Supplementary Table S1. Search strategies.

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| --- | --- |
| Database | Search Strategy |
| PubMed | ((("Home Care Services"[Mesh] OR “in home”[ti])) AND ("Costs and Cost Analysis"[Mesh] OR Costs[tiab] OR Cost[tiab] OR price OR pricing OR "Models, Economic"[Mesh] OR Economics[ti] OR economic[ti] OR "Cost-Benefit Analysis"[Mesh] OR "marginal analyses" OR "marginal analysis")) AND ("Telemedicine"[Mesh] OR telemedicine OR telehealth OR telecare OR "mobile health" OR mHealth\* OR eHealth\* OR "Monitoring, Physiologic"[Mesh] OR "physiologic monitoring" OR "physiological monitoring" OR "physiological monitor" OR "patient monitoring" OR "patient monitor" OR "patient monitored" OR "Signal Processing, Computer-Assisted"[Mesh] OR "computer-assisted signal processing" OR "digital signal processing" OR "digital signal process" OR "Blood Pressure Monitors"[Mesh] OR "blood pressure monitors" OR "blood pressure monitor" OR "blood pressure monitors" OR "Monitoring, Ambulatory"[Mesh] OR "outpatient monitoring" OR "ambulatory monitoring" OR "ambulatory monitor" OR Observ\*[tiab] OR Detect\*[tiab] OR Surveillance\*[tiab] OR "Remote Consultation"[Mesh] OR "remote consultation" OR "teleconsultation" OR "teleconsultations" OR "remote monitor" OR "remote monitoring" OR "distance monitoring" OR "Diagnosis, Computer-Assisted"[Mesh] OR "computer-assisted diagnosis" OR "computer assisted diagnosis" OR Telemanage\* OR "Therapy, Computer-Assisted"[Mesh] OR "computer-assisted therapy" OR "computer assisted therapy" OR "computer-assisted therapies" OR "computer-assisted protocol-directed therapy" OR "computer-assisted protocol directed therapy" OR "computer assisted protocol-directed therapy") filters: Publication date from 2000/01/01 to 2017/11/30; English |
| Cochrane | "Telemedicine" OR Telehealth OR Telecare OR telehome OR "mobile health" OR mHealth\* OR eHealth\* OR "physiologic monitor\*" OR "physiological monitor\*" OR "patient monitor\*" OR "patient monitor" OR "computer-assisted signal process\*" OR "digital signal process\*" OR "blood pressure monitor\*" OR "outpatient monitor\*" OR "ambulatory monitor\*" OR "ambulatory monitor" OR Observ\* OR Detect\* OR Surveillance\* OR "Remote Consult\*" OR "teleconsult\*" OR "remote monitor\*" OR "distance monitor\*" OR "computer-assisted diagnosis\*" OR Telemanage\* OR "computer-assisted therap\*" OR "computer-assisted protocol-directed therap\*" in Title, Abstract, Keywords and Cost\* OR "cost Analysis" OR Price OR Pricing OR Priced OR "Economic Model\*" OR Economic\* OR "Cost-Benefit Analysis" OR "marginal analyses" OR "marginal analysis" in Title, Abstract, Keywords and "Home Care Services" OR "in home" OR home in Title, Abstract, Keywords in Cochrane Reviews' |
| CINAHL | ( (MH "Telemedicine+") OR Telemedicine OR (MH "Telehealth+") OR “Mobile Health” OR mHealth\* OR eHealth\* OR Telehealth OR Telecare OR telehome OR (MH "Monitoring, Physiologic+") OR “physiologic monitoring” OR “physiological monitoring” OR “physiological monitor” OR “patient monitoring” OR “patient monitor” OR “patient monitored” OR “Monitoring Physiological” OR (MH "Signal Processing, Computer Assisted") OR “Computer Assisted Signal Process\*” OR “Digital Signal Process\*” OR (MH "Blood Pressure Devices+") OR “Blood Pressure Monitor\*” OR “Blood Pressure Device\*” OR “BP Monitor\*” OR “BP Device\*” OR "outpatient monitor\*" OR "ambulatory monitor\*" OR TI Observ\* OR AB Observ\* OR TI Detect\* OR AB Detect\* OR TI Surveillance OR AB Surveillance OR (MH "Remote Consultation") OR Teleconsultat\* OR “Remote Consultat\*” OR "remote monitor\*" OR (MH "Diagnosis, Computer Assisted+") OR “Computer Assisted Diagnosis” OR Telemanage\* OR (MH "Therapy, Computer Assisted+") OR “Computer Assisted Therap\*” ) AND ( (MH "Costs and Cost Analysis+") OR TI costs OR AB costs OR TI cost OR AB cost OR Price\* OR Pricing OR TI economic\* OR (MH "Cost Benefit Analysis") ) AND ( (MH "Home Health Care+") OR TI "in home" OR AB "in home" OR “Home Care Service\*” OR “Home Healthcare” OR TI “home” )  Limiters - Published Date: 20000101-20171130; Age Groups: All Adult; English Language  |
| Embase | 'telehealth'/exp OR 'telehealth' OR 'e-health'/exp OR 'e-health' OR 'ehealth'/exp OR 'ehealth' OR 'tele-health'/exp OR 'tele-health' OR 'physiologic monitoring'/exp OR 'physiologic monitoring' OR 'patient monitoring'/exp OR 'patient monitoring' OR 'intraoperative monitoring'/exp OR 'intraoperative monitoring' OR 'intraoperative neurophysiological monitoring'/exp OR 'intraoperative neurophysiological monitoring' OR 'peroperative monitoring'/exp OR 'peroperative monitoring' OR 'signal processing'/exp OR 'signal processing' OR 'digital signal processing'/exp OR 'digital signal processing' OR 'computer-assisted signal processing' OR 'remote sensing'/exp OR 'remote sensing' OR 'long distance monitoring' OR 'remote monitoring'/exp OR 'remote monitoring' OR 'remote sensing technology'/exp OR 'remote sensing technology' OR 'telesensing'/exp OR 'telesensing' OR 'computer assisted diagnosis'/exp OR 'computer assisted diagnosis' OR 'automatic diagnosis'/exp OR 'automatic diagnosis' OR 'computer diagnosis'/exp OR 'computer diagnosis' OR 'computer-assisted image interpretation' OR telemanage OR 'computer-assisted radiographic image interpretation' OR 'computer assisted therapy'/exp OR 'computer assisted therapy' OR observ\*:ab,ti OR detect\*:ab,ti OR surveillance\*:ab,ti AND ('cost benefit analysis'/exp OR 'cost benefit analysis' OR cost\*:ab,ti OR price OR pricing OR priced OR economic:ti OR economics:ti) AND ('home care'/exp OR 'home care' OR 'domestic health care'/exp OR 'domestic health care' OR 'domiciliary care'/exp OR 'domiciliary care' OR 'home health nursing'/exp OR 'home health nursing' OR 'home help'/exp OR 'home help' OR 'home nursing'/exp OR 'home nursing' OR 'home service'/exp OR 'home service' OR 'home treatment'/exp OR 'home treatment' OR 'homecare'/exp OR 'homecare' OR 'homemaker services'/exp OR 'homemaker services' OR 'in home':ab,ti OR home:ti) AND ([adult]/lim OR [middle aged]/lim OR [aged]/lim OR [very elderly]/lim) AND [english]/lim AND [embase]/lim AND [2000-2017]/py |

