



Center for  
**Connected**  
**Health Policy**  
The National Telehealth Policy Resource Center

## Remote Patient Monitoring Research Catalogue

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August 2018

To increase and organize the evidence for the use of telehealth, the Center for Connected Health Policy (CCHP) has been examining published studies that have been designed to measure the use of telehealth in achieving one or more of the goals of the Triple Aim. CCHP has been cataloguing studies published in peer reviewed journals that meet certain criteria. This catalogue of Remote Patient Monitoring studies is one result.

CCHP employed several search parameters when selecting Remote Patient Monitoring studies. All studies selected were U.S. based, published post 2007, have a sample size of no less than 50 (for studies with control groups, there needed to be a minimum of at least 30 subjects per group), a study period of no less than 6 months and a primary focus on the outcomes (though if all other factors were met and the time period was unspecified, the article was included), quality and or costs of a selected telehealth modality. Journal articles that were focused on tele-ICU, telephonic, and care management environments were eliminated, as well. Retrospective study and pilot studies have been included separately, due to the absence of a widely accepted quality assessment scale for these types of studies.

Pub Med, Science Direct, Academic OneFile, Springer Link, Wiley Online Library, and EBSCO were used in the peer-reviewed articles search. If CCHP was unable to obtain a copy of the full article, it was not included in the catalogue.

This catalogue was prepared by Laura Nasserri and the work supervised by Mei Wa Kwong and Christine Calouro. The catalogue was updated in July 2016 by Claire Rice and again in July 2018 by Michelle Grant.

## CONTROL TRIAL SUMMARIES:

Basch, Deal, Kris, Scher, Hudis, Sabbatini, ... Schrag. (2016). Symptom Monitoring With Patient-Reported Outcomes During Routine Cancer Treatment: A Randomized Controlled Trial. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology*, 34(6), 557-65.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
6 months	NY	766	Remote Patient Monitoring	Randomized Controlled Trial	X		

### Summary

**Purpose:** There is growing interest to enhance symptom monitoring during routine cancer care using patient-reported outcomes, but evidence of impact on clinical outcomes is limited.

**Methods:** We randomly assigned patients receiving routine outpatient chemotherapy for advanced solid tumors at Memorial Sloan Kettering Cancer Center to report 12 common symptoms via tablet computers or to receive usual care consisting of symptom monitoring at the discretion of clinicians. Those with home computers received weekly e-mail prompts to report between visits. Treating physicians received symptom printouts at visits, and nurses received e-mail alerts when participants reported severe or worsening symptoms. The primary outcome was change in health-related quality of life (HRQL) at 6 months compared with baseline, measured by the EuroQol EQ-5D Index. Secondary endpoints included emergency room (ER) visits, hospitalizations, and survival.

**Results:** Among 766 patients allocated, HRQL improved among more participants in the intervention group than usual care (34% v 18%) and worsened among fewer (38% v 53%;  $P < .001$ ). Overall, mean HRQL declined by less in the intervention group than usual care (1.4- v 7.1-point drop;  $P < .001$ ). Patients receiving intervention were less frequently admitted to the ER (34% v 41%;  $P = .02$ ) or hospitalized (45% v 49%;  $P = .08$ ) and remained on chemotherapy longer (mean, 8.2 v 6.3 months;  $P = .002$ ). Although 75% of the intervention group was alive at 1 year, 69% with usual care survived the year ( $P = .05$ ), with differences also seen in quality-adjusted survival (mean of 8.7 v. 8.0 months;  $P = .004$ ). Benefits were greater for participants lacking prior computer experience. Most patients receiving intervention (63%) reported severe symptoms during the study. Nurses frequently initiated clinical actions in response to e-mail alerts.

**Conclusion:** Clinical benefits were associated with symptom self-reporting during cancer care.

**Access:** <https://www.ncbi.nlm.nih.gov/pubmed/26644527>

Ishani, Christopher, Palmer, Otterness, Clothier, Nugent, . . . Rosenberg. (2016). Telehealth by an Interprofessional Team in Patients With CKD: A Randomized Controlled Trial. *American Journal of Kidney Diseases*, 68(1), 41-49.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
7 months	MN	601	Remote Patient Monitoring (RPM)	Randomized Clinical Trial	x		

### Summary

**Background:** Telehealth and interprofessional case management are newer strategies of care within chronic disease management. We investigated whether an interprofessional team using telehealth was a feasible care delivery strategy and whether this strategy could affect health outcomes in patients with chronic kidney disease (CKD).

**Study Design:** Randomized clinical trial.

**Setting & Participants:** Minneapolis Veterans Affairs Health Care System (VAHCS), St. Cloud VAHCS, and affiliated clinics March 2012 to November 2013 in patients with CKD (estimated glomerular filtration rate, 60 mL/min/1.73 m<sup>2</sup>).

**Interventions:** Patients were randomly assigned to receive an intervention (n 5,451) consisting of care by an interprofessional team (nephrologist, nurse practitioner, nurses, clinical pharmacy specialist, psychologist, social worker, and dietician) using a telehealth device (touch screen computer with peripherals) or to usual care (n 5,150).

**Outcomes:** The primary end point was a composite of death, hospitalization, emergency department visits, or admission to skilled nursing facilities, compared to usual care.

**Results:** Baseline characteristics of the overall study group: mean age, 75.1 6 8.1 (SD) years; men, 98.5%; white, 97.3%; and mean estimated glomerular filtration rate, 37 6 9 mL/min/1.73 m<sup>2</sup>. Telehealth and interprofessional care were successfully implemented with meaningful engagement with the care system. One year after randomization, 208 (46.2%) patients in the intervention group versus 70 (46.7%) in the usual-care group had the primary composite outcome (HR, 0.98; 95% CI, 0.75-1.29; P 5 0.9). There was no difference between groups for any component of the primary outcome: all-cause mortality (HR, 1.46; 95% CI, 0.42-5.11), hospitalization (HR, 1.15; 95% CI, 0.80-1.63), emergency department visits (HR, 0.92; 95% CI, 0.68-1.24), or nursing home admission (HR, 3.07; 95% CI, 0.71-13.24).

**Limitations:** Older population, mostly men, potentially underpowered/wide CIs.

**Conclusions:** Telehealth by an interprofessional team is a feasible care delivery strategy in patients with CKD. There was no statistically significant evidence of superiority of this intervention on health outcomes compared to usual care.

