

# ConnectedHealthInitiative

## Key Clinical Studies Demonstrating the Benefits of Connected Health Technologies

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## ASSISTED LIVING/AGEING

### **Innovative Assisted Living Tools, Remote Monitoring Technologies, Artificial Intelligence-Driven Solutions, and Robotic Systems for Aging Societies: Systemic Review**

“Increased life expectancies and recent advancements in technology and medical science have changed the way we deliver health services to the aging societies. Evidence suggests that home telemonitoring can significantly decrease the number of readmissions, and continuous monitoring of older adults’ daily activities and health-related issues might prevent medical emergencies. This review aimed to identify advances in assistive technology devices for seniors and aging-in-place technology and to determine the level of evidence for research on remote patient monitoring, smart homes, telecare, and artificially intelligent monitoring systems. A literature review was conducted using Cumulative Index to Nursing and Allied Health Literature Plus, MEDLINE, EMBASE, Institute of Electrical and Electronics Engineers Xplore, ProQuest Central, Scopus, and Science Direct. Publications related to older people’s care, independent living, and novel assistive technologies were included in the study. Within the 91 publications that met the inclusion criteria, four themes emerged in the data: technology acceptance and readiness, novel patient monitoring and smart home technologies, intelligent algorithm and software engineering, and robotics technologies. The results revealed that most studies had poor reference standards without an explicit critical appraisal. Using ubiquitous home monitoring and smart technologies for aged people’s care will increase their independence and the health care services availed to them as well as improve frail elderly people’s health conditions. This review identified four different themes that require different conceptual approaches to solution development. Although the engineering teams were focused on prototype and algorithm development, the medical science teams were concentrated on outcome research. We also identified the need to develop custom technology solutions for different aging societies. The convergence of medicine and informatics could lead to the development of new interdisciplinary research models and new assistive products for the care of older adults.”

<https://aging.jmir.org/2019/2/e15429/>

## BLOOD PRESSURE MANAGEMENT

### **Cuff-Less Methods for Blood Pressure Telemonitoring**

Blood pressure telemonitoring (BPT) is a telemedicine strategy that uses a patient's self-measured blood pressure (BP) and transmits this information to healthcare providers, typically over the internet. BPT has been shown to improve BP control compared to usual care without remote monitoring. Traditionally, a cuff-based monitor with data communication capabilities has been used for BPT; however, cuff-based measurements are inconvenient and cause discomfort, which has prevented the widespread use of cuff-based monitors for BPT. The development of new technologies which allow for remote BP monitoring without the use of a cuff may aid in more extensive adoption of BPT. This would enhance patient autonomy while providing physicians with a more complete picture of their patient's BP profile, potentially leading to improved BP control and better long-term clinical outcomes. This mini-review article aims to: (1) describe the fundamentals of current techniques in cuff-less BP measurement; (2) present examples of commercially available cuff-less technologies for BPT; (3) outline challenges with current methodologies; and (4) describe potential future directions in cuff-less BPT development.

<https://www.frontiersin.org/articles/10.3389/fcvm.2019.00040/full>

### **How FQHCs Are Standing Up, Sustaining Remote Patient Monitoring (RPM) Programs**

The Green River Medical Center launched its RPM program last March, supported by Rimidi, a cloud-based software platform that combines patient-generated data with information from the EHR to support clinical decision-making. Hypertension patients are able to take their blood pressure readings at home and transmit them electronically to Green River Medical Center via the platform provided by Rimidi.

<https://mhealthintelligence.com/features/how-fqhcs-are-standing-up-sustaining-remote-patient-monitoring-programs>

### **Implementation of A Cloud-Connected Remote Blood Pressure Monitoring Program During The Postpartum Period Improves Ascertainment (Eligible Sample Size: 1,008 Patients)**

**“Introduction:** Postpartum hypertension is a leading cause of postpartum hospital readmissions and severe maternal morbidity. Monitoring postpartum blood pressure (BP) through office visits is challenging due to barriers in accessing care, which disproportionately affect people of color. Remote BP monitoring programs are promising but many require cellular data plans or smartphones. The aim of this study is to examine the impact of a cloud-connected remote BP monitoring program in BP ascertainment during the six weeks postpartum in a diverse, safety-net hospital population.

**Methods:** Eligible patients were those delivering between April 2020 through September 2021 at Boston Medical Center and at high-risk of postpartum hypertension, including those with hypertensive disorders of pregnancy, chronic hypertension, or hypertension during hospitalization for delivery. Patients were given a cell-enabled cuff and provided instructions in either English, Spanish, or Haitian Creole to take their BP daily for six weeks. BP measurements are transmitted to a web-based portal via the local cellular network. Data collected through the portal were merged with clinical information from the medical record. Metrics of compliance included frequency, defined as number of daily measurements ascertained, and duration, or day of last measurement, within the six-week period were examined using means and standard deviations (SD). We examined compliance by self-reported race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic). We calculated the prevalence of postpartum hypertension, defined as  $\geq 2$  BP measures with systolic blood pressure (SBP)  $\geq 140$  mmHg and/or diastolic blood pressure (DBP)  $\geq 90$  mmHg. Severe hypertension was defined as SBP  $\geq 160$  and/or DBP  $\geq 110$ .

**Results:** Among the 3,525 deliveries during the study period, 1,008 (28.6%) were eligible for the program. Of the eligible participants, 40.5% identified as Black (n=409), 36.3% as Hispanic (n=366), and 14.4% as White (n=145). Participation was high; only 15 patients (1.5%) did not take any BP measures. Among the 993 participants, the average number of daily BP measures was 17.1 (SD: 10.4), which was similar across racial/ethnic groups (Black: 17.3, Hispanic: 16.5, White: 17.1). Furthermore, the mean duration of participation was 31.7 days (SD: 12.2), which was also similar by race/ethnicity. In this high-risk cohort, the prevalence of postpartum hypertension was 64.3% (n=638), with 9.6% (n=61) meeting severe criteria.

**Conclusion:** In conclusion, implementation of a cloud-connected BP monitoring program among a diverse, safety-net population was successful at ascertaining multiple BP measures in the postpartum period. Furthermore, similar patterns of use across racial and ethnic groups suggest that this program could reduce disparities with respect to postpartum BP ascertainment.”

Mujic, E., Parker, S., & Yarrington, C. (2022). Abstract EP50: Implementation Of A Cloud-Connected Remote Blood Pressure Monitoring Program During The Postpartum Period Improves Ascertainment. *Circulation*, 145(Suppl\_1).  
[https://doi.org/10.1161/circ.145.suppl\\_1.ep50](https://doi.org/10.1161/circ.145.suppl_1.ep50)

[https://www.ahajournals.org/doi/10.1161/circ.145.suppl\\_1.EP50](https://www.ahajournals.org/doi/10.1161/circ.145.suppl_1.EP50)

### **Remote Non-Physician Care Helps Blood Pressure**

“Patients were identified by electronic health record (EHR) screening or primary care clinician referral. They were given home blood pressure cuffs and received phone calls from non-licensed patient "navigators" who provided educational information and ordered lab tests; pharmacists initiated and titrated medicines — all without in-person patient visits. In the current study, at 3 months, 40% of patients in the lipid management program and 44% of patients in the hypertension management program had attained maintenance levels of low-density lipoprotein cholesterol (LDL-C) and blood pressure; 92% of these patients were at their target levels and the rest were close.”

"The program effectively improves hypertension and LDL-cholesterol in high-risk patients [and] reduces the need for in-person visits and physician time," Blood, a research fellow at Brigham and Women's Hospital in Boston, Massachusetts concluded.

LDL Control[Marlene Busko November 29, 2021]

[https://www.medscape.com/viewarticle/963783?uac=282903CK&faf=1&sso=true&implID=3838041&src=wnl\\_edit\\_tpal#vp\\_1](https://www.medscape.com/viewarticle/963783?uac=282903CK&faf=1&sso=true&implID=3838041&src=wnl_edit_tpal#vp_1)

### **Using simple telehealth in primary care to reduce blood pressure: a service evaluation**

(n=364) with 124 intervention patients. “Conclusions: Simple telehealth is acceptable and effective in reducing patients’ BP. In future, poorly controlled patients could be targeted to maximize BP reductions or broader use could improve diagnostic accuracy and accessibility for patients who struggle to regularly attend their GP surgery.”