Supplementary Table S2. Selected characteristics of included studies.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First author, Year | Study design | Disease | No. of subjects | Length of study (month) | Key personnela | Equipment | Vendor | Outcome measure | study setting | Location | Funding source |
| Fletcher, 2000 | Prospective case study | Obstructive sleep apnea | 63 | N/A | N/A | Unattended home monitoring along with automatic titrating continuous positive airway pressure | DeVilbiss | Number of subjects able to be diagnosed by unattended home monitoring | Academic(University of Louisville hospital & VA medical center) | N/A | N/A |
| Dansky, 2001 | RCT | Diabetes | 171 | 18 | Nurse | Camera with a close-up lens, medical sensors (sphygmomanometer and stethoscope) | American Telecare, Inc. | Costs associated with providing telehomecare services | Academic & Community (Pennsylvania State University & visiting nurses association) | Urban | Government(US Depart. of Commerce) |
| Smith, 2002  | Pilot feasibility study  | Obstructive sleep apnea | 5 | 6 | Nurse | Included a camera and modem mounted on top of a television (transmitted via Plain Old Telephone Service [POTS]) | N/A | The reliability of gathering data from home ventilator patients compared to data recorded by a home health nurse in the subject's home | Academic(University of Kansas) | N/A | The University of Kansas, School ofNursing Competitive Research Fund |
| Benatar, 2003 (36) | RCT | Heart failure | 216 | 12 | Nurse | Transtelephonic home monitoring devices programmed to measure blood pressure, heart rate, arterial oxygen saturation, and weight. | AvidCare Corporation | HF readmissions , length of stay, HF hospitalization charges, and pre- and post-intervention quality-of-life measurements | Academic(University of Illinois at Chicago) | Urban | Government(NIH) |
| Cheung, 2003 | Prospective case study | Prosthetic valve, atrial fibrillation, cardiomyopathy, stroke, MI, & deep venous thrombosis orpulmonary embolism (with the use of warfarin) | 35 | 24 | Nurse | Portable Coagulometer | Basel | International Normalized Ratio of a drop of whole blood | Community(Cardiac home health agency) | Urban | Government(AHRQ) |
| Bohnekamp, 2004  | Quasi-experimental study | Cancer | 28 | N/A | Nurse | A home health monitor and equipment for connecting to a TV | N/A | Type of care, costs, patient satisfaction, ostomy adjustment, and time to achieve ostomy self-care | Academic(University Medical Center) | N/A | N/A |

