



Center for
Technology and Aging

Measuring Return on Investment of Remote Patient Monitoring

Developing the Model

Table of Contents

Executive Summary	3
Background and Purpose	7
Methods.....	8
Results	9
Discussion	20
Next Steps	20
Appendix A: Remote Patient Monitoring Program Descriptions	21
<i>Centura Health at Home Remote Patient Monitoring Project</i>	<i>21</i>
<i>Dignity Health Remote Patient Monitoring Project</i>	<i>23</i>
<i>HealthCare Partners Remote Patient Monitoring Project</i>	<i>25</i>
<i>Sharp HealthCare Foundation Remote Patient Monitoring Program</i>	<i>27</i>
<i>Veterans Administration Central California Health Care System Remote Patient Monitoring Program.....</i>	<i>29</i>

Executive Summary

Remote patient monitoring (RPM) technologies that collect clinical and behavioral data from individuals for review by a health care provider have been demonstrated to improve patient care and patient outcomes. Studies indicate that use of RPM for serious chronic health conditions, such as heart failure, is associated with improved symptom recognition and control and decreased use of acute care services. Financial factors, such as lack of Medicare reimbursement, have limited use of RPM in fee-for-service health care practices. However, recent Medicare reforms, including impending penalties for excessive hospital readmissions and initiatives that move care away from fee-for-service payment and its attendant effect on promoting volume over value, appear to be increasing interest in RPM.

The objective of this Phase 1 project was to develop a return on investment (ROI) tool for health care organizations to evaluate intrinsic financial benefits of RPM—with or without reimbursement. The project was collaboratively implemented by the Center for Technology and Aging (CTA) and the Center for Connected Health (CCH).

The ROI of RPM tool was developed in conjunction with five diverse health care organizations (see Appendix A) and input from other stakeholders. The resulting model was applied by each of the five health care organizations to test and validate the ROI of RPM tool. The ROI evaluations for the five organizations used some forward-looking assumptions regarding patient enrollment and staffing requirements, but incorporated actual outcomes seen from their current programs to calculate the financial returns.

Results

Results from the ROI analysis for each organization are summarized in Tables 1 and 2. Further details can be found in the Results section of this report. Highlights include:

- The benefits of using RPM to more closely monitor patients with serious chronic health conditions were shown to outweigh the costs of RPM in all five health care organizations. In two organizations, the ROI was greater than 0 but less than 1, which means they may yield a positive net return, but the amount is smaller than the cost of the program. In the other three organizations, the ROI was greater than 1 and therefore a positive ROI.
- Return on RPM investment can be attributed to reduced hospitalization rates in four of the five organizations. Returns on RPM investment for the fifth organization, Centura Health at Home (CHAH), the only home health agency in the study group, can be attributed to both a reduction in hospitalization rates and a reduction in the number of home care visits that were required per patient.
- HealthCare Partners (HCP) achieved the largest ROI of the five organizations. Year 1 ROI was 1.3, meaning each dollar invested in RPM yielded \$1.30 dollars in savings for HCP. Projected ROI for HCP in Years 2 through 5 exceeded 18. Factors that are unique to the HCP RPM program include the use of interactive

voice response (IVR) technology, which does not require in-home installation, and the use of an opt-out patient enrollment strategy.

- While the ROI analysis of Dignity Health's RPM program indicates a modest Year 1 ROI of 0.4, Dignity Health has the highest dollar returns per patient (\$9882) in Year 1.
- The ROI of RPM is substantially lower in Year 1 for Dignity Health and HCP compared to ROI projections for Years 2 through 5. This is primarily due to the magnitude of the two organization's program startup costs.
- The RPM program at the Veterans Administration Central California Health Care System (VACCHCS) achieves a modest ROI. The projected ROI for Year 1 through Year 5 ranges from 0.14 to 0.22. Factors that are unique to the VACCHCS program are that the program was conducted as a randomized trial (compared to pre-post comparisons in the other four organizations) and included an extended intervention period of 12 months (compared to 1.5 to 6 month interventions) and had heavier staffing that would not occur in normal clinic operations. (Note: Due to the trial design, this program is different from standard VA programs that have consistently shown significant cost savings.).