[Elizabeth Cottrell, Ruth Chambers, Phil Connell. *BMJ Open*. 2012;2:e001391. Doi:10.1136/bmjopen-2012-001391]

<http://bmjopen.bmj.com/content/2/6/e001391>

## **COVID-19**

### **Telehealth for Noncritical Patients with Chronic Diseases During the COVID-19 Pandemic**

“Due to the Coronavirus disease (Covid-19) pandemic, telehealth has received greater attention due to its role in reducing hospital visits from patients with Covid-19 or other conditions, while supporting home isolation in patients with mild symptoms. With reduced opportunities for routine clinical visits, these patients are adopting various telehealth services such as video consultation and remote monitoring. We advocate for more innovative designs to be considered to enhance patient’s feeling of “copresence” – a sense of connection with another interactant via digital technology – with their healthcare providers during this time.”

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8734917/>

### **Hospitalization Outcomes Among Patients With COVID-19 Undergoing Remote Monitoring (Sample Size: 10,0660 COVID-19 Positive Patients)**

135,786 patients underwent testing for COVID-19, and 25,040 patients (18.4%) had at least 1 positive test. Of these patients, 10 660 were retained for analysis after excluding those who were younger than 18 years, who did not have an internal PCP, or who were hospitalized at the time of testing. A total of 9,378 patients (88.0%) were offered enrollment into the RPM program through an email invitation, comprising the final analytical cohort. The mean (SD) age of invited patients was 46.9 (16.3) years, and 5448 patients (58.1%) were women. Of the 9,378 invited patients, 5364 (57.2%) activated monitoring This study demonstrated how effective remote monitoring lowers the hospitalization rate of patients with COVID-19.

[https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2793927?utm\\_source=For\\_The\\_Media&utm\\_medium=referral&utm\\_campaign=ftm\\_links&utm\\_term=070722](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2793927?utm_source=For_The_Media&utm_medium=referral&utm_campaign=ftm_links&utm_term=070722)

## DIABETES MANAGEMENT

### **Early Results Support Efficacy and Clinical efficiency of Diabetes Management Decision support software for Blood Glucose Control: Two cohorts of 43 comparative cases**

Preliminary results from an ongoing study by Rimidi indicate that the decision support software, Diabetes+Me, helps to ensure a safe but meaningful reduction in A1c and therefore reduction in event rate as well as overall healthcare costs. Diabetes+Me has not only lead to improved benefits to patients, but has also allowed Desert Oasis healthcare, the facility who is conducting the study, to expand the scalability of its already successful diabetes management program without having to make the expensive investment of hiring additional healthcare providers. Lindsey Valenzuela, PharmD BCACP, Lucienne Ide, MD PhD, Michael Jardula, MD, Mena Salib, MD, Jade Le, PharmD BCACP, Early Results Support Efficacy and Clinical Efficiency of Diabetes Management Decision Support Software for Blood Glucose Control (Nov 2015),

<https://rimidi.com/early-results-support-efficacy-and-clinical-efficiency-of-diabetes-management-decision-support-software-for-blood-glucose-control/>

### **Mobile Phone Personalized Behavior Coaching for Diabetes: Study Size 163 patients over 26 Practices**

“Conclusions – The combination of behavioral mobile coaching with blood glucose data, lifestyle behaviors, and patient self-management individually analyzed and presented with evidence-based guidelines to providers substantially reduced glycated hemoglobin level over 1 year.”

Cluster-Randomized Trial of a Mobile Phone Personalized Behavioral Intervention for Blood Glucose Control, Charlene Quinn, Michelle Shardell, Michael Terrin, Eric Barr, Soshana Ballew, Ann Gruber-Baldini, Diabetes Care. Published Online July 25, 2011:

<http://care.diabetesjournals.org/content/34/9/1934.long>

### **Mobile Phone Diabetes Management: Study Size 30 patients from 3 group practices**

“Conclusions: Adults with type 2 diabetes using WellDoc’s software achieved statistically significant improvements in A1c. HCP and patient satisfaction with the system was clinically and statistically significant.”

WellDoc™ Mobile Diabetes Management Randomized Controlled Trial: Change in Clinical and Behavioral Outcomes and Patient and Physician Satisfaction, Charlene Quinn, Suzanne Sysko Clough, James Minor, Dan Lender, Maria Okafor, Ann Gruber-Baldini, Diabetes Technology & Therapeutics, Vol 10, Number 3, 2008, pps 160-168.  
<http://online.liebertpub.com/doi/pdf/10.1089/dia.2008.0283>

### **Testing Diabetic Retinopathy with Telemedicine Found Successful**

A study in *JAMA Internal Medicine* finds that telemedicine is an effective method to test for diabetic retinopathy (DR) in Los Angeles. The practice of teleretinal DR screening was applied in the Los Angeles County Department of Health Services, the largest publicly operated county safety net in the United States. The use of telemedicine for DR screening kept patients from needing approximately 14,000 specialist visits, wait times decreased by 89.2 percent and DR screening annual rates increased by more than 16 percent.

Daskivich LP, Vasquez C, Martinez C, Tseng C, Mangione CM. Implementation and Evaluation of a Large-Scale Teleretinal Diabetic Retinopathy Screening Program in the Los Angeles County Department of Health Services. *JAMA Intern Med*. Published online March 27, 2017. doi:10.1001/jamainternmed.2017.0204  
<http://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2612116>

### **Clinical and Economic Impact of a Digital, Remotely-Delivered Intensive Behavioral Counseling Program on Medicare Beneficiaries at Risk for Diabetes and Cardiovascular Disease**

More than 500 Humana Medicare Advantage beneficiaries at elevated risk of diabetes enrolled in Omada Health's digital Diabetes Prevention Program. Omada placed them into small peer groups and provided them with a cellular scale, proprietary curriculum and a professional health coach. Outcomes examined at 16 weeks, 6 months, and 12 months showed significant and sustained weight loss, improved blood glucose control and decreased cholesterol among participants with clinical data. In addition to significantly reducing their risk for type 2 diabetes, participants also reported improvements in self-care, diet, exercise, and depression and isolation scores.

Castro Sweet CM, Chig uluri V, Gumpina R, Abbott P, Madero EN, Payne M, et al. Outcomes of a Digital Health Program With Human Coaching for Diabetes Risk Reduction in a Medicare Population. *Journal of Aging and Health* [Internet] 2017 Jan 1 [Cited 2017 Apr 5]: [19p]  
<https://doi:10.1177/0898264316688791>.

### **Outcomes of a Digital Health Program With Human Coaching for Diabetes Risk Reduction in a Medicare Population**

Based on data from more than 1,100 participants over the age of 65, Omada Health's fifth peer-reviewed study demonstrates the success of the company's flagship program with a senior population. Participants with an average age of 69 enrolled in Omada's digital, remotely-delivered intensive behavioral counseling program. Omada participants remained engaged, with 9 in 10 individuals completing a minimum of 9 lessons. The seniors, on average, achieved clinically-meaningful weight loss, which is expected to significantly reduce their risk of type 2 diabetes and other chronic conditions related to obesity. These reductions in chronic disease risk projected to an average estimated three-year savings of \$1,720-1,770 per participant. Medical savings exceeded intervention costs within 2 years.

Chen F, Su W, Becker SH, Payne M, Castro Sweet CM, Peters AL, et al. (2016) Clinical and Economic Impact of a Digital, Remotely-Delivered Intensive Behavioral Counseling Program on Medicare Beneficiaries at Risk for Diabetes and Cardiovascular Disease. PLoS ONE 11(10): e0163627. <https://doi:10.1371/journal.pone.0163627>

### **RPM Helps Lower A1c Below 9% for 84% of Patients at Leon Medical Centers**

“At the beginning of 2020, Leon Medical Centers defined a patient cohort, in this case, any patient with an A1c greater than 9%, uploaded their information into the Rimidi/Smart Meter technology solution and enrolled them in remote patient monitoring, with the goal of reducing their A1c.