Access: <https://www.ncbi.nlm.nih.gov/pubmed/26947216>

Ong, M., Romano, P., Edgington, S., Aronow, H., Auerbach, A., Black, J., De Marco, T., Escarce, J., Evangelista, L., Hanna, B., Ganiats, T., Greenberg, B., Greenfield, S., Kaplan, S., Kimchi, A., Liu, H., Lombardo, D., Mangione, C., Sadeghi, B., Sadeghi, B., Sarrafzadeh, M., Tong, K., Fonarow, G. (2016). Effectiveness of Remote Patient Monitoring After Discharge of Hospitalized Patients With Heart Failure: The Better Effectiveness After Transition-Heart Failure (BEAT-HF) Randomized Clinical Trial. *JAMA Internal Medicine*, 176(3) 310-318.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
2 years	CA	1437	Remote Patient Monitoring (RPM)	Randomized Clinical Trial	x	x	

#### Summary

**Importance:** It remains unclear whether telemonitoring approaches provide benefits for patients with heart failure (HF) after hospitalization.

**Objective:** To evaluate the effectiveness of a care transition intervention using remote patient monitoring in reducing 180-day all-cause readmissions among a broad population of older adults hospitalized with HF.

**Design, Setting, and Participants:** We randomized 1,437 patients hospitalized for HF between October 12, 2011, and September 30, 2013, to the intervention arm (715 patients) or to the usual care arm (722 patients) of the Better Effectiveness After Transition-Heart Failure (BEAT-HF) study and observed them for 180 days. The dates of our study analysis were March 30, 2014, to October 1, 2015. The setting was 6 academic medical centers in California. Participants were hospitalized individuals 50 years or older who received active treatment for decompensated HF.

**Interventions:** The intervention combined health coaching telephone calls and telemonitoring. Telemonitoring used electronic equipment that collected daily information about blood pressure, heart rate, symptoms, and weight. Centralized registered nurses conducted

telemonitoring reviews, protocolized actions, and telephone calls.

**Main Outcomes and Measures:** The primary outcome was readmission for any cause within 180 days after discharge. Secondary outcomes were all-cause readmission within 30 days, all-cause mortality at 30 and 180 days, and quality of life at 30 and 180 days.

**Results:** Among 1,437 participants, the median age was 73 years. Overall, 46.2% (664 of 1,437) were female, and 22.0% (316 of 1,437) were African American. The intervention and usual care groups did not differ significantly in readmissions for any cause 180 days after discharge, which occurred in 50.8% (363 of 715) and 49.2% (355 of 722) of patients, respectively (adjusted hazard ratio, 1.03; 95% CI, 0.88-1.20; P = .74). In secondary analyses, there were no significant differences in 30-day readmission or 180-day mortality, but there was a significant difference in 180-day quality of life between the intervention and usual care groups. No adverse events were reported.

**Conclusions and Relevance:** Among patients hospitalized for HF, combined health coaching telephone calls and telemonitoring did not reduce 180-day readmissions.

**Access:** <http://www.ncbi.nlm.nih.gov/pubmed/26857383>

**Davis, C., Bender, M., Smith, T., Broad, J. (2015). Feasibility and Acute Care Utilization Outcomes of a Post-Acute Transitional Telemonitoring Program for Underserved Chronic Disease Patients. *Telemedicine and e-Health*, 21(9), 705-713.**

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
2 years	CA	COPD: 69 HF: 80	Remote Patient Monitoring (RPM)	Feasibility Study	x	x	

## Summary

**Background:** Chronic obstructive pulmonary disease (COPD) and heart failure (HF) are chronic diseases that impart significant health and care costs to the patient and health system. Limited access to health services affects disease severity and functional status.

Telemonitoring has shown promise in reducing acute care utilization for chronic disease patients, but the benefit for the underserved has not been determined. We evaluated acute care utilization outcomes following an acute event of a 90-day transitional care program integrating telemonitoring technology and home visits for underserved COPD and HF patients.

**Materials and Methods:** Patients were enrolled into the program between October 2010 and August 2012. Primary outcomes included rates of emergency department (ED) visits and all-cause re-admission at 30, 90, and 180 days post-discharge. Program and functional status at enrollment and discharge and satisfaction with telemonitoring at discharge were measured. Telemonitoring included daily symptomatology recording and was removed at 90 days. A control cohort was identified through electronic health records and propensity-matched via 15 variables to achieve a sample size with balanced baseline characteristics.

**Results:** Program patients showed 50% reduction in 30-day re-admission and 13-19% reduction in 180-day re-admission compared with control patients. There was no significant difference in ED utilization. Patients were satisfied with telemonitoring services, and functional status improved by program end.

**Conclusions:** This feasibility study suggests telemonitoring in the context of a transitional care model following an acute event may reduce all-cause 30-day re-admissions by up to 50% and has the potential to reduce long-term acute care utilization and thus care costs. More rigorous and long-term investigation is warranted.

**Access:** <http://www.ncbi.nlm.nih.gov/pubmed/25955129>

Upatising, B., Wood, D., Kremers, W., Christ, S., Yih, Y., Hanson, G., Takahashi, P. (2015). Cost Comparison Between Home Telemonitoring and Usual Care of Older Adults: A Randomized Trial (Tele-ERA). *Telemedicine and e-Health* 21(1):3-8.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
12 months	MN	205	Remote Patient Monitoring (RPM)	Randomized Controlled Trial			x

**Summary**

**BACKGROUND:** From 1992 to 2008, older adults in the United States incurred more healthcare expense per capita than any other age group. Home telemonitoring has emerged as a potential solution to reduce these costs, but evidence is mixed. The primary aim of the study was to evaluate whether the mean difference in total direct medical cost consequence between older adults receiving additional home telemonitoring care (TELE) (n = 102) and those receiving usual medical care (UC) (n = 103) were significant. Inpatient, outpatient, emergency department, decedents, survivors, and 30- day readmission costs were evaluated as secondary aim.

**MATERIALS AND METHODS:** Multivariate generalized linear models (GLMs) and parametric bootstrapping methods were used to model cost and to determine significance of the cost differences. We also compared the differences in arithmetic mean costs.

**RESULTS:** From the conditional GLMs, the estimated mean cost differences (TELE versus UC) for total, inpatient, outpatient, and ED were - \$9,537 (p = 0.068), - \$8,482 (p = 0.098), - \$1,160 (p = 0.177), and \$106 (p = 0.619), respectively. Mean post-enrollment cost was 11% lower than the prior year for TELE versus 22% higher for UC. The ratio of mean cost for decedents to survivors was 2.1:1 (TELE) versus 12.7:1 (UC).