Discussion

Results from this project indicate that the ROI of RPM tool was able to accurately capture all the inputs and outcomes for the programs, and provide a framework for organizations to examine the value of these programs. The tool was not only useful for program managers to evaluate the return from the program in terms of dollars, but also to easily see where the program could be made more efficient. Going forward, it appears that this analysis will be useful in helping health care organizations improve care, improve health outcomes, and lower costs—aligning with the Triple Aims of the National Quality Strategy. Results further support use of RPM to lower avoidable hospitalization rates—aligning with provisions of the Affordable Care Act.

Next Steps

Phase 2 of this project will transform the conceptual model built as part of Phase 1 into an interactive, user-friendly and publicly available web-based tool. Phase 2 will also include beta testing of this web-enabled tool, development of a manual to guide use of the tool, and a national launch of the tool to stimulate its use in conducting ROI of RPM analyses.

Table 1: Overview of Results

Return on Investment Analysis of Remote Patient Monitoring Programs
Implemented within Five Health Care Organizations

Organization	ROI of RPM Results	Program Summary
Centura Health at Home	<ul style="list-style-type: none"> • ROI = 2.6 in Year 1 • Total returns/patient = \$1761 • 49% of returns attributable to avoidance of home care visits; 51% attributable to reduced hospital admits 	<ul style="list-style-type: none"> • Diabetes, COPD, or CHF patients in Denver, CO • 24/7/365 clinical call center linked with RPM utilizing Cardiocom • 1.5 month average intervention length • Pre-post comparison
Dignity Health	<ul style="list-style-type: none"> • ROI = 0.4 in Year 1 • Total returns/patient = \$9882 • Returns attributable to reduced hospital admits 	<ul style="list-style-type: none"> • Patients with Class II, III, or IV CHF residing in Central California Coast • RPM utilizing Philips Telesation • 6 month average intervention length • Pre-post comparison
HealthCare Partners	<ul style="list-style-type: none"> • ROI = 1.3 in Year 1 • Total returns/patient = \$4388 • Returns attributable to reduced hospital admits 	<ul style="list-style-type: none"> • California-based patients with COPD and other chronic health conditions • Utilized low-cost interactive voice response monitoring (IVR) system • 6 month average intervention length • Pre-post comparison
Sharp HealthCare	<ul style="list-style-type: none"> • ROI = 1.6 in Year 1 • Total returns/patient = \$2837 • Returns attributable to reduced hospital admits 	<ul style="list-style-type: none"> • San Diego, California-based patients with Class II or III CHF that are high utilizers of acute care and that have little or no health care insurance • Utilized Cardiocom Telescale • 2.6 month average intervention length • Pre-post comparison
VA Central California	<ul style="list-style-type: none"> • ROI = 0.14 in Year 1 • Total returns/patient = \$2625 • Returns primarily attributable to reduced hospitalization rate of treatment group vs. control group (0.37 vs. 0.14 hospitalization rate, respectively) 	<ul style="list-style-type: none"> • Central California veterans with CHF and recent hospitalization • Utilized Health Buddy and IVR • 12 month intervention • Patients randomly assigned to treatment or control group

Table 2: Five-Year Projected ROI

Return on Investment Analysis of Remote Patient Monitoring Programs
Implemented within Five Health Care Organizations

Organization	Year 1	Year 2	Year 3	Year 4	Year 5
Centura	2.57	2.88	3.54	3.81	3.92
Dignity Health	0.38	2.92	4.09	4.76	5.19
HealthCare Partners	1.3	7.24	12.66	14.41	18.90
Sharp HealthCare	1.63	1.66	1.68	1.69	1.70
VA Central California	0.14	0.16	0.18	0.20	0.22

Background and Purpose

The purpose of this project was to enable health care organizations to efficiently and effectively complete rigorous financial and outcomes analyses of remote patient monitoring (RPM) programs in order to understand the costs and benefits for patients and other stakeholders. The project was conducted as a collaboration between the Center for Technology and Aging (CTA) and the Center for Connected Health (CCH) at Partners Healthcare.