When patients enrolled in either their in-person clinic appointments or virtually, they were given a SmartMeter iGlucose cellular-enabled glucometer and instructed by their doctor how often to take their blood-glucose reading... The data from iGlucose was then able to flow directly into the Rimidi platform, where it was curated alongside relevant clinical data from the EHR.” To date, approximately 225 high-risk patients have been enrolled to be remotely monitored by Leon clinicians. Now, 84% of those patients have been able to get their A1cs below 9%, a key indicator of better diabetes control. The average number of blood-glucose readings per assigned device per month is 28, indicating high levels of patient engagement.

<https://www.healthcareitnews.com/news/rpm-helps-lower-a1c-below-9-84-patients-leon-medical-centers>

## **EATING DISORDERS**

### **Effectiveness of delivering evidence-based eating disorder treatment via telemedicine for children, adolescents, and youth**

“Barriers limit access to eating disorder treatment. Evidence-based treatment delivered using telemedicine could expand access. This study determined the effectiveness of enhanced Family-Based Treatment (FBT+) delivered using telemedicine for children and adolescents with eating disorders. Participants had a confirmed eating disorder diagnosis, lived in states where treatment was available, and lived with a family member willing to participate. Most patients were cisgender female (83%) White, (71%), required weight restoration (78%), and had anorexia nervosa, restricting type (63%). After 16 weeks, patients on weight restoration gained on average 11 · 3 [9 · 86, 12 · 8] pounds and the average change in EDE-QS score was -6 · 31 [-8 · 67, -4 · 10] points. Patients and caregivers reported satisfaction with treatment... Virtual FBT+ for eating disorders can transcend geographical and psychosocial treatment barriers, expanding access to evidence-based eating disorder treatment.”

[https://mcusercontent.com/90255236ac79b82de92c365b9/files/d90ae4c7-8bd4-199b-4425-731b9ec44ed3/Steinberg\\_et\\_al\\_Equip\\_outcomes\\_2022.pdf?mc\\_cid=28510dbaeb&mc\\_eid=5109c485ba](https://mcusercontent.com/90255236ac79b82de92c365b9/files/d90ae4c7-8bd4-199b-4425-731b9ec44ed3/Steinberg_et_al_Equip_outcomes_2022.pdf?mc_cid=28510dbaeb&mc_eid=5109c485ba)

## **GENERAL CHRONIC CONDITION MANAGEMENT**

### **Monitoring Systems for Patients with Chronic Diseases in Primary Health Care: Systematic Review**

“The digital age, with digital sensors, the Internet of Things (IoT), and big data tools, has created new opportunities for improving both delivery of and access to healthcare. Remote monitoring is a key aspect of said improvement, and the versatility of remote monitoring systems has extensively been demonstrated during the Covid-19 pandemic. A reduction in patient load at hospitals and health centers is just one advantage associated with health remote monitoring systems (HRMS). The benefits of HRMS are far-reaching, especially for patients with chronic diseases, older adults, and patients that experience less severe symptoms when recovering from SARS-CoV-2 viral infection. The goal of this paper was to perform a systematic review of the literature of HRMS in primary healthcare (PHC) settings, identifying the current status of the digitalization of health processes, remote data acquisition, and interactions between healthcare personnel and patients. This review was conducted using PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) guidelines to identify articles that explored interventions in patients with chronic diseases in the PHC setting.”

“The literature review yielded 123 publications, 18 of which met the predefined inclusion criteria. The selected articles highlighted that sensors and wearables are already being used in multiple scenarios related to chronic disease management at the PHC level. The studies focused mostly on patients with diabetes (9/26, 35%) and cardiovascular diseases (7/26, 27%). The major problem that stood out when evaluating the implementation of these interventions was the integration of information into already existing systems in the PHC infrastructure and in changing working processes of PHC professionals (83%). Although there are inherent limitations associated with conducting a literature review, the small number of studies in the PHC context is a relevant limitation. This study aimed to demonstrate the importance of matching technological development to the working PHC processes in interventions regarding the use of sensors and wearables for remote monitoring as a source of information for chronic disease management, so that information with clinical value is not lost along the way.”

### **Randomized Control Trial of Telehealth and Telecare: Study Size 6,191 patients, 238 GP practices**

“The early indications show that if used correctly telehealth can deliver a 15% reduction in A&E visits, a 20% reduction in emergency admissions, a 14% reduction in elective admissions, a 14% reduction in bed days and an 8% reduction in tariff costs. More strikingly they also demonstrate a 45% reduction in mortality rates.”

“Whole System Demonstrator Programme, Headline Findings – December 2011”, Department of Health, United Kingdom]

[http://www.telecare.org.uk/sites/default/files/file-directory/secure\\_annual\\_reports/Publications/Effect%20of%20Telehealth%20on%20use%20of%20secondary%20care%20and%20mortality%20findings%20from%20the%20WSD%20cluster%20randomised%20trial.pdf](http://www.telecare.org.uk/sites/default/files/file-directory/secure_annual_reports/Publications/Effect%20of%20Telehealth%20on%20use%20of%20secondary%20care%20and%20mortality%20findings%20from%20the%20WSD%20cluster%20randomised%20trial.pdf)

### **Analysis of Clinician and Patient Factors and Completion of Telemedicine Appointments Using Video**

“In total, 75,947 patients and 1155 clinicians participated in 137,846 scheduled video encounters, 17,190 patients (23%) were 65 years or older, and 61,223 (81%) patients were of White race and ethnicity. Of the scheduled video encounters, 123,473 (90%) were successful, and 14,373 (10%) were converted to telephone services. A total of 16,776 patients (22%) completed a patient experience survey. Lower clinician comfort with technology (odds ratio [OR], 0.15; 95% CI, 0.08-0.28), advanced patient age (66-80 years: OR, 0.28; 95% CI, 0.26-

0.30), lower patient socioeconomic status (including low high-speed internet availability) (OR, 0.85; 95% CI, 0.77-0.92), and patient racial and ethnic minority group status (Black or African American: OR, 0.75; 95% CI, 0.69-0.81) were associated with conversion to telephone visits. Patient characteristics accounted for systematic components for success; marginal pseudo R2 values decreased from 23% (95% CI, 21.1%-26.1%) to 7.8% (95% CI, 6.3%-9.4%) with exclusion of patient factors... This quality improvement study suggests that underserved patients may become disproportionately vulnerable by cuts in coverage for telephone-based services.”

[file:///C:/Users/14047/Dropbox%20\(ACT\)/PC/Downloads/crotty\\_2021\\_oi\\_210934\\_1635279111.74358.pdf](file:///C:/Users/14047/Dropbox%20(ACT)/PC/Downloads/crotty_2021_oi_210934_1635279111.74358.pdf)

### **Chronic Patient Remote Monitoring Through the Application of a Big Data and Internet of Things**

“Even though chronic patients could benefit from technological advances, the clinical approaches for these kinds of patients are still limited. This paper describes a system for in home and external environment monitoring of chronic patients. For this purpose, we used novel technologies such as big data, cloud computing, and internet of things (IoT). The use cases that the system has been validated for are cardiovascular disease (CVD), hypertension (HPN), and chronic obstructive pulmonary disease (COPD), which were selected for their incidence in the population. Due to the use of a big data architecture based on open-source components, this system is incredibly innovative within the health ecosystem. Also, it provides a scalable and distributed environment for storage and processing of biomedical sensor data. In order to improve the self-management of chronic disease and to develop better strategies for health interventions for chronic and dependent patients, the proposed system enables the incorporation of non-medical data sources.”

<https://journals.sagepub.com/doi/full/10.1177/14604582211030956>

### **Patient Expectations and Experiences of Remote Monitoring for Chronic Diseases: Systematic Review and Thematic Synthesis of Qualitative Studies**

“The objective of this study was to describe the range of patients’ beliefs, attitudes, expectations, and experiences of remote monitoring for chronic conditions across different healthcare contexts and populations. MEDLINE, Embase, PsychINFO, and CINAHL, Google Scholar, and reference list of related studies through July 2017 were searched. To analyze the findings of the primary studies, thematic synthesis was used. All healthcare settings were considered, all participants were adults with chronic diseases, and the studies were conducted in 8 countries. 16 studies involving 307 participants with chronic obstructive pulmonary disease, heart failure, diabetes, hypertension, and end stage kidney disease were included. Four major themes were identified: *gaining knowledge and triggering actions* (tracking and responding to change, prompting timely and accessible care, supporting self-management and shared decision-making); *reassurance and security* (safety in being alone, peace of mind); *concern about additional burden* (reluctance to learn something new, lack of trust in technology, avoiding additional out-of-pocket costs), and *jeopardizing interpersonal connections* (fear of being lost in data, losing face to face contact). Patients with chronic disease experienced increased disease specific knowledge, initiated earlier clinical assessment and treatment, improved self-management, and shared decision-making via the use of remote monitoring. However, these potential benefits were balanced against concerns about the additional personal responsibility of remote monitoring and losing interpersonal contact.”