**CONCLUSIONS:** There were no significant differences in the mean total cost between the two treatment groups. The TELE group had less variability in cost of care, lower decedents to survivors cost ratio, and lower total 30-day readmission cost than the UC group.

**Access:** <http://online.liebertpub.com/doi/pdf/10.1089/tmj.2014.0021>

Margolis, K., Asche, S., Bergdall, A., Dehmer, S., Groen, S., Kadmas, H., Kerby, T., Klotzle, K., Maciosek, M., Michels, R., O'Connor, P., Pritchard, R., Sekenski, J., Sperl-Hillen, J., Trower, N. (2013). Effect of Home Blood Pressure Telemonitoring and Pharmacist Management on Blood Pressure Control: A Cluster Randomized Clinical Trial. *JAMA* 310(1):46-56.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
18 months	MN	450	Remote Patient Monitoring (RPM)	Cluster Randomized Controlled Trial	x		

### Summary

**IMPORTANCE:** Only about half of patients with high blood pressure (BP) in the United States have their BP controlled. Practical, robust, and sustainable models are needed to improve BP control in patients with uncontrolled hypertension.

**OBJECTIVES:** To determine whether an intervention combining home BP telemonitoring with pharmacist case management improves BP control compared with usual care and to determine whether BP control is maintained after the intervention is stopped.

**DESIGN, SETTING, AND PATIENTS:** A cluster randomized clinical trial of 450 adults with uncontrolled BP recruited from 14,692 patients with electronic medical records across 16 primary care clinics in an integrated health system in Minneapolis-St Paul, Minnesota, with 12 months of intervention and 6 months of post intervention follow-up.

**INTERVENTIONS:** Eight clinics were randomized to provide usual care to patients (n = 222) and 8 clinics were randomized to provide a telemonitoring intervention (n = 228). Intervention patients received home BP telemonitors and transmitted BP data to pharmacists who adjusted antihypertensive therapy accordingly.

**MAIN OUTCOMES AND MEASURES:** Control of systolic BP to less than 140mm Hg and diastolic BP to less than 90mmHg (<130/80mm Hg in patients with diabetes or chronic kidney disease) at 6 and 12 months. Secondary outcomes were change in BP, patient satisfaction, and BP control at 18 months (6 months after intervention stopped).

**RESULTS:** At baseline, enrollees were 45% women, 82% white, mean (SD) age, 61.1 (12.0) years; mean systolic BP, 148mm Hg; diastolic BP, 85mm Hg. The proportion of patients with BP control at both 6 and 12 months was significantly greater in the telemonitoring group than in the usual care group. Compared with the usual care group, systolic BP decreased more from baseline among patients in the

telemonitoring intervention group at 6 months (-10.7mm Hg [95%CI, -14.3 to -7.3mm Hg]; P<.001), at 12 months (-9.7mm Hg [95%CI, -13.4 to -6.0mm Hg]; P<.001), and at 18 months (-6.6mm Hg [95%CI, -10.7 to -2.5mm Hg]; P = .004).

**CONCLUSIONS AND RELEVANCE:** Home BP telemonitoring and pharmacist case management achieved better BP control compared with usual care during 12 months of intervention that persisted during 6 months of post intervention follow-up.

**Access:** <http://web.b.ebscohost.com/ehost/detail/detail?vid=2&sid=227cc6ac-091b-4af9-826d-e8d8d8cea374%40sessionmgr112&hid=110&bdata=JnNpdGU9ZWZwhvc3QtbGl2ZQ%3d%3d#db=mnh&AN=23821088>

**Madigan, E., Schmotzer, B., Struk, C., DiCarlo, C., Kikano, G., Pina, I., Boxer, R. (2013). Home Health Care with Telemonitoring Improves Health Status for Older Adults With Heart Failure. *Home Health Care Management and Practice* 25(5):187-195.**

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
6 months	OH	99	RPM	Randomized Control Trial (RCT)	x		

**Summary**

Home telemonitoring can augment home health care services during a patient's transition from hospital to home. Home health care agencies commonly use telemonitors for patients with heart failure although studies have shown mixed results in the use of telemonitors to reduce rehospitalizations. This randomized trial investigated if older patients with heart failure admitted to home health care following a hospitalization would have a reduction in rehospitalizations and improved health status if they received telemonitoring. Patients were followed up to 180 days post-discharge from home health care services. Results showed no difference in the time to rehospitalizations or emergency visits between those who received a telemonitoring vs. usual care. Older heart failure patients who received telemonitoring had better health status by home health care discharge than those who received usual care. Therefore for older adults with heart failure telemonitoring may be important adjunct to home health care services to improve health status.

Access: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4002284/>

Pekmezaris, R., Mitzner, I., Pecinka, KR., Nouryan, CN., Lesser, ML., Siegel, M., Swiderski, JW., Moise, G., Younker, R., Smolich, K. (2012). The impact of remote patient monitoring (telehealth) upon Medicare beneficiaries with heart failure. *Telemedicine and e-Health* 18(2):101-108.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
2 years	NY	168	RPM	RCT	x		x

#### Summary

**OBJECTIVE:** To study the impact of remote patient monitoring (RPM) upon the most frequent diagnosis in hospitalized patients over 65 years of age—heart failure (HF). We examined the effect of RPM on hospital utilization and Medicare costs of HF patients receiving home care.

**MATERIALS AND METHODS:** Two studies were simultaneously conducted: A randomized and a matched cohort study. In the randomized study, 168 subjects were randomly assigned (after hospitalization) to home care utilizing RPM (live nursing visits and video-based nursing visits) or to home care receiving live nursing visits only. In the matched-cohort study, 160 subjects receiving home care with RPM (live nursing visits and video-based nursing visits) were matched with home care subjects receiving live nursing visits only.

**RESULTS:** Regardless of whether outcomes were being analyzed for all subjects (intention to treat) or for hospitalized subjects only, hospitalization rates, time to first admission, length of stay, and costs to Medicare did not differ significantly between groups in either study at 30 or 90 days after enrollment. A notable trend, however, emerged across studies: Although time to hospitalization was shorter in the RPM groups than the control groups, RPM groups had lower hospitalization costs.

**CONCLUSIONS:** RPM, when utilized in conjunction with a robust management protocol, was not found to significantly differ from live nursing visits in the management of HF in home care. Shorter hospitalization times and lower associated costs may be due to earlier

identification of exacerbation. These trends indicate the need for further study.

