American Telemedicine Association

Telemedicine's Impact on Healthcare Cost and Quality Research Outcomes

Over 40 years of research has yielded a wealth of data about the cost effectiveness and efficacy of many telemedicine applications. PubMed a bibliographic database of medical research that is maintained by the National Library of Medicine includes over 10,000 citations of published works related to telemedicine or telehealth. Over 2,000 evaluative studies related to telemedicine have been published in two journals devoted to telemedicine alone. The summaries that appear highlight the results from a few of the studies that have evaluated the cost effectiveness, quality of care and patient acceptance of telemedicine.

COST EFFECTIVENESS OF TELEMEDICINE

Most of the peer-reviewed research about the cost effectiveness of telemedicine that is based on large sample sizes and follow sound scientific rigor are relatively new, many emerging in the past two years. These studies are consistent in finding that telemedicine saves the patients, providers and payers money when compared with traditional approaches to providing care. Many of these studies assess the cost effectiveness of specific telemedicine applications.

The Value of Provider-to-Provider Telehealth Technologies Center for Information Technology Leadership Partners HealthCare System, Inc, 2007
This study examined several specific telemedicine applications and used a rigorous approach to define both costs and financial benefits to the nationwide implementation of each application.

- For the use of telemedicine to join EMERGENCY ROOMS - the cost to equip all US emergency departments with hybrid telehealth technologies could easily be covered by savings from a reduction in transfers between emergency departments. From a baseline of 2.2 million patients transported each year between emergency departments at a cost of $1.39 billion in transportation costs, hybrid technologies would avoid 850,000 transports with a cost savings of $537 million a year.
- For the use of telemedicine in CORRECTIONAL FACILITIES - Correctional facilities could cover their costs of hybrid telehealth equipment by savings from a reduction in transporting patients to emergency departments and to physician offices, and by avoiding the costs of the emergency department visit. From a baseline of 94,180 transports made annually from correctional facilities to emergency departments at a cost of $158 million in transportation and visit costs, hybrid technologies could avoid almost 40,000 transports with a cost savings of $60.3 million a year. Further, hybrid technologies could avoid visits to physician offices. From an annual baseline of 691,000 physician office visits at a cost of $302 million, hybrid technologies could avoid 543,000 inmate transports with a cost savings of $210 million.
- For the use of telemedicine in NURSING HOMES - the costs of implementing hybrid telehealth equipment in nursing homes could be covered by savings from a reduction in transferring residents to emergency departments and physician offices, and by avoiding the costs of the emergency department visit. From a baseline of 2.7 million transports made annually from nursing facilities to emergency departments at a cost of $3.62 billion in current transportation and emergency department visit costs, hybrid technologies could avoid 387,000 transports with a cost savings of $327 million. In addition, of the 10.1 million physician office visits made annually from nursing facilities at a cost of $1.29 billion for in-person physician office visits and transportation, hybrid technologies could avoid 6.87 million transports with a cost savings of $479 million.

Care Coordination/Home Telehealth: The Systematic Implementation of Health Informatics, Home Telehealth, and Disease Management to Support the Care of Veteran Patients with Chronic Conditions Adam Darkins, Patricia Ryan, Rita Kobb,

Linda Foster, Ellen Edmonson, Bonnie Wakefield, Anne E. Lancaster *Telemedicine and e-Health. December 2008, 14(10): 1118-1126.*
The Veterans Health Administration (VHA) introduced a national home telehealth program, Care Coordination/Home Telehealth (CCHT), in 2003 to coordinate the care of veteran patients with chronic conditions and avoid their unnecessary admission to long-term institutional care. CCHT patients increased from 2,000 to 31,570 (1,500% growth) between 2003 and 2007. CCHT is now a routine noninstitutional care (NIC) service provided by VHA to support veteran patients with chronic conditions as they age. Routine analysis of data obtained for quality and performance purposes from a cohort of 17,025 CCHT patients shows the benefits of a 25% reduction in numbers of bed days of care, 19% reduction in numbers of hospital admissions, and mean satisfaction score rating of 86% after enrollment into the program. These results demonstrate a dramatic reduction in costs and an equally dramatic increase in quality.

A Systematic Review of the Key Indicators for Assessing Telehomecare Cost-Effectiveness Stephanie Vergara Rojas, Marie-Pierre Gagnon. *Telemedicine and e-Health November 1, 2008, 14(9): 896-904. doi:10.1089/tmj.2008.0009.*
This careful review identified reports on telehomecare published between 1997 and 2007. Of the identified studies, 23 were appropriate for comparison of costs in various ways. Of these, 70% were in the United States, 15 of 23 were randomized control trials, and 48% were published between 2003 and 2007. Teleconsultation was about equal to telemonitoring in the services. Total cost, cost per patient, and cost per visit were all reduced by telehomecare. The report also concluded that standardization of cost outcomes should be implemented in order to help funding agencies better understand the importance of telehomecare.