<https://www.sciencedirect.com/science/article/pii/S1386505618309821>

## **Audit of the Veterans Health Administration Home Telehealth Program: Over 15,000 patients**

On March 09, 2015, the VA Office of Inspector General released an Audit which showed that the Home Telehealth Program increase patient access and reduced costs by reducing the number of admissions. For example, before the program there were 2,365 admissions over six months by the over 15,000 patients who participated in the Home Telehealth Program. After the program there were 1,773 admissions for the following six months. This equates to about 8 fewer hospital admissions for every 100 patients in this program.

<http://www.va.gov/oig/pubs/VAOIG-13-00716-101.pdf>

## **Telehealth and the VA - FY2013 Report**

In FY2013, **608,900 (11%)** of veterans received some element of their health care via telehealth. This amounted to **1,793,496** telehealth episodes of care. **45%** of these patients lived in rural areas.

### ***Home Telehealth Services: Helps patients with chronic conditions***

- Provided care for 144,520 veterans
- 59% reduction in bed days of care
- 35% reduction in hospital readmissions
- Saves \$1,999 per annum per patient
- 84% patient satisfaction

### ***Store-and-Forward Telehealth: Remote scanning, then send to specialist***

- Served 311,396 veterans
- 95% patient satisfaction
- Saves \$38.41 per consultation

### ***Clinical Video Telehealth: Real-time video consultation that covers over 44 specialties***

- 94% patient satisfaction
- Saves \$34.45 per consultation

### ***TeleMental Health***

- Over 278,000 encounters to 91,000 patients
- million patient encounters since FY2003
- Reduced bed days of care by 38%
- Nearly 7,500 patients with chronic mental health conditions are now living independently thanks to TeleMental Health

The number of veterans receiving care through telehealth is climbing by **22%** each year.

<http://ehrintelligence.com/2014/06/23/va-reduces-admissions-by-35-due-to-telemedicine-services/>

<http://c.ymcdn.com/sites/www.hisa.org.au/resource/resmgr/telehealth2014/Adam-Darkins.pdf>

<http://www.va.gov/health/NewsFeatures/2014/June/Connecting-Veterans-with-Telehealth.asp>

### **Veterans Administration: Study Size: Over 17,000 patients**

“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 enrolment into the program. The cost of CCHT is \$1,600 per patient per annum, substantially less than other NIC programs and nursing home care. VHA's experience is that an enterprise-wide home telehealth implementation is an appropriate and cost-effective way of managing chronic care patients in both urban and rural settings.” “Care Coordination/Home Telehealth: the systematic implementation of health informatics, home telehealth, and disease management to support the care of veteran patients with chronic condition”

Darkins A, Ryan P, Kobb R, Foster L, Edmonson E, Wakefield B, Lancaster AEs, Telemed J E Health. 2008 Dec;14(10):1118-26. doi: 10.1089/tmj.2008.0021.

<http://online.liebertpub.com/doi/pdf/10.1089/tmj.2008.0021>.

Supplemented with further data by Darkins, available at:

<http://c.ymcdn.com/sites/www.hisa.org.au/resource/resmgr/telehealth2014/Adam-Darkins.pdf>

### **Artificial Intelligence of Things (AIoT) Based Patient Activity Tracking System for Remote Patient Monitoring**

“Since the beginning of the pandemic, telehealth and remote monitoring (RPM) have been critical components that have received substantial attention and gained hold. Not only does telehealth and RPM allow easy access to patient data, but it also helps provide high-quality care to patients at a low cost. This article proposes an Intelligent Remote Patient Activity Tracking System that can monitor patient activities and vitals during those activities based on the attached sensors. An Internet of Things- (IoT-) enabled health monitoring device is designed using machine learning models to track patient's activities such as running, sleeping, walking, and exercising, the vitals during those activities such as body temperature and heart rate, and the patient's breathing pattern during such activities. Different activities of the patient can be identified and analyzed by machine learning models to assess the patient's respiratory health during various activities. At this time, the machine learning models are used to detect cough and healthy breathing only. A web application is also designed to track the data uploaded by the proposed devices.”

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8904099/>

## **Reduced Hospitalizations of Nursing Facility Residents**

A study that introduced telemedicine in a Massachusetts for-profit nursing home chain, during the period October 2009 – September 2011, demonstrates the cost-effectiveness of utilizing telemedicine to reduce potential re-hospitalizations for nursing facility patients. The study's findings show that savings to Medicare from using telemedicine to reduce re-hospitalizations for nursing facility patients exceed the investment in the telemedicine equipment.

- The findings of the study suggest that the nursing facilities that were more engaged in off-hours telemedicine coverage could generate cost savings for Medicare that exceeded the facility's investment in the telemedicine service.
- The average savings to Medicare for a nursing facility that participated and was engaged with telemedicine, was \$151,000 per nursing facility per year, relative to the less-engaged facilities.
- During the two-year period, the rate of hospitalizations per 1,000 resident days declined across the pre- and post-intervention periods for both the treatment and the control groups.
- The difference in the hospitalizations in the treatment group was 4.4 percentage points lower.

David C. Grabowski and A. James O'Malley, "Use of Telemedicine Can Reduce Hospitalizations of Nursing Home Residents and Generate Savings for Medicare," *Health Affairs*, 33, no. 2 (2014): 244-250.

## **Integrated Telehealth and Care Management Program For Medicare Beneficiaries With Chronic Disease Linked To Savings**

A study from the Health Affairs found significant savings among patients who used the Health Buddy telehealth program, which integrates a telehealth tool with care management for chronically ill Medicare beneficiaries. Specifically, patients who utilized the Health Buddy Program saw spending reductions of approximately 7.7–13.3 percent (\$312–\$542) per person per quarter.

September 2011: <http://content.healthaffairs.org/content/30/9/1689.abstra>

## **Rural Hospitals and Communities Save Money Through Telemedicine Program**

A report from NTCA-The Rural Broadband Association explores how much money a rural hospital and community can save by using a telemedicine program. The report analyzes savings in travel costs, lost wages, hospital workers' wages, and lab and pharmacy revenues that can stay local by allowing patients to stay in their own communities rather than travel to larger metropolitan areas for care.

The report finds that on average a rural community can save \$31,000 in travel costs and lost wages, per hospital per year. Rural hospitals can on average save more than \$81,000 a year in doctors' wages, while generating revenue through local MRIs, and other lab and pharmacy work.

March 2017: <http://www.frs.org/images/AnticipatingEconomicReturnsOfRuralTelehealth.pdf>

## **Telemedicine Saves Patients Time and Money**

Scholars at the University of California Davis studied results and data of 18 years of inpatient and outpatient visits, ending in 2013. The scholars found that the 19,246 interactive video visits

over 18 years saved patients approximately nine years of travel time, 5 million miles, and \$3 million in related costs. Each patient using telemedicine for treatment saved on average four hours driving time, 278 miles and \$156 in travel costs over the period studied.

Impact of a University-Based Outpatient Telemedicine Program on Time Savings, Travel Costs, and Environmental Pollutants

Dullet, Navjit W. et al. Value in Health, Volume 0, Issue 0 ,

[http://www.valueinhealthjournal.com/article/S1098-3015\(17\)30083-9/fulltext](http://www.valueinhealthjournal.com/article/S1098-3015(17)30083-9/fulltext)

## HEART FAILURE MANAGEMENT

### **Chronic Disease Management in Heart Failure: Focus on Telemedicine and Remote Monitoring**

In the context of the Covid-19 pandemic, many barriers to telemedicine vanished as virtual visits and telemonitoring strategies became routine. Evidence related to the safety and efficacy of virtual visits to replace in-person visits has been accumulating. Based on this evidence, a structured approach to virtual encounters is recommended. Telemonitoring includes but is not limited to: patient reported remote virtual sign monitoring, information from wearable devices, cardiac implantable devices, and invasive remote hemodynamic monitoring. The intensity of the monitoring should match the risk profile of the patient. Additionally, attention to cultural and educational barriers is important to prevent disparities in telehealth implementation.