**Access:**

[http://kc7za5wx4c.scholar.serialssolutions.com/?sid=google&auinit=R&aulast=Pekmezaris&atitle=The+impact+of+remote+patient+monitoring+\(telehealth\)+upon+Medicare+beneficiaries+with+heart+failure&id=doi:10.1089/tmj.2011.0095&title=Telemedicine+journal+and+e-health&volume=18&issue=2&date=2012&spage=101&issn=1530-5627](http://kc7za5wx4c.scholar.serialssolutions.com/?sid=google&auinit=R&aulast=Pekmezaris&atitle=The+impact+of+remote+patient+monitoring+(telehealth)+upon+Medicare+beneficiaries+with+heart+failure&id=doi:10.1089/tmj.2011.0095&title=Telemedicine+journal+and+e-health&volume=18&issue=2&date=2012&spage=101&issn=1530-5627)

**Bowles, K., Hanlon, A., Glick, H., Naylor, M., O'Connor, M., Riegel, B., Shih, N., Weiner, M. (2011). Clinical Effectiveness, Access to, and Satisfaction with Care Using a Telehomecare Substitution Intervention: A Randomized Controlled Trial. *International Journal of Telemedicine and Applications* 2011(1):1-13.**

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
6 months	PA	217	RPM (telehome care)	RCT	x	x	

**Summary**

**BACKGROUND:** Hospitalization accounts for 70% of heart failure (HF) costs; readmission rates at 30 days are 24% and rise to 50% by 90 days. Agencies anticipate that telehomecare will provide the close monitoring necessary to prevent HF readmissions.

**METHODS AND RESULTS:** Randomized controlled trial to compare a telehomecare intervention for patients 55 and older following hospital discharge for HF to usual skilled home care. Primary endpoints were 30- and 60-day all-cause and HF readmission, hospital days, and time to readmission or death. Secondary outcomes were access to care, emergency department (ED) use, and satisfaction with care. All-cause readmissions at 30 days (16% versus 19%) and over six months (46% versus 52%) were lower in the telehomecare group but were not statistically significant. Access to care and satisfaction were significantly higher for the telehomecare patients, including the number of in-person visits and days in home care.

**CONCLUSIONS:** Patient acceptance of the technology and current home care policies and processes of care were barriers to gaining clinical effectiveness and efficiency.

**Access:** <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3236461/>

**Chaudhry, S., Mattera, J., Curtis, J., Spertus, J., Herrin, J., Lin, Z., Phillips, C., Hodshon, B., Cooper, L., Krumholz, H . (2010).  
Telemonitoring in Patients with Heart Failure. *The New England Journal of Medicine* 363(24):2301-2309.**

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
6 months	Not specified (US)	1653	RPM	RCT	x		

#### Summary

**BACKGROUND:** Small studies suggest that telemonitoring may improve heart-failure outcomes, but its effect in a large trial has not been established.

**METHODS:** We randomly assigned 1653 patients who had recently been hospitalized for heart failure to undergo either telemonitoring (826 patients) or usual care (827 patients). Telemonitoring was accomplished by means of a telephone-based interactive voice response system that collected daily information about symptoms and weight that was reviewed by the patients' clinicians. The primary end point was readmission for any reason or death from any cause within 180 days after enrollment. Secondary end points included hospitalization for heart failure, number of days in the hospital, and number of hospitalizations.

**RESULTS:** The median age of the patients was 61 years; 42.0% were female, and 39.0% were black. The telemonitoring group and the usual-care group did not differ significantly with respect to the primary end point, which occurred in 52.3% and 51.5% of patients, respectively (difference, 0.8 percentage points; 95% confidence interval [CI], -4.0 to 5.6; P=0.75 by the chi-square test).

Readmission for any reason occurred in 49.3% of patients in the telemonitoring group and 47.4% of patients in the usual care group (difference, 1.9 percentage points; 95% CI, -3.0 to 6.7; P=0.45 by the chi-square test). Death occurred in 11.1% of the telemonitoring group and 11.4% of the usual care group (difference, -0.2 percentage points; 95% CI, -3.3 to 2.8; P=0.88 by the chi-square test). There were no significant differences between the two groups with respect to the secondary end points or the time to the primary end point or its components. No adverse events were reported.

**CONCLUSIONS:** Among patients recently hospitalized for heart failure, telemonitoring did not improve outcomes. The results indicate the importance of a thorough, independent evaluation of disease-management strategies before their adoption. (Funded by the National Heart, Lung, and Blood Institute; ClinicalTrials.gov number, NCT00303212.)

**Access:**

<http://kc7za5wx4c.scholar.serialssolutions.com/?sid=google&auinit=SI&aualast=Chaudhry&atitle=Telemonitoring+in+patients+with+heart+failure&id=doi:10.1056/NEJMoa1010029&title=New+England+journal+of+medicine&volume=363&issue=24&date=2010&page=2301&issn=0028-4793>

**Tomkins, C., Orwat, J. (2010). A randomized trial of telemonitoring heart failure patients. *Journal of Healthcare Management* 55(5):312-322.**

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
6 months	AZ	390	RPM (home telemonitors)	RCT		x	X (not statistically significant)

### Summary

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. Patients were recruited and randomly assigned for six months to either telemonitoring or standard care. Telemonitoring transmitted vital signs and clinical alerts daily to a central nursing station. Utilization of covered services was analyzed for the six month telemonitoring period to test for hypothesized reductions in hospital days and changes in utilization of the emergency department (ED), urgent care, and primary care. Negative binomial regressions adjusted for gender, age, co-occurring diabetes, co-occurring chronic obstructive pulmonary disease, and residence neighborhood were used to analyze units of service, and two-part (hurdle) multivariable models were used for expenditures. The main finding was a tendency for lower total number of hospital days for patients assigned to telemonitoring. Results for other covered services were generally consistent with hypothesized direction and magnitude; however, statistical power was reduced because of lower than- expected recruitment rates into the study. Within a managed-care environment, telemonitoring appears to facilitate better ambulatory management of heart failure patients, including fewer ED visits, which were offset by more frequent primary care and urgent care visits.