Supplementary Table S2. Continued.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First author, Year | Study design | Disease | No. of subjects | Length of study (month) | Key personnela | Equipment | Vendor | Outcome measure | study setting | Location | Funding resource |
| Noel, 2004  | RCT | CHF, COPD, and diabetes | 104 | 6 | Nurse | Camera, a touch screen interface and FDA-approved peripheral devices plug into the telehealth unit | N/A | Quality-of-life, health resource use, and costs | VA Healthcare System | N/A | Government(VA Health Services Research and Development)  |
| Walsh, 2005  | Case study  | Heart disease and diabetes | 4 | N/A | Nurse | Blood pressure cuff, electronic stethoscope, video camera, with magnifier, monitor, pulse oximetry, digital scale and glucose monitor | N/A | Costs, projected savings, and patient satisfaction | Community(visiting nurse association) | N/A | N/A |
| Finkelstein, 2006  | RCT | CHF, COPD, chronic wound care | 53 | 36 | Nurse | A set-top box connected to the subject’s television set and telephone line and an eyeball camera was placed on the box.  | 8x8 Inc. & Philips Electronics | Mortality, morbidity, transfer to a different level of care, costs, and satisfaction | Academic & Community (University of Minnesota & Home Health Care agency) | Rural | Government(US Depart. of Commerce) |
| Hicks, 2009  | Quasi-experimental study | Surgical aftercare, cardiovascular problems, lung problems, cancer, diabetes, and infections | 94 | N/A | Nurse | FDA Class II medical device that collects key vital signs (blood pressure, heart rate, oxygen saturation, temperature) | N/A | Additional costs and benefits associated with home telehealth monitoring, and client and provider satisfaction | Academic & Community (University of Missouri & home healthcare agency) | Rural | Government(Missouri Tobacco Settlement Fund) |
| Rabinowitz, 2010  | Case study  | Mental health  | 106 | N/A | Physicians | State-of-the-art videoconferencing equipment and large-screen monitors | Polycom | Potential cost and time savings (telepsychiatry vs. in-person care) | Academic & Community (Fletcher Allen Health Care & University of Vermont Telemedicine program) | N/Ai | N/A |
| Reed, 2010  | RCT  | Hypertension | 61 | 24 | Nurse | Electronic blood pressure measurement devices | N/A | Direct and patient time costs | Academic(Health system, Duke University) | Urban | Government(NHLBI) |

aNurse included advanced practice nurse, clinical nurse specialist, & registered nurse.

Abbreviation: RCT, randomized controlled trial; MI, myocardial infarction, CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; HF, heart failure; FDA, Food and Drug Administration; NIH, National Institute of Health; AHRQ, Agency for Healthcare Research and Quality; NHLBI, National Heart, Lung, and Blood institute; N/A, not applicable.