<https://www.imrpress.com/journal/RCM/22/2/10.31083/j.rcm2202046/htm>

### **Digital Medicine and Evolution of Remote Patient Monitoring in Cardiac Electrophysiology: A State-of-the-Art Perspective**

With the evolution in digital medicine to identify and monitor cardiac electrophysiological (EP) conditions, increased access to cardiac implantable electronic devices (CIEDs), and reimbursements for non-face-to-face care, remote patient monitoring (RPM) is becoming a key part of the EP service line. RPM of cardiac electrophysiological conditions including the use of CIEDs has improved the quality of care and high patient satisfaction and proved to be cost-effective. The focus of this review is literature on RPM in EP, evidence from randomized trials, and observational studies including those of Apple Watch and future of CIEDs.

Atreja, A., Francis, S., Kurra, S., & Kabra, R. (2019). Digital Medicine and Evolution of Remote Patient Monitoring in Cardiac Electrophysiology: A State-of-the-Art Perspective. *Current Treatment Options in Cardiovascular Medicine*, 21(12). <https://doi.org/10.1007/s11936-019-0787-3>

<https://link.springer.com/article/10.1007/s11936-019-0787-3#Sec10>

### **Program Evaluation of Remote Heart Failure Monitoring: Healthcare Utilization Analysis in a Rural Regional Medical Center**

**Background:** Remote monitoring for heart failure (HF) has had mixed and heterogeneous effects across studies, necessitating further evaluation of remote monitoring systems within specific healthcare systems and their patient populations. "Care Beyond Walls and Wires," a wireless remote monitoring program to facilitate patient and care team co-management of HF patients, served by a rural regional medical center, provided the opportunity to evaluate the effects of this program on healthcare utilization.

**Materials and Methods:** Fifty HF patients admitted to Flagstaff Medical Center (Flagstaff, AZ) participated in the project. Many of these patients lived in underserved and rural communities,

including Native American reservations. Enrolled patients received mobile, broadband-enabled remote monitoring devices. A matched cohort was identified for comparison.

**Results:** HF patients enrolled in this program showed substantial and statistically significant reductions in healthcare utilization during the 6 months following enrollment, and these reductions were significantly greater compared with those who declined to participate but not when compared with a matched cohort. **Conclusions:** The findings from this project indicate that a remote HF monitoring program can be successfully implemented in a rural, underserved area. Reductions in healthcare utilization were observed among program participants, but reductions were also observed among a matched cohort, illustrating the need for rigorous assessment of the effects of HF remote monitoring programs in healthcare systems.

William T. Riley, PhD., et al. DOI: 10.1089/tmj.2014.0093. Vol. 21 No. 3, March 2015, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4365431/>

### **Remote Patient Monitoring of Heart Failure Patients, Meta analysis: Study Size 4,264 patients**

“Remote monitoring programs reduced rates of admission to hospital for chronic heart failure by 21% (95% confidence interval 11% to 31%) and all-cause mortality by 20% (8% to 31%); of the six trials evaluating health related quality of life three reported significant benefits with remote monitoring.”

Telemonitoring or structured telephone support programs for patients with chronic heart failure: systematic review and meta-analysis, Robyn Clark, Sally Inglis, Finlay McAlister, John Cleland, Simon Stewart, MJ (British Medical Journal), doi:10.1136/bmj.39156.536968.55 (published 10 April 2007)] <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1865411/>

### **Remote Patient Monitoring of Heart Failure Patients: Meta analysis: Study Size 6,258/ 2,354 Patients**

“Respectively, 6,258 patients and 2,354 patients were included in RCTs and cohort studies. Median follow-up duration was 6 months for RCTs and 12 months for cohort studies. Both RCTs and cohort studies showed that RPM was associated with a significantly lower number of deaths (RCTs: relative risk [RR]: 0.83, 95% confidence interval [CI]: 0.73 to 0.95,  $p = 0.006$ ; cohort studies: RR: 0.53, 95% CI: 0.29 to 0.96,  $p < 0.001$ ) and hospitalizations (RCTs: RR: 0.93, 95% CI: 0.87 to 0.99,  $p = 0.030$ ; cohort studies: RR: 0.52, 95% CI: 0.28 to 0.96,  $p < 0.001$ ). The decrease in events was greater in cohort studies than in RCTs. The study found that RPM confers a significant protective clinical effect in patients with chronic HF compared with usual care.”

J Am Coll Cardio: 2009;54:1683-94 <http://content.onlinejacc.org/article.aspx?articleid=1140154>

### **Remote Patient Monitoring at St. Vincent's Hospital**

"Impact: In less than two years, preliminary results show that the care management program implemented by St. Vincent Health and facilitated by the Guide platform reduced hospital readmissions to 5 percent for patients participating in the program – a 75 percent reduction compared to the control group (20 percent), and to the national average (20 percent)."

St. Vincent's Hospital Reduces Readmissions by 75 percent with a Remote Patient Monitoring-Enabled Program, Case Study by Care Innovations, an Intel GE Company]

[http://www.careinnovations.com/data/sites/1/downloads/Guide\\_product/guide\\_stvincent\\_profile.pdf](http://www.careinnovations.com/data/sites/1/downloads/Guide_product/guide_stvincent_profile.pdf)

### **Telehome Monitoring Program: 1,000 Patients Enrolled**

"Research at the Heart Institute has shown telehome monitoring at the Heart Institute has cut hospital readmission for heart failure by 54 percent with savings up to \$20,000 for each patient safely diverted from an emergency department visit, readmission and hospital stay."

University of Ottawa Heart Institute, February 24, 2011, Press Release.

[http://www.heartandlung.org/article/S0147-9563\(07\)00084-2/fulltext](http://www.heartandlung.org/article/S0147-9563(07)00084-2/fulltext)

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## **KIDNEY DISEASE**

### **Improving Care for Peritoneal Dialysis through Remote Biometric Monitoring and the Adoption of Telehealth. (Sample size = 269)**

Participants on peritoneal dialysis (PD) (n = 269) participated in a Telehealth pilot study of which 253 used remote monitoring of blood pressure (BP) and 255 for Wt. Blood pressure and Wt readings were transmitted in real time to a Telehealth call center, which were then forwarded to the PD nurses for real-time review. Uptake of remote biometric monitoring (RBM) was substantial, with 89.7% accepting RBM, generating 74,266 BP and 52,880 Wt measurements over the study period. The study demonstrated how effective remote monitoring can be in chronic care management and the detection of levels that are alarming. Remote biometric monitoring was feasible, allowing for increased communication between patient and PD clinical staff with real-time patient data for providers to act on to potentially improve adherence and outcomes.

*Adoption of Telehealth: Remote Biometric Monitoring Among Peritoneal Dialysis Patients in the United States*

Susie Q. Lew, Neal Sikka, Clinton Thompson, Teena Cherian and Manya Magnus  
Peritoneal Dialysis International;

[https://journals.sagepub.com/doi/10.3747/pdi.2016.00272?url\\_ver=Z39.88-2003&rfr\\_id=ori%3Arid%3Acrossref.org&rfr\\_dat=cr\\_pub++0pubmed&](https://journals.sagepub.com/doi/10.3747/pdi.2016.00272?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub++0pubmed&)

### **Kidney Health Initiative on Advancing technologies to facilitate Remote Monitoring and Patient Generate Health Data**

This study demonstrates that the use of telehealth and telemedicine leads to decreases in the need for in-center monthly assessments, increases is patient satisfaction and the potential for cost savings. Unfortunately, despite data showing equivalent or superior outcomes and preferences, uptake of these modalities has been slow.

For an example of cost saving, "The University of Iowa Stead Family Children's Hospital where the addition of a monthly Skype remote visit supplemented with quarterly face-to-face visits led to yearly cost savings of approximately \$5000/ year for the patient's family, as compared with monthly face-to-face visits, without any change in outcomes ".