#### Access:

<http://kc7za5wx4c.scholar.serialssolutions.com/?sid=google&auinit=C&aualast=Tompkins&atitle=A+randomized+trial+of+telemonitoring+heart+failure+patients.&id=pmid:21077581>

**Kronke, K., Theobald, D., Wu, J., Norton, K., Morrison, G., Carpenter, J., Tu, W. (2010). Effect of telecare management on pain and depression in patients with cancer: a randomized trial. *Journal of the American Medical Association* 304(2):163-171.**

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
2.5 years	ID	202	RPM	RCT	x		

## Summary

**CONTEXT:** Pain and depression are 2 of the most prevalent and treatable cancer related symptoms, yet they frequently go unrecognized, undertreated, or both.

**OBJECTIVE:** To determine whether centralized telephone-based care management coupled with automated symptom monitoring can improve depression and pain in patients with cancer.

**DESIGN, SETTING, AND PATIENTS:** Randomized controlled trial conducted in 16 community- based urban and rural oncology practices involved in the Indiana Cancer Pain and Depression (INCPAD) trial. Recruitment occurred from March 2006 through August 2008 and follow-up concluded in August 2009. The participating patients had depression (Patient Health Questionnaire-9 score >10), cancer-related pain (Brief Pain Inventory [BPI] worst pain score >6), or both.

**INTERVENTION:** The 202 patients randomly assigned to receive the intervention and 203 to receive usual care were stratified by symptom type. Patients in the intervention group received centralized telecare management by a nurse-physician specialist team coupled with automated home-based symptom monitoring by interactive voice recording or Internet.

**MAIN OUTCOME MEASURES:** Blinded assessment at baseline and at months 1, 3, 6, and 12 for depression (20-item Hopkins Symptom Checklist [HSCL-20]) and pain (BPI) severity.

**RESULTS:** Of the 405 participants enrolled in the study, 131 had depression only, 96 had pain only, and 178 had both depression and pain. Of the 274 patients with pain, 137 patients in the intervention group had greater improvements in BPI pain severity over the 12 months of the trial whether measured as a continuous severity score or as a categorical pain responder (>30% decrease in BPI) than the 137 patients in the usual-care group ( $P<.001$  for both). Similarly, of the 309 patients with depression, the 154 patients in the intervention group had greater improvements in HSCL-20 depression severity over the 12 months of the trial whether measured as a continuous severity score or as a categorical depression responder (>50% decrease in HSCL) than the 155 patients in the usual care group ( $P<.001$  for both). The standardized effect size for between-group differences at 3 and 12 months was 0.67(95% confidence interval [CI], 0.33-1.02) and 0.39(95%CI, 0.01-0.77) for pain, and 0.42 (95% CI, 0.16-0.69) and 0.41 (95% CI, 0.08-0.72) for depression.

**CONCLUSION:** Centralized telecare management coupled with automated symptom monitoring resulted in improved pain and depression

outcomes in cancer patients receiving care in geographically dispersed urban and rural oncology practices.

Access: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3010214/>

Stone, R., Rao, R., Sevick, M., Cheng, C., Hough, L., Macpherson, D., Franko, C., Anglin, R., Obrosky, D., DeRubertis, F. (2010). Active Care Management Supported by Home Telemonitoring in Veterans With Type 2 Diabetes. *American Diabetes Association: Diabetes Care* 20(1):18-23.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
1.5 years	PA	150	RPM	RCT	x		

#### Summary

**OBJECTIVE:** We compared the short-term efficacy of home telemonitoring coupled with active medication management by a nurse practitioner with a monthly care coordination telephone call on glycemic control in veterans with type 2 diabetes and entry A1C  $\geq 7.5\%$ .

**RESEARCH DESIGN AND METHODS:** Veterans who received primary care at the VA Pittsburgh Healthcare System from June 2004 to December 2005, who were taking oral hypoglycemic agents and/or insulin for  $\geq 1$  year, and who had A1C  $\geq 7.5\%$  at enrollment were randomly assigned to either active care management with home telemonitoring (ACM+HT group, n = 73) or a monthly care coordination telephone call (CC group, n = 77). Both groups received monthly calls for diabetes education and self-management review. ACM+HT group participants transmitted blood glucose, blood pressure, and weight to a nurse practitioner using the Viterion 100 TeleHealth Monitor; the nurse practitioner adjusted medications for glucose, blood pressure, and lipid control based on established American Diabetes Association targets. Measures were obtained at baseline, 3-month, and 6-month visits.

**RESULTS:** Baseline characteristics were similar in both groups, with mean A1C of 9.4% (CC group) and 9.6% (ACM+HT group). Compared with the CC group, the ACM+HT group demonstrated significantly larger decreases in A1C at 3 months (1.7 vs. 0.7%) and 6 months (1.7 vs. 0.8%;  $P < 0.001$  for each), with most improvement occurring by 3 months.

**CONCLUSIONS:** Compared with the CC group, the ACM+HT group demonstrated significantly greater reductions in A1C by 3 and 6 months. However, both interventions improved glycemic control in primary care patients with previously inadequate control.

**Access:** <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2827492/>

**Dansky, K., Vasey, J., Bowles, K. (2008). Impact of Telehealth on Clinical Outcomes in Patients With Heart Failure. *Clinical Nursing Research* 17(3):182-199.**

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
1.5 years	PA	284	RPM	RCT	x		

#### Summary

The purpose of this randomized field study was to determine the effects of telehomecare on hospitalization, emergency department (ED) use, mortality, and symptoms related to sodium and fluid intake, medication use, and physical activity. The sample consists of 284 patients with heart failure. The authors used logistic regression to study the effects of telehomecare on health services utilization and mortality and a general linear model to analyze changes in self-reported symptoms. On average, patients in the telehomecare groups had a lower probability of hospitalizations and ED visits than did patients in the control group. Differences were statistically significant at 60 days but not 120 days. Results show a greater reduction in symptoms for patients using telehomecare compared to control patients. The technology enables frequent monitoring of clinical indices and permits the home health care nurse to detect changes in cardiac status and intervene when necessary.

Access: <http://cnr.sagepub.com.cuhsl.creighton.edu/content/17/3/182.full.pdf+html>

## RETROSPECTIVE STUDIES

Darkins, A., Kendall, S., Edmonson, E., Young, M., Stresel, P. (2015). Reduced Cost and Mortality Using Home Telehealth to Promote Self-Management of Complex Chronic Conditions: A Retrospective Matched Cohort Study of 4,999 Veteran Patients. *Telemedicine and e-Health* 21(1):70-76.

Study Length	State	Sample Size	Telehealth Modality Type	Method	Outcome	Quality	Cost
3 years	U.S. (VHA)	4,999	Care coordination home telehealth (CCHT)	Retrospective study	x		x

### Summary

**OBJECTIVE:** This retrospective analysis of 2009–2012 Veterans Health Administration (VHA) administrative data assessed the efficacy of care coordination home telehealth (CCHT), a model of care designed to reduce institutional care.

