-Sept. 2011.</li> <li>• Studied the introduction of telemedicine in a Massachusetts for-profit nursing home chain, which included eleven nursing homes.</li> <li>• Telemedicine provider delivered services in the nursing homes to cover urgent or emergent calls on weeknights and weekend days.</li> <li>• Telemedicine intervention in the nursing home included two-way videoconferencing and a high-resolution camera for use in wound care.</li> <li>• Based on a recent study looking at rehospitalization rates from skilled nursing facilities and associated reimbursement from 2000-2006, they assumed Medicare paid \$10,000 per hospitalization.</li> </ul>