*Perspectives from the Kidney Health Initiative on Advancing Technologies to Facilitate Remote Monitoring of Patient Self-Care in RRT*

Mitchel H. Rosner, Susie Q. Lew, et. al.

Clinical Journal of the American Society of Nephrology 12: 1900–1909, 2017.doi:

<https://doi.org/10.2215/CJN.12781216>

### **Remote Patient Management in Peritoneal Dialysis Improves Clinical Outcomes**

“Remote patient management (RPM) is a strategy that allows for accurate home monitoring of chronic patients, enabling the team to improve care through prevention and early identification of problems, with consequent timely interventions. Peritoneal dialysis (PD) is a home-based therapy representing an ideal model for testing the ability of RPM to improve clinical outcomes by allowing the 2-way link between health providers and patients. The literature and our own results confirm that RPM applied to automated peritoneal dialysis (APD) allows an efficient use of healthcare resources, helping to improve tailoring of APD prescription and to intervene early with troubleshooting, reducing the frequency of in-person visits for emergency problems.”

Ronco C, Crepaldi C, Rosner MH (eds): Remote Patient Management in Peritoneal Dialysis. Contrib Nephrol. Basel, Karger, 2019, vol 197, pp I-VI.

<https://www.karger.com/Article/Pdf/496319>

### **Satisfaction and Improvements in Peritoneal Dialysis Outcomes when Associated with Telehealth. (Sample size: 300 patient 18 years of age or older)**

“End stage renal disease (ESRD) affects approximately 600,000 persons in the United States each year, representing a significant financial and structural burden to the health care system; Medicare fee-for-service spending for ESRD cost \$30.9 billion in 2013, accounting for 7.1% of the overall Medicare paid claims cost.”

“At-home treatments associated with PD have allowed ESRD patients to carry out medical tasks without having to allocate time and resources associated with attendance of multiple weekly clinic visits. Our results suggest that the use of telehealth increased patients’ perceived autonomy and confidence regarding dialysis treatments as well as satisfaction with the care their health professionals provided over the phone and via remote biometric monitoring.. The majority of the study participants were also satisfied or completely satisfied with the telehealth interface, suggesting that patients are likely to adopt its components. Supplementing PD with telehealth has the potential to have a positive impact on patient perceptions of PD and consequently improve clinical outcomes”.

“The majority of participants (80.1%) indicated that they were satisfied or completely satisfied with the components of the system”.

*Satisfaction and Improvements in Peritoneal Dialysis Outcomes Associated with Telehealth*

Manya Magnus, Neal Sikka, Teena Cherian and Susie Q. Lew

Applied Clinical Informatics 2017; 8: 214-225 <https://doi.org/10.4338/ACI-2016-09-RA-0154>

### **Telehealth Clinical Studies pertaining to Home Dialysis**

For patients receiving dialysis, almost \$3 billion is spent annually on transportation.

Teleconsultation was conducted in a shorter average period of time (22 versus 33 min), was

effective, significantly reduced hospitalization rates, but slightly more expensive (198 versus 177 euro or \$233 versus \$208) when compared with hospital consultation. However, annual savings of \$46,613 USD and annual cost of \$79,489 when videoconferencing for daily visits.

Perspectives from the Kidney Health Initiative on Advancing Technologies to Facilitate Remote Monitoring of Patient Self-Care in RRT

(Remote Monitoring of Dialysis Patients)

Mitchell H. Rosner, et al.

Clinical Journal of the American Society of Nephrology

<https://www.asn->

[online.org/membership/BlastEmails/files/KHI\\_RemoteMonitoring\\_Publication\\_July2017.pdf](https://www.asn-online.org/membership/BlastEmails/files/KHI_RemoteMonitoring_Publication_July2017.pdf)

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## MEDICATION ADHERENCE FOR CHRONIC CONDITIONS

### **A Remotely Delivered Hypertension and Lipid Program in 10,000 Patients Across a Diverse Health Care Network**

The Mass General Brigham (MGB) designed and implemented a remote hypertension (HTN) and hyperlipidemia management program at scale across a diverse health care network. **Methods:** Between 1/2018 and 10/2021, we screened and enrolled patients into remote HTN and lipids education and management programs through electronic health record screenings and provider referrals. We provided an “end-to-end” disease management solution including identification, engagement, device integration, education, and medication titration. Non-licensed navigators, supervised by a team of pharmacists, nurse practitioners and physicians coordinated care using customer relationship management software, task automation, and omni-channel communication. Daily BP measurements and labs were monitored in real-time for efficacy and safety.

**Conclusion:** Our results in over 10,000 patients demonstrate that standardized, remote, algorithmic care can effectively optimize guideline-directed therapy at scale, reduce cardiovascular risk, and minimize the need for in-person visits. These results highlight that traditionally underserved and undertreated populations can be managed effectively with digitally enabled remote care programs.

[https://www.abstractsonline.com/pp8/?\\_ga=2.141042993.2042594723.1635046736-1021258137.1633710264#!/9349/presentation/18153](https://www.abstractsonline.com/pp8/?_ga=2.141042993.2042594723.1635046736-1021258137.1633710264#!/9349/presentation/18153)

### **Automated Medication Reminder Application for Mobile Phones and Hypertension Medication Adherence in a High-Risk Urban Population**

50 high-risk urban patients with hypertension and who were using at least two prescription medications for hypertension were recruited into an open-label trial using medication reminder software on a mobile phone. Medication adherence was assessed by review of pharmacy refill rates before, during, and after availability of the medication reminder software (pre-activation, activation, and post-activation phase, respectively). All subjects were insured by Medicaid, 96% were African American, and the majority had diabetes mellitus. The proportion of days covered for each study phase was as follows: pre-activation phase = 0.54, activation phase = 0.58, and post-activation phase = 0.46. A significant difference was found between the activation and post-activation phases ( $p = .001$ ). The increase in measured adherence between the pre-activation and activation phases approached significance ( $p = .057$ ). Forty-six patients completed the pre- and post-Morisky medication adherence survey. The median score rose from 2.0 at baseline to

3.0 at study completion ( $p < .001$ ). Average blood pressure and level of control during study period improved significantly after initiation of the study and remained improved from baseline through the course of the study. The 48 subjects who completed the study reported a high level of satisfaction with the medication reminder application at the final study visit.

Samir Patel, M.D., Laura Jacobus-Kantor, Ph.D., Lorraine Marshall, R.N., Clark Ritchie, B.A., Michelle Kaplinski, M.D., Parvinder S. Khurana, M.D., and Richard J. Katz, M.D., Mobilizing Your Medications: An Automated Medication Reminder Application for Mobile Phones and Hypertension Medication Adherence in a High-Risk Urban Population, *J Diabetes Sci Technol*. 2013 May; 7(3): 630–639, Published online 2013 May 1. doi: 10.1177/193229681300700307

### **Case Study: Mobilizing Your Medications: An Automated Medication Reminder Application for Mobile Phones and Hypertension Medication Adherence in a High-Risk Urban Population**

**Background:** Hypertension frequently accompanies diabetes mellitus, worsening prognosis and complicating medical care for patients. Low medication adherence with multiple medications is a major factor in the inadequate achievement of blood pressure treatment goals. Widespread access to mobile phones offers a new opportunity to communicate with patients and enhance disease self-management.

**Methods:** We recruited 50 high-risk urban patients with hypertension, who are using at least two prescription medications for hypertension, into an open-label trial using medication reminder software on a mobile phone. Medication adherence was assessed by review of pharmacy refill rates before, during, and after availability of the medication reminder software (pre-activation, activation, and post-activation phase, respectively).

**Results:** Forty-eight patients completed the study. All subjects were insured by Medicaid, 96% were African-American, and the majority had diabetes mellitus. The proportion of days covered for each study phase was as follows: pre-activation phase = 0.54, activation phase = 0.58, and post-activation phase = 0.46. A significant difference was found between the activation and post-activation phases ( $p = .001$ ). The increase in measured adherence between the pre-activation and activation phases approached significance ( $p = .057$ ). Forty-six patients completed the pre- and post-Morisky medication adherence survey. The median score rose from 2.0 at baseline to 3.0 at study completion ( $p < .001$ ). Average blood pressure and level of control during study period improved significantly after initiation of the study and remained improved from baseline through the course of the study. The 48 subjects who completed the study reported a high level of satisfaction with the medication reminder application at the final study visit.