**MATERIALS AND METHODS:** Outcomes for 4,999 CCHT–non-institutional care (NIC) patients were compared with usual (non-CCHT) care in a matched cohort group (MCG) of 183,872 Veterans. Both cohorts were comprised of patients with complex chronic conditions with statistically similar baseline (pre-CCHT enrollment) healthcare costs, when adjusted for age, sex, chronic disease, emergency room (ER) visits, hospital admissions, hospital lengths of stay, and pharmacy costs.

**RESULTS:** Subsequent analyses after 12 months of CCHT-NIC enrollment showed mean annual healthcare costs for CCHT-NIC patients fell 4%, from \$21,071 to \$20,206, whereas the corresponding costs for MCG patients increased 48%, from \$20,937 to \$31,055. Higher mean annual pharmacy expenditure of 22% (\$470 over baseline) for CCHT-NIC patients versus 15% for MCG patients (\$326 over baseline) was attributable to the medication compliance effect of better care coordination. Several healthcare cost drivers (e.g., ER visits and admissions) had sizable declines in the CCHT-NIC group. Medicare usage review in both cohorts

excluded this as a confounding factor in cost analyses. Prefinal case selection criteria analysis of both cohorts yielded a 9.8% mortality rate in CCHT patients versus 16.58% in non-CCHT patients.

**CONCLUSIONS:** This study corroborates previous positive VHA analyses of CCHT but contradicts results from recent non-VHA studies, highlighting the efficacy of the VHA's standardized CCHT model, which incorporates a biopsychosocial approach to care that emphasizes patient self-management.

**Access:** <http://online.liebertpub.com/doi/pdf/10.1089/tmj.2014.0067>

## **PILOT STUDY SUMMARIES**

**Cattrysse, F., Peeters, M., Calaerts, S., Ferson, K., Degryse, JM. (2014). Detection of sleep apnea by case-finding and home monitoring with Somnolter®: a pilot study. *BioMed Central: Research Notes* 7(1):1-9.**

**Telehealth Modality Type:** Somnolter®

**Funder:** Catholic University of Leuven

### **Summary**

**BACKGROUND:** Obstructive sleep apnea and hypopnea syndrome (OSAHS) is a disorder that causes clinical symptoms (e.g. snoring, excessive daytime sleepiness and impaired concentration) that may increase the risk of traffic accidents, cardiovascular disease, type 2 diabetes and reduce the quality of life. A recently developed device (Somnolter®) detects apneas and hypopneas in a home setting, allowing to detect OSAHS in a more comfortable environment compared to the gold standard polysomnography. The aim of our study was to investigate whether the Somnolter® is useful in family practice to identify patients with OSAHS.

**METHODS:** Questionnaires were offered to patients in five general practitioner (GP) practices. Based on the questionnaire and body mass index, patients with an increased risk of OSAHS were contacted to collaborate in the study. In this convenience sample, 18 patients were successfully tested with the Somnolter® measuring SaO<sub>2</sub>, mandibular movements, body position, heart rate, nasal air

flow and thoracic and abdominal breathing movements. The Somnolter® automatically analyses the data and different parameters to detect OSAHS. Afterwards, the data were manually revised by the researchers.

**RESULTS:** Out of 365 subjects, 31 met the inclusion criteria and 18 were successfully tested at home. Sixteen out of 18 patients had an Apnea Hypopnea Index (AHI)  $\geq 5$ , ten of them had mild OSAHS, 3 were categorized as moderate OSAHS and finally 3 matched the criteria of severe OSAHS.

**CONCLUSION:** The proposed case-finding strategy still needs optimization, but is considered helpful in selecting patients at high risk of OSAHS. OSAHS was detected in 14 out of 18 patients tested with the Somnolter®. In the future the Somnolter® might be a feasible alternative to diagnose OSAHS.

**Access:** <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4174633/>

**Ding, H., Karunanithi, M., Kanagasingam, Y., Vingarajan, J., Moodley, Y. (2014). A pilot study of a mobile-phone-based home monitoring system to assist in remote interventions in cases of acute exacerbation of COPD. *Journal of Telemedicine and Telecare* 20(3):128-134.**

**Telehealth Modality Type:** Mobile phone-based telemonitoring system

**Funder:** Not Specified (Publisher: Journal of Telemedicine and Telecare)

### Summary

We conducted a six-month feasibility study of a mobile-phone-based home monitoring system, called M-COPD. Patients with a history of moderate Acute Exacerbation of COPD (AECOPD) were given a mobile phone to record major symptoms (dyspnoea, sputum colour and volume), minor symptoms (cough and wheezing) and vital signs. A care team remotely monitored the recorded data and provided clinical interventions. Eight patients (mean age 65 years) completed the trial. Ten acute exacerbations occurred during the trial and were successfully treated at home. Prior to the AECOPD episode, the combined score of the major symptoms

increased significantly ( $P < 0.05$ ). Following the intervention, it decreased significantly ( $P < 0.05$ ) within two weeks and returned to the baseline. The score of the minor symptoms also increased significantly ( $P < 0.05$ ), but the decrease following the intervention was not significant. There were significantly fewer hospital admissions during the trial, fewer ED presentations and fewer GP visits than in a six-month matched period in the preceding year. The results demonstrate the potential of home monitoring for analysing respiratory symptoms for early intervention of AECOPD.

**Access:** <http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=c7380ffb-1c20-40ab-9dba-f6ad22c15c3c%40sessionmgr4001&vid=1&hid=4214>

**Nimako, K., Lu, S., Ayite, B., Priest, K., Winkley, A., Gunapala, R., Popat, S., O'Brien, M. (2013). A pilot study of a novel home telemonitoring system for oncology patients receiving chemotherapy. *Journal of Telemedicine and Telecare* 19(1):148-152.**

**Telehealth Modality Type:** Telemonitoring system

**Funder:** Phillips Healthcare

### Summary

We examined the accuracy and acceptability of a home telemonitoring system for patients receiving chemotherapy. Patients undergoing two cycles of chemotherapy (over six weeks) used the telemonitoring system to analyse their own blood (capillary) and to enter symptom and temperature data. The blood results obtained from self-testing were compared with those from a venous blood sample analysed in the hospital laboratory analyser (the gold standard). We also documented the number and type of alerts generated by the telemonitoring system. Acceptability (ease of use and patient satisfaction) was assessed using questionnaires. Ten patients (mean age 61 years, 60% female) provided 48-paired samples. None of the patients succeeded in obtaining all blood results within pre-defined limits of agreement (i.e. within 15% for haemoglobin, haematocrit, white cell count; and 20% for neutrophil count) during the study. However, the level of clinical agreement between the system and the laboratory standard was good; only three out of the 48 samples and two out of the 10 patients had differences in blood results that might have had clinical implications. The telemonitoring system correctly generated 42 alerts. The patients found the telemonitoring system easy to use. With further

refinement this should become an acceptable component of routine clinical practice for monitoring patients receiving chemotherapy.