Economic Impact of eICU Implementation in an Academic Surgical ICU Benjamin A Kohl, Frank D Sites, Jacob T Gutsche, Patrick Kim, Anesthesiology and Critical Care, University of Pennsylvania, Philadelphia, PA Crit Care Med. 2007;35(12):A26.
This study shows an improvement in mortality and length of stay after implementing *e*ICU (VISICU, Baltimore, MD) in a large academic surgical ICU. The purpose of this study was to measure the economic impact of this transition. Hypothesis: Implementation of *e*ICU in an academic surgical ICU, allowing round-the clock intensivist oversight, will decrease ICU and hospital costs. METHODS: The study retrospectively compared a random sample of 189 patients pre-*e*ICU to 2,622 patients 3 years post *e*ICU using a multiplier of 13.87 to normalize populations. Assumptions based upon published literature include an average surgical ICU cost per day of $1,500-$2,000 and an average daily cost on a general floor of $500-$600. Because of the disparate sizes in populations a multiplier of 13.87 was used to standardize the numbers. There was no significant change in practice paradigm during the time period. APACHE III scores were used to calculate predicted length of stay in ICU and hospital. RESULTS: An almost 10% reduction in ICU stay and 20% reduction in floor stay occurred after implementation of *e*ICU. This translated into a savings of $706,272-$941,697 for the ICU and $2,134,339-$2,842,940 for the floor. CONCLUSIONS: Implementation of an *e*ICU in an academic SICU resulted in significantly reduced costs.

Cost-Utility Analysis of Telemedicine and Ophthalmoscopy for Retinopathy of Prematurity Management
Kevin M. Jackson, OD, MPH; Karen E. Scott, MD, MBA; Joshua Graff Zivin, PhD; David A. Bateman, MD; John T. Flynn, MD; Jeremy D. Keenan, MD, MPH; Michael F. Chiang, MD Arch Ophthalmol. 2008; 126(4):493-499.
Objective To evaluate the cost-effectiveness of telemedicine and standard ophthalmoscopy for retinopathy of prematurity (ROP) management. METHODS - Models were developed to represent ROP examination and treatment using telemedicine and standard ophthalmoscopy. Cost-utility analysis was performed using decision analysis, evidence-based outcome data from published literature, and present value modeling. Visual outcome data were converted to patient preference–based time trade-off utility values based on published literature. Costs of disease management were determined based on 2006 Medicare reimbursements. Costs per quality-adjusted life year gained by telemedicine and ophthalmoscopy for ROP management were compared. One-way sensitivity analysis was performed on the following variables: discount rate (0%-7%), incidence of treatment-requiring ROP (1%-20%), sensitivity and specificity of ophthalmoscopic diagnosis (75%-100%), percentage of readable telemedicine images (75%-100%), and sensitivity and specificity of telemedicine diagnosis (75%-100%). RESULTS 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. Sensitivity analysis resulted in ranges of costs per quality-adjusted life year from $1235 to $18 898 for telemedicine and from $2171 to $27 215 for ophthalmoscopy. CONCLUSIONS Telemedicine is more cost-effective than standard ophthalmoscopy for ROP management. Both strategies are highly cost-effective compared with other health care interventions.

TELEMEDICINE AND QUALITY OF CARE

Scientific studies in this area indicate that the use of telemedicine for such applications as monitoring of chronic care patients or allowing specialists to provide care to patients over a large region care have resulted in significantly improved care. For most telemedicine applications, studies have shown that there is no difference in the ability of the provider to obtain clinical information, make an accurate diagnosis, and develop a treatment plan that produces the same desired clinical outcomes as compared to in-person care when used appropriately. Here are a few examples.

Home-based telehealth: a review and meta analysis Dellifraine JL, Dansky KH. *J Telemed Telecare. 2008;14(2):62-6* Department of Health Policy and Administration, The Pennsylvania State University, Pennsylvania 16802, USA. We conducted a systematic review to identify studies on the effect of home telehealth on clinical care outcomes. The search was restricted to peer-reviewed publications (published between 2001 and 2007) about studies conducted in home or residential settings. The search yielded 154 potential articles and dissertations. A total of 29 articles met the inclusion criteria and were included in a meta-analysis. The weighted mean effect size for the overall meta-analysis was 0.50, and the z-statistic was 3.0, indicating that telehealth had a moderate, positive and significant effect (P < or = 0.01) on clinical outcomes. Sub-analyses also indicated positive significant effects of telehealth for some disease categories (heart disease and psychiatric conditions), but not others (diabetes), patient populations and telehealth interventions. Overall, the meta-analysis indicated that telehealth positively affects clinical outcomes of care, even in different patient populations.

Janca, 2000. Telepsychiatry: an update on technology and its implications. *Curr Op in Psych* 13: 591-7.
This study/article concluded that even "early research demonstrated that the psychiatric interview conducted over videoconferencing is reliable for diagnostic assessment and treatment recommendations." In addition, a retrospective review of medical records comparing clinical outcomes of patients seen by [interactive TV] (IATV) and those in-person showed no significant difference found in the percentage of change in Global Assessment of Functioning (GAF) between the two groups suggesting clinical outcomes were not affected by the use of IATV.