**Conclusion:** A mobile-phone-based automated medication reminder system shows promise in improving medication adherence and blood pressure in high-cardiovascular-risk individuals.

Samir Patel, M.D., et al. *Journal of Diabetes Science and Technology* Volume 7, Issue 3, May 2013

<https://www.ncbi.nlm.nih.gov/pubmed/23759395>

### **Using Data to Keep Vaccines Cold in Kenya: Remote Temperature Monitoring With Data Review Teams for Vaccine Management**

Global vaccination coverage rates have remained around 85% for the past several years. Increasing immunization coverage rates requires an effective cold chain to maintain vaccine potency. Remote temperature monitoring (RTM) technology for vaccine refrigerators has shown

promise for improving the ability of supply systems to maintain optimal temperature conditions to ensure potent vaccines reach the end users.

Lutukai, M., Bunde, E. A., Hatch, B., Mohamed, Z., Yavari, S., Some, E., Chweya, A., Kania, C., Ross, J. C., Keddem, C., & Chandani, Y. (2019). Using Data to Keep Vaccines Cold in Kenya: Remote Temperature Monitoring With Data Review Teams for Vaccine Management. *Global Health: Science and Practice*, 7(4), 585–597.  
<https://doi.org/10.9745/ghsp-d-19-00157>

[https://www.ghspjournal.org/content/7/4/585?utm\\_source=TrendMD&utm\\_medium=cpc&utm\\_campaign=Global\\_Health%253A\\_Science\\_and\\_Practice\\_TrendMD\\_0](https://www.ghspjournal.org/content/7/4/585?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Global_Health%253A_Science_and_Practice_TrendMD_0)

## MENTAL/ COGNITIVE DISEASE

### **Cleveland Alzheimer’s Managed Care Outcomes: Study Size: 89 Patients**

“The Cleveland Alzheimer’s Managed Care Demonstration is one of the few studies of dementia care that gather data directly from patients, particularly information regarding their perception of symptoms and care”.

“Overall, findings show that care consultation delivered within a partnership between Kaiser Permanente of Ohio and the Cleveland Area Alzheimer’s Association is a promising strategy for improving outcomes for patients with memory problems”.

Outcomes for Patients with Dementia from the Cleveland Alzheimer’s Managed Care Demonstration

P.A. Clark, D.M. Bass, W.J. Looman, C.A. McCarthy & S. Eckert  
*Aging & Mental Health*, January 2004; 8(1): 40-51

<http://www.tandfonline.com/doi/abs/10.1080/13607860310001613329?journalCode=camh20>

### **Consolidation/Reconsolidation Therapies for the Prevention and Treatment of PTSD and re-experiencing: A Systematic Review and Meta-Analysis**

“Translational research highlights the potential of novel 'memory consolidation/reconsolidation therapies' to treat re-experiencing symptoms and post-traumatic stress disorder (PTSD). This systematic review and meta-analysis assessed the efficacy of so-called memory consolidation/reconsolidation therapies in random controlled trials (RCTs) for prevention and treatment of PTSD and symptoms of re-experiencing in children and adults...The primary outcome in the meta-analysis for preventative studies was a reduction in PTSD incidence and/or severity of re-experiencing symptoms 3–6 months after the traumatic event, while for treatment studies the primary outcome was a reduction in PTSD incidence and/or severity of re-experiencing symptoms 3–6 months post-intervention (it was agreed a priori that the nearest time point to this would be accepted and the vast majority of included reconsolidation studies only reported outcomes in the 1–4 weeks post-intervention).”

<https://www.nature.com/articles/s41398-021-01570-w#Sec11>

### **Dementia Care in an Underserved Retirement Community, thanks to Telemedicine Sample Size: 78 total with 33 Completing Satisfaction Exit-Interviews**

“Prior to 2013, a neurologist from USC commuted every weekend from Los Angeles to Palm Desert (120 miles, 2 h each way) to assess and manage patients. It became apparent that this setup was not sustainable as clinic wait0time lengthened to 6+ months.”

“In our experience, over the past 3 years, telemedicine poses no barrier to accurate evaluation and is as effective as a meeting in person.”

In 2012, USC-EMC MAC was only able to bring in under 20 people. After telemedicine was implemented, by 2014, they were able to increase intake to around 85 new patients per year.

Satisfaction:

- Overall Satisfaction with the clinic of 4.84 out of 5
- General satisfaction with the neurologist at 4.88 out of 5
- Satisfaction with the telemedicine system at 4.65 out of 5

A Multidisciplinary Model of Dementia Care in an Underserved Retirement Community, Made Possible by Telemedicine

Jason V. Tso, Roxanna Farinpour, Helena C. Chui and Collin Y. Liu

Frontiers in Neurology

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5179531/>

### **Does Remote Patient Monitoring Reduce Acute Care Use? A Systematic Review**

**Objective** Chronic diseases are associated with increased unplanned acute hospital use. Remote patient monitoring (RPM) can detect disease exacerbations and facilitate proactive management, possibly reducing expensive acute hospital usage. Current evidence examining RPM and acute care use mainly involves heart failure and omits automated invasive monitoring. This study aimed to determine if RPM reduces acute hospital use.

Results show that the use of RPM reduces hospital visits.

Taylor, M. L., Thomas, E. E., Snoswell, C. L., Smith, A. C., & Caffery, L. J. (2021). Does remote patient monitoring reduce acute care use? A systematic review. *BMJ Open*, 11(3), e040232. <https://doi.org/10.1136/bmjopen-2020-040232>

<https://bmjopen.bmj.com/content/11/3/e040232.abstract>

### **Economic Evaluations of Remote Patient Monitoring for Chronic Disease: A Systematic Review**

This study systematically reviewed and summarized economic evaluations of noninvasive remote patient monitoring (RPM) for chronic diseases compared with usual care. Searches of PubMed, Embase, CINAHL, and EconLit using keyword synonyms for RPM and economics identified articles published from up until September 2021. Title, abstract, and full-text reviews were conducted. Data extraction of study characteristics and health economic findings was performed. Overall, this review demonstrates that there is evidence that noninvasive RPM can be cost-effective compared with usual care for managing chronic disease. There was more robust health economic evidence for RPM of hypertension, COPD, and heart failure than other chronic diseases.

De Guzman, K. R., Snoswell, C. L., Taylor, M. L., Gray, L. C., & Caffery, L. J. (2022). Economic Evaluations of Remote Patient Monitoring for Chronic Disease: A Systematic Review. *Value in Health*. <https://doi.org/10.1016/j.jval.2021.12.001>

<https://www.sciencedirect.com/science/article/abs/pii/S1098301521032241>

### **Impact of Remote Patient Monitoring on Clinical Outcomes: An Updated Meta-Analysis of Randomized Controlled Trials**

Five high-quality studies compared RPM with usual care for high-acuity patients with chronic obstructive pulmonary disease (COPD) or heart failure. In Chau et al., 40 participants with a previous hospitalization and diagnosed with moderate or severe COPD were randomized to usual care or a telecare device kit that provided patient feedback and was monitored by a community nurse. Although several participants experienced technical problems using the device kit, participants expressed greater engagement in self-management of their COPD overall due to telemedicine visits.

<https://www.nature.com/articles/s41746-017-0002-4>

### **North Dakota Assistance Program For Dementia Caregivers Lowered Utilization, Produced Savings, and Increased Empowerment**

“These changes saved an estimated 179,580 days in long-term care (average:7.7 years per person with dementia), which translated into \$39.2 million in potential cost savings during the forty-two-month period”.

This program also drastically decreased hospital stays, ambulance uses, emergency department visits and 911 calls at a relatively steady rate over a year and a half.

- For example, Hospital stays – in months 1-3, the rate of event per person was .754 and when the months reached 16-18, the rate was a measly .071.