Supplementary Table S3. Cost components of telemedicine programs.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| First author,Year | Cost metrics | Estimate | Telemedicine Program Costs | Cost year provided? | Cost benefits | Comment |
| Staffing | Technology | Miscellaneous |
| Fletcher,2000  | Total home diagnosis and treatment costs  | USD29,787  | USD86.5/study | USD15,600 (3 computer units [USD4,200 each] & 3 auto-CPAP units [USD1000 each]) | USD137 per patient (nasal mask, tubing, valve, & oximeter finger piece) | No | Reduced diagnostic and treatment costs by USD1,128 per patient | Home diagnosis costs for each intervention group but not detail provided. No cost measure unit |
| Dansky, 2001  | Total costs of telehomecare per year | USD35,689 | USD12,035 | USD19,113 | USD4,541 (insurance, supplies, & administrative) | No | Reduce home visit costs between USD319-USD697 per patient per episode for patients who were in home care for 60 days  | Provided most details of telehomecare costs |
| Smith, 2002  | Total costs of telehealth (visits, materials, & travel for installation and pick-up) per 6-month | USD1,360 | USD560 for 23 telehealth nurse visits(24.32/visit) | USD800 | N/A | No | Reduced costs by USD41 per visit | Limited telemedicine costs detail (no costs of materials and travel for installation and pick-up) |
| Benatar, 2003  | Total fractionated costs of telemonitoring per day  | USD2.87 | USD0.57/day (nurse and physician time) | USD2.28/day (cellular telephone, biotechnology & home monitor); USD832/year | USD0.02/day (papers)  | No | Reduced readmission charged by USD136,332 at a 1-year period | The overhead (rental property, space leasing, or facility owned property) costs were not accounted for; we converted the costs to an annual basis |
| Cheung, 2003 | Average costs per International Normalized Ratio | USD6.85/INR | N/A | N/A | USD6.85/INR (test strips, depreciation of the coagulometer, training, quality control, repeat tests, & confirmation tests) | Yes(1999) | Reduced costs of INR measurement by USD10.45/INR | No costs of coagulometer and personnel were reported |
| Bohnekamp, 2004  | Average costs of per telenursing visit | USD18.9 (nurse salary, airtime, & equipment) | USD17.70 (30 minutes) | USD1.20 (phone line charges & prorated cost for equipment and maintenance) | N/A | No | Reduced costs by USD44.1 per telenursing visit  | The overhead costs were not included |
| Noel, 2004  | Total costs of telehealth unit per 6-month | USD78,302 | N/A | N/A | N/A | Yes(2002) | Reduced health care costs, including transportation, RN home visits, bed-day-of-care (admission and discharge days plus integral days as inpatient), ER visit, specialty clinical, and primary care, by USD2,648 per patients at a 6-month period | No detail about the telehealth unit costs |

Supplementary Table S3. Continued.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| First author,Year | Cost metrics | Estimate | Telemedicine Program Costs | Cost year provided? | Cost benefits | Comment |
| Staffing | Technology | Miscellaneous |
| Walsh, 2005  | Total costs of telehealth monitoring | USD19,160-USD21,160  | USD43 for telehealth visits (compared to USD121 in person) | USD7,160 (blood pressure cuff, electronic stethoscope, video camera with magnifier, monitor, pulse oximetry, digital scale, & glucose monitor) | USD12,000-USD14,000 (clinician station) | Yes(2003) | Reduced costs of skilled nurse visits by USD3,432 at a 6-month period | No detail about the program components, costs of clinician station, and cost metrics |
| Finkelstein, 2006  | Average total costs per visit (virtual visits & monitoring) at a 6-month period | USD33.11/visit; total costs = USD33.11 × 292 = USD9,668 | USD10.20 (nurse time), total costs= USD10.20 × 292 = USD2,978 | USD10.98 (total costs=USD10.98 × 292 = USD3,206) | USD11.93 (technician travel, technical time, & overhead), total costs = USD11.93 × 292 = USD3,484  | No | Reduced average costs by USD15.16 per visit (total costs saving = USD41,361) compared to the actual visit group | Great detail about the home virtual visit & monitoring |
| Hicks, 2009  | Total costs of telemedicine per 6-month | USD53,562 | USD17,100 | USD20,298 | USD16,164 (mileages & travel time) | Yes(2005) | Reduced hospitalization expenses by USD126,899 | Details of personnel costs associated with telemedicine were provided; no detail of what consist of total service expenses |
| Rabinowitz, 2010  | Total costs of telepsychiatry per year | USD24,426 | N/A | USD6,425/per site | USD1,220 (support hardware and software & service contract) | Yes(2002) | Psychiatric visit reduced potential patients-to-physician travel (estimated at USD20, USD30 and USD40/hour) and physician-to-patient travel (estimated at USD100, USD200, and USD300/hour) costs by USD13,060-USD46,798 and USD63,668-USD232,361, respectively | No detail about the costs of videoconference unit and staffing; saving was resulted from travel distance, travel time, gasoline, personnel and physician costs  |
| Reed, 2010  | Total costs of home blood pressure monitoring & telephonic behavioral intervention per year | Fixed costs of USD54,404; variable costs per patient of USD124  | USD51,703 (nurse salary and fringe) | USD104.66/per patients (blood pressure monitor & batteries, and initial training and assessment); telephone service of USD669/year | USD2,032 (startup and office space) | Yes(2008) | Combined intervention reduced direct medical costs by USD627 compared to usual care during 2 years; by the incremental 2-year cost per 1-point reduction in systolic blood pressure was USD107 in direct medical costs and USD297 when including patient time costs | Great details about the cost components of telephonic behavioral intervention |

Abbreviation: INR, international normalized ratio. N/A, not applicable.