**Access:** <http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=d7b22f6d-17d9-495e-b548-2a4757e0a995%40sessionmgr4003&vid=1&hid=4214>

**Antoniades, NC., Rochford, PD., Preto, JJ., Pierce, RJ., Gogler, J., Steinkrug, J., Sharpe, K., McDonald, CF. (2012). Pilot study of remote telemonitoring in COPD. *Telemedicine Journal and E-Health* 18(8):634-640.**

**Telehealth Modality Type:** Remote in-home monitoring

**Funder:** Department of Human Services, Victoria, Australia

### Summary

**BACKGROUND:** Remote in-home monitoring (RM) of symptoms and physiological variables may allow early detection and treatment of exacerbations of chronic obstructive pulmonary disease (COPD). It is unclear whether RM improves patient outcomes or healthcare resource utilization. This study determined whether RM is feasible in patients with COPD and if RM reduces hospital admissions or length of stay (LOS) or improves health-related quality of life (HRQOL).

**SUBJECTS AND METHODS:** Forty-four patients were randomized to standard best practice care (SBP) (n = 22) or SBP + RM (n = 22). RM involved daily recording of physiological variables, symptoms, and medication usage.

**RESULTS:** There were no differences (mean – SD, SBP versus SBP + RM) in age (68 – 8 versus 70 – 9 years), gender (male:female 10:12 in both groups), or previous computer familiarity (59% versus 50%) between groups. The SBP group had a lower forced expiratory volume in 1 s (0.66 – 0.24 versus 0.91 – 0.34 L, p < 0.01) and more current smokers (six versus none, p < 0.05). There were no differences in number of COPD-related admissions/year (1.5 – 1.8 versus 1.3 – 1.7, p = 0.76), COPD-related LOS days/year (15.6 – 19.4 versus 11.4 – 19.6, p = 0.66), total admissions/year (2.2 – 2.1 versus 2.0 – 2.3, p = 0.86), total LOS days/year (22.1 – 29.9 versus

21.6 – 30.4,  $p = 0.88$ ), or HRQOL between the two groups.

**CONCLUSIONS:** The addition of RM to SBP was feasible but did not reduce healthcare utilization or improve quality of life in this group of patients already receiving comprehensive respiratory care.

**Access:**

<http://kc7za5wx4c.scholar.serialssolutions.com/?sid=google&aunit=NC&aualast=Antoniades&atitle=Pilot+study+of+remote+telemo+onitoring+in+COPD&id=doi:10.1089/tmj.2011.0231&title=Telemedicine+journal+and+e-health&volume=18&issue=8&date=2012&spage=634&issn=1530-5627>

Fruhauf, J., Schwantzer, Ambros-Rudolph, CM., Weger, W., Ahlgrimm-Siess V., Salmhofer, W., Hofmann-Wellenhof, R. (2012). Pilot study on the acceptance of mobile teledermatology for the home monitoring of high-need patients with psoriasis. *Australasian Journal of Dermatology* 53(1):41-46.

**Telehealth Modality Type:** Mobile teledermatology service

**Funder:** Not specified (user interfaces were developed in cooperation with Joanneum Research).

### Summary

**BACKGROUND/OBJECTIVES:** The willingness to be educated is one of the highest desires among patients with psoriasis. Therefore, a collaborative model of management would appear to be essential in enhancing patient satisfaction in this challenging condition. The present study aimed at examining the applicability of a mobile teledermatology service in this regard and assessing the association between patient acceptance and perceived health-related quality of life.

**METHODS:** High-need patients with psoriasis performed visits over 12 weeks transmitting clinical images together with some relevant clinical information via mobile phones to teledermatologists, who provided treatment instructions. Ten patients and two teledermatologists completed 20-item patient (weeks 6 and 12) and 10-item physician (at week 12) acceptance questionnaires. In

addition, patients answered the dermatology life quality index (DLQI) at weeks 0, 6 and 12.

**RESULTS:** Both patients and teledermatologists were pleased with the service with high acceptance rates (patients: 81.0% at week 6 and 82.9% at week 12; teledermatologists: 74.0%). In addition, 80% of the patients considered the service an alternative to in-person consultation and 90% felt they were in good hands but had achieved a more flexible and empowered lifestyle. No significant correlations were found between patient acceptance and DLQI. Both teledermatologists found the service a convenient and reliable tool for patient monitoring. Neither patients nor teledermatologists thought further in-person consultations necessary.

**CONCLUSION:** Mobile teledermatology is a valuable tool for the home monitoring of patients with psoriasis that makes a meaningful difference in their lives. It is well accepted by both patients and the physicians involved.

**Access:**

<http://kc7za5wx4c.scholar.serialssolutions.com/?sid=google&auinit=J&aualast=Fr%C3%BChauf&atitle=Pilot+study+on+the+acceptance+of+mobile+teledermatology+for+the+home+monitoring+of+high%E2%80%90need+patients+with+psoriasis&id=doi:10.1111/j.1440-0960.2011.00852.x&title=Australasian+journal+of+dermatology&volume=53&issue=1&date=2012&spage=41&issn=0004-8380>

**Kulshreshtha, A., Kvedar, J., Goyal, A., Halpern, E., Watson, A. (2010). Use of Remote Monitoring to Improve Outcomes in Patients with Heart Failure: A Pilot Trial. *International Journal of Telemedicine and Applications* 2010(3).**

**Telehealth Modality Type:** Telemonitoring system

**Funder:** Partners Healthcare

**Summary**

Remote monitoring (RM) of homebound heart failure (HF) patients has previously been shown to reduce hospital admissions. We conducted a pilot trial of ambulatory, non-homebound patients recently hospitalized for HF to determine whether RM could be

successfully implemented in the ambulatory setting. Eligible patients from Massachusetts General Hospital (n = 150) were randomized to a control group (n = 68) or to a group that was offered RM (n = 82). The participants transmitted vital signs data to a nurse who coordinated care with the physician over the course of the 6-month study. Participants in the RM program had a lower all-cause per person readmission rate (mean = 0.64, SD ± 0.87) compared to the usual care group (mean = 0.73, SD ± 1.51; P-value = .75) although the difference was not statistically significant. HF-related readmission rate was similarly reduced in participants. This pilot study demonstrates that RM can be successfully implemented in non-homebound HF patients and may reduce readmission rates.