*North Dakota Assistance Program For Dementia Caregivers Lowered Utilization, Produced Savings, And Increased Empowerment*

Marilyn G. Klug, Gwen Wagstrom Halaas, and Mandi-Leigh Peterson

Health Affairs 33, no. 4 (2014): 605-612

<http://content.healthaffairs.org/content/33/4/605.abstract>

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## **PSORIASIS**

### **Effectiveness of Online vs In-Person Care for Adults With Psoriasis: A Randomized Clinical Trial**

“In a 12-month randomized clinical equivalency trial, adults with psoriasis randomized to the online model experienced improvement in disease severity equivalent to those randomized to in-person management. Differences between the 2 arms were within prespecified equivalence margins... f the 296 randomized participants, 147 were women, 149 were men, 187 were white, and the mean (SD) age was 49 (14) years. The online, collaborative connected-health model was as effective as in-person management in improving clinical outcomes among patients with psoriasis. Innovative telehealth delivery models that emphasize collaboration, quality, and efficiency can be transformative to improving patient-centered outcomes in chronic diseases.”

<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2705854?resultClick=3>

## RESPIRATORY AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE MANAGEMENT

### **Content-Driven Telehealth System Coupled with Care Management: Study Size Medicare patients enrolled in CMS' Health Buddy Program demonstration from 2006-2010**

The Health Buddy Program is a content-driven telehealth system combined with care management designed to enhance patient education, self-management, and timely access to care. "The Health Buddy Program was associated with 23% lower quarterly all-cause hospital admissions and 40% lower quarterly respiratory-related hospital admissions compared to baseline for intervention beneficiaries vs. controls. In subgroup analyses, patients who engaged in the intervention during the study period (n=247) demonstrated significantly lower quarterly hospital admissions for chronic obstructive pulmonary disease exacerbations.

Conclusion: A content-driven telehealth system combined with care management has the potential to improve health outcomes in Medicare beneficiaries with chronic obstructive pulmonary disease."

Au, DH, Macaulay, DS, et al. Impact of a telehealth and care management program for patients with chronic obstructive pulmonary disease. *Ann Am Thorac Soc.* 2015 Mar;12(3):323-31. Doi: 10.1513/AnnalsATS.201501-042OC. <http://www.ncbi.nlm.nih.gov/pubmed/25642649>

### **Home Telehealth for Patients with Severe COPD: 60 patients**

Telehealth is an important part of the need for innovative models of care for patients with severe COPD and frequent acute exacerbations. In a cluster assignment, controlled trial study design, 60 patients were recruited: 30 in home telehealth (TH) and 30 in conventional care (CC). Results: "After 7-months of monitoring and follow-up, there was significant reduction in ER visits (20 in HT vs 57 in CC), hospitalizations (12 vs 33), length of hospital stay in (105 vs 276 days), and even need for non-invasive mechanical ventilation (0 vs 8, all  $p < 0.05$ )

Segrelles CG, et al. A home telehealth program for patients with severe COPD: the PROMETE study. *Respir Med.* 2014 Mar; 108(3):453-62. Doi: 10.1016/j.med.2013. 12.003. Epub 2013 Dec 16.

<http://www.ncbi.nlm.nih.gov/pubmed/?term=A+home+telehealth+program+for+patients+with+COPD%3A+The+PROMETE+study>

### **Home telemonitoring program: 369 patients with at least one COPD exacerbation per year prior to enrollment**

The study was designed to evaluate the effects of home telemonitoring on healthcare utilization in patients with COPD. "Of these, 71.5% had a reduction in number of ED visits and exacerbations requiring hospitalization after enrollment in the program. The average number of hospital admissions, ED visits, and total exacerbations were all reduced ( $0.41 \pm 1.68$ ,  $0.15 \pm 1.65$ , and  $0.56 \pm 2.3$ , respectively; all with  $p < 0.01$ )."

Alrajab S, Smith TR, et al. A home telemonitoring program reduced exacerbation and healthcare utilization rates in COPD patients with frequent exacerbations. *Telemed J E Health.*

2012 Dec; 18(10):772-6. Doi: 10.1089/tmj.2012.0005. Epub 2012 Oct 19.  
<http://www.ncbi.nlm.nih.gov/pubmed/?term=Alrajab+S%2C+Smith+TR%2C+et+al>

### **Tele-assistance (TA) in chronic respiratory failure patients: 240 patients (101 with COPD)**

Chronic respiratory patients requiring oxygen or home mechanical ventilation experience frequent exacerbations and hospitalizations with related costs. Patients were randomized into two groups: an intervention group (1-year TA) and control group (conventional care). “Compared with controls, the TA group experienced significantly fewer hospitalizations (-36%), fewer GP calls (-65%) and acute exacerbations (-71%). After deduction of TA costs, the average overall cost for each patient was 33% less than for usual care.”

Vitacca M, Bianchi L, et al. Tele-assistance in chronic respiratory failure patients: a randomized clinical trial. *Eur Respir J*. 2009 Feb;33(2):411-8. Doi: 10.1183/09031936.00005608. Epub 2008 Sep 17.  
<http://www.ncbi.nlm.nih.gov/pubmed/18799512>

### **Telehealth Program for CPAP Adherence: 122 patients**

This study evaluated the effectiveness of coaching labor requirements of a web-based automated telehealth (TH) messaging program compared with standard of care (SOC) in newly diagnosed patients with obstructive sleep apnea. “There was a significant reduction in the number of minutes coaching [by respiratory therapists] required per patient in the TH vs SOC group ( $23.9 \pm 26$  vs.  $58.3 \pm 25$ , 59% reduction;  $p < 0.0001$ ).”

More than 2 million patients on continuous positive airway pressure (CPAP) for obstructive sleep apnea (OSA) are being monitored at home using AirView. Key parameters of treatment effectiveness can be determined remotely at the patient level to adjust therapy or troubleshoot and correct device problems, or at the population level to efficiently measure adherence levels and track frequency of complications like mask leak. Adherence to therapy can be significantly improved through the use of remote patient monitoring and patient engagement technologies.

Munafa D, Hevener W, Crocker M, Willes L, Sridasome S, Muhsin M. A telehealth program for CPAP adherence reduces labor and yields similar adherence and efficacy when compared to standard of care. *Sleep Breath*. 2016 May;20(2):777-85. doi: 10.1007/s11325-015-1298-4. Epub 2016 Jan 11. PMID: 26754933; PMCID: PMC4850183.  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4850183/>

### **Telemedicine Versus Face-to-Face Evaluations by Respiratory Therapists**

This pilot study includes 40 assessments by 16 RTs on 11 subjects (5 neonatal ICU; 6 pediatric ICU). Anonymously completed intake forms by 2 different RTs concurrently assessing 14 ventilator-derived and patient-based respiratory variables were used to determine correlations. The study aimed to determine how well respiratory assessments for ventilated neonates and children correlated when performed simultaneously by 2 respiratory therapists face-to-face and via telemedicine. The study found that telemedicine evaluations highly correlated with face-to-face for 10 of 14 aspects of standard bedside respiratory assessment. Poor correlation was noted for more complex, patient-generated parameters, highlighting the importance of further investigation incorporating a virtual stethoscope.

Bell, RC, Yager PH, et al. Telemedicine Versus Face-to-Face Evaluations by Respiratory Therapists of Mechanically Ventilated Neonates and Children: A Pilot Study.  
<https://rc.rcjournal.com/content/61/2/149>

## SINUSITIS & URINARY TRACT INFECTION

### **A Comparison of Care at E-visits and Physician Office Visits for Sinusitis and Urinary Tract Infection**

“Of the 5,165 visits for sinusitis, 465 (9%) were e-visits. Of the 2,954 visits for UTI, 99 were e-visits (3%). Our findings refute some concerns about e-visits but support others. The fraction of patients with any follow-up was similar. Follow-up rates are a rough proxy for misdiagnosis or treatment failure and the lack of difference will therefore be reassuring to patients and physicians. Among e-visit users, half will use an e-visit when they have a subsequent illness in the next year. Patients appear generally satisfied with e-visits.”

[Ateev Mehrotra, MD; Suzanne Paone, DHA; G. Daniel Martich, MD; Steven M. Albert, PhD; Grant J. Shevchik, MD, JAMA Intern Med. 2013;173(1):72-74. doi: 10.1001/2013.jamainternmed.305]  
<http://archinte.jamanetwork.com/article.aspx?articleid=1392490>