Young TL, Ireson C. Effectiveness of school-based telehealth care in urban and rural elementary schools. Pediatrics. 2003 Nov;112(5):1088-94.
Telehealth technology was effective in delivering pediatric acute care to children in [these] schools. Pediatric providers, nurses, parents, and children reported primary care school-based telehealth as an acceptable alternative to traditional health care delivery systems.

Leggett PF, Graham L , Steele K, Gilliland A, Stevenson M, O'Reilly D, Wootton R, and Taggart A (Sep 2001) Telerheumatology: Diagnostic accuracy and acceptability to patient, specialist, and general practitioner. *British Journal of General Practice* 51(470*)* : 746-8.
This study examines the diagnostic accuracy and acceptability of telemedicine in the field of rheumatology. One hundred patients had a telephone and televisual consultation and the results were compared with a face-to-face consultation. While the telephone consultations were often unsatisfactory, the televisual consultations were highly accurate (97%) and acceptable to patients, general practitioners, and specialists.

Jerant AF, Azari R, Martinez C, Nesbitt TS.A randomized trial of telenursing to reduce hospitalization for heart failure: patient-centered outcomes and nursing indicators. *Home Health Care Serv Q*. 2003;22(1):1-20.
Patient self-care adherence, medications, health status, and satisfaction did not significantly differ between groups. Telenursing can reduce CHF hospitalizations and allow increased frequency of communication with patients.

Belmont JM, Mattioli LF. Accuracy of analog telephonic stethoscopy for pediatric telecardiology. *Pediatrics*. 2003 Oct;112(4):780-6
In pediatric patients, a narrow-bandwidth telephonic stethoscope can accurately distinguish between functional and organic murmurs and thus can detect heart disease. Accuracy is greatest when the instrument is used by an experienced examiner with patients at least 5 years of age.

Ermer D.J., 1999. Child and adolescent telepsychiatry clinics. *Psych Services* Jul 29(7): 409-14.
This study concluded that severely disturbed children can be adequately assessed and treated, the range of expressed emotion and the quality of clinical interaction appear similar in TelePsychiatry and [in-person] interactions, and children in crisis can be safely assessed and treated [via telepsychiatry].

Arizona telepsychiatry project gains national attention, patient approval, 1998. *Mental Health Weekly*, Jan 19, 8(3): 4.
Main purpose of the project was to facilitate mental health in the region with the use of telehealth technology – role of simplifying case management and prior authorization. Program instituted by the Northern Arizona Regional Behavioral Health Authority.

Craig J, et. al. 2000. The cost-effectiveness of teleneurology consultations for patients admitted to hospitals without neurologists on site. *Journ of Telemedicine and Telecare* 6 (suppl 1): S1: 46-9.
Comparison of outcomes of patients admitted to two small. One hospital received neurological services by telehealth, the other in-person . Neurological services were provided via Telemedicine. Comparing case-mix, process of management, and outcomes for all patients using ICD-10 codes with a final diagnosis of neurological condition there were no appreciable differences noted between the clinical outcomes and the length of stay between patients receiving services in-person and those who received services via telehealth.

Telemedicine and Diabetes Dimmick et. al. *Telemed Journal and e-Health*, 9(1): 13-23 (2003)
This is a study of patients receiving care over a telemedicine network that linked three hospitals and an FQHC with six sites, a dental clinic, and patient homes. Outcomes from the disease management programs conducted over telemedicine for the diabetes group showed that the diabetes disease management program increased the number of diabetics who brought their blood sugar under control.

PATIENT SATISFACTION WITH TELEMEDICINE

Patient satisfaction with the use of telemedicine to access care and the use of telecommunications technologies to connect with specialists and other health care providers in order to meet unmet medical needs has consistently been very high. Degrees of satisfaction may vary slightly with the specialty accessed through telemedicine, but overall patients have responded well to its use. The source of satisfaction for most patients is the ability to see a specialist trained in the area most closely related to the patient's condition, the feeling of getting personalized care from a provider who has the patient's interest in mind, and the ability to communicate with the provider in a very personal and intimate manner over the telecommunications technologies. Examples appear below.

Gustke, S.S., Balch, D.C., West, V.L., and Rogers, L.O. 2000. Patient satisfaction with telemedicine. *Telemedicine Journal* Spring 6(1): 5-13.
Patient satisfaction was examined in relation to patient age, gender, race, income, education, and insurance. Overall patient satisfaction was found to be 98.3%.

Janca, 2000. Telepsychiatry: an update on technology and its implications. *Curr Op in Psych* 13: 591-7.
In this study, results indicated that "most consumers found that a video link with a psychiatrist moderately or greatly helped them in managing their treatment, with 98% of the preferring to be offered videoconferencing in combination with local services."

Brodey et al, 2000. Satisfaction of forensic psychiatry patients with remote telepsychiatric evaluation. *Psych Services:* Oct 51(10): 1305-7.
This study indicated that satisfaction did not differ significantly between video and in-person consultations for incarcerated patients.