**Access:** <http://www.hindawi.com/journals/ijta/2010/870959/>

**Schwarz, KA., Mion, LC., Hudock, D., Litman, G. (2008). Telemonitoring of heart failure patients and their caregivers: a pilot randomized controlled trial. *Progress in Cardiovascular Nursing* 23(1):18-26.**

**Telehealth Modality Type:** Telemonitoring system

**Funder:** National Institute of Nursing Research, National Institutes of Health (NIH), and the Ohio Board of Regents.

### Summary

Heart failure (HF) is the leading cause of rehospitalization in older adults. The purpose of this pilot study was to examine whether telemonitoring by an advanced practice nurse reduced subsequent hospital readmissions, emergency department visits, costs, and risk of hospital readmission for patients with HF. One hundred two patient/caregiver dyads were randomized into 2 groups postdischarge; 84 dyads completed the study. Hospital readmissions, emergency department visits, costs, and days to readmission were abstracted from medical records. Participants were interviewed soon after discharge and 3 months later about effects of telemonitoring on depressive symptoms, quality of life, and caregiver mastery. There were no significant differences due to telemonitoring for any outcomes. Caregiver mastery, informal social support, and electronic home monitoring were not significant predictors for risk of hospital readmission. Further studies should address the interaction between the advanced practice nurse and

follow-up intervention with telemonitoring of patients with HF to better target those who are most likely to benefit.

**Access:**

<http://kc7za5wx4c.scholar.serialssolutions.com/?sid=google&auinit=KA&aualast=Schwarz&atitle=Telemonitoring+of+heart+failure+patients+and+their+caregivers:+a+pilot+randomized+controlled+trial&id=doi:10.1111/j.1751-7117.2008.06611.x&title=Progress+in+cardiovascular+nursing&volume=23&issue=1&date=2008&spage=18&issn=0889-7204>

**Stepnowsky, C., Palau, J., Marler, M., Gifford, A. (2007). Pilot Randomized Trial of the Effect of Wireless Telemonitoring on Compliance and Treatment Efficacy in Obstructive Sleep Apnea. *Journal of Medical Internet Research* 9(2).**

**Telehealth Modality Type:** Wireless transmitter

**Funder:** ResMed Corp.

**Summary**

**BACKGROUND:** Obstructive sleep apnea (OSA) is a prevalent and serious medical condition characterized by repeated complete or partial obstructions of the upper airway during sleep and is prevalent in 2% to 4% of working middle-aged adults. Nasal continuous positive airway pressure (CPAP) is the gold-standard treatment for OSA. Because compliance rates with CPAP therapy are disappointingly low, effective interventions are needed to improve CPAP compliance among patients diagnosed with OSA.

**OBJECTIVE:** The aim was to determine whether wireless telemonitoring of CPAP compliance and efficacy data, compared to usual clinical care, results in higher CPAP compliance and improved OSA outcomes. **Methods:** 45 patients newly diagnosed with OSA were randomized to either telemonitored clinical care or usual clinical care and were followed for their first 2 months of treatment with CPAP therapy. CPAP therapists were not blinded to the participants' treatment group.

**RESULTS:** 20 participants in each group received the designated intervention. Patients randomized to telemonitored clinical care

used CPAP an average of  $4.1 \pm 1.8$  hours per night, while the usual clinical care patients averaged  $2.8 \pm 2.2$  hours per night ( $P = .07$ ). Telemonitored patients used CPAP on  $78\% \pm 22\%$  of the possible nights, while usual care patients used CPAP on  $60\% \pm 32\%$  of the nights ( $P = .07$ ). No statistically significant differences between the groups were found on measures of CPAP efficacy, including measures of mask leak and the Apnea-Hypopnea Index. Patients in the telemonitored group rated their likelihood to continue using CPAP significantly higher than the patients in the usual care group. Patients in both groups were highly satisfied with the care they received and rated themselves as “not concerned” that their CPAP data were being wirelessly monitored.

**CONCLUSIONS:** Telemonitoring of CPAP compliance and efficacy data and rapid use of those data by the clinical sleep team to guide the collaborative (ie, patient and provider) management of CPAP treatment is as effective as usual care in improving compliance rates and outcomes in new CPAP users. This study was designed as a pilot—larger, well-powered studies are necessary to fully evaluate the clinical and economic efficacy of telemonitoring for this population.

**Access:** <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1874716/>

Scalvini, S., Zanelli, E., Volterrani, M., Martinelli, G., Baratti, D., Buscaya, O., Baiardi, P., Glisenti, F., Giordano, A. (2003). A pilot study of nurse-led, home-based telecardiology for patients with chronic heart failure. *Journal of Telemedicine and Telecare* 10(2):113-117.

**Telehealth Modality Type:** Tele-ECG monitor

**Funder:** Not specified

#### Summary

We assessed the feasibility of home-based telecardiology for patients with chronic heart failure (CHF). Seventy-four CHF patients were enrolled into a programme of telephone follow-up and single-lead electrocardiography (ECG) monitoring. The patients transmitted their ECG data by fixed telephone line to a receiving station, where a nurse was available for an interactive

teleconsultation. Patients were followed up for a mean (SD) of 307 (108) days; 1467 calls were analysed (213 ad hoc consultations and 1254 scheduled consultations). A total of 124 cardiovascular events were recorded. Modifications to therapy were suggested in response to 119 calls; hospital admissions were suggested for 13 patients, further investigations for 7 and a consultation with the patient's general practitioner for 13. No action was taken after 1330 calls. Twenty-two ECG abnormalities were recorded. In 63 patients receiving the beta-blocker carvedilol, the mean dosage increased from 36 to 42 mg. In the previous year there were 1.8 hospitalizations per patient, while in the follow-up period there were 0.2 hospitalizations per patient. Following up CHF patients using a nurse-led telecardiology programme seems to be feasible and useful.

**Access:** <http://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=ca0d20f5-f112-43b7-8f20-cde39264257b%40sessionmgr114&vid=1&hid=128>