Remote patient monitoring (RPM) technologies enable the monitoring, evaluation, and management of an individual through a remote interface that collects clinical data from individuals and then transmits the information to a health care provider for clinical review, management, and patient education. Proponents of remote health monitoring believe that widespread deployment of the technology could result in considerable cost-savings due to decreased readmissions to hospitals, avoidance of unnecessary visits to physicians, enhanced medication compliance, and improved communication between patients and clinicians. Remote monitoring is most useful for managing the care of patients with chronic conditions with the strongest evidence for cardiac applications. However, this evidence has not been adequate to spur widespread adoption of remote monitoring technologies. Many of the challenges are connected to misaligned incentives and lack of reimbursement but often it is because organizations have not completed rigorous financial analyses to fully understand the return on investment (ROI) of RPM.

CTA has supported, via grant funding and oversight, a variety of technology demonstrations with health care and aging services organizations across the country to implement successful technologies that are ready for adoption. In the Remote Patient Monitoring (RPM) grant cycle, CTA supported seven organizations in the adoption of RPM technologies, many of which focused on using RPM for improving congestive heart failure (CHF) management. While all sites expected to sustain their RPM programs, they did not incorporate financial analyses needed to convince senior management at their respective organizations that the RPM program was sustainable.

CTA selected five of its seven RPM grantees to participate in this ROI of RPM project and contracted with the study sites to collect the necessary data to participate in the ROI model development and test application of the model. The grantees represented a spectrum of health system models, including safety net providers, home health service agencies, commercial medical groups, and an integrated health system. Grantees and their RPM programs are described in Appendix A.

Methods

The basic framework of ROI, as utilized in this project, is based on the general principles of cost inputs and outcomes. The initial ROI model developed through this initiative included cost inputs and return based on change in healthcare utilization. Return was restricted to change in utilization, as this change had immediate implications on the health care system, and because this represented a fair assessment of the quality of care provided to the patient. The ROI was developed as a forward-looking model, using current program data on costs and return, as well as projected assumptions and targets for patient enrollment and program costs to scale the RPM program over five years.

Each grantee was interviewed initially to determine the various categories of program costs, ranging from how they staffed the projects, to their contracting structures with technology vendors. Grantees were asked to also consider how these current costs may change as the RPM program is further integrated into their workflow and EMR as it is operationalized. The ROI model was refined to take into account the different perspectives on how the RPM programs were currently run, as well as the various operational designs to scale these programs.

The cost inputs for the model included assumptions for patient enrollment and growth, technology costs, operational costs, and staffing requirements. Grantees were asked to project patient enrollment over five years. Depending upon the average length of the RPM intervention, a concurrent patient enrollment number was estimated. The cost of the technology differed by organization, depending upon whether the technology was rented or purchased. In addition, the model took into account multiple technology options, such as a cellular connection option, to be applied to a certain percentage of the patient population. Grantees were able to provide information either on an aggregate basis for the entire program, a per-patient basis, or a per-patient-per-month (PPPM) basis.

For staffing requirements, the ROI model differentiates between management resources and variable resources. The management staff was assigned an FTE percentage and loaded salary to the RPM program over the five years. The variable staff was assigned a patient load number, which was applied to the concurrent patient enrollment projections to calculate FTE requirements. An overall technology and operating cost per patient number was calculated based on these assumptions.

Estimated return for the programs was based on change in healthcare utilization. In-patient and outpatient admissions, home care visits, and medication use were also included. The ROI was calculated for Years 1 to Years 5, using assumptions for patient enrollment growth. In addition, for each grantee, scenarios were run to provide perspective on how changes to certain inputs or outcomes could change the overall impact of the RPM program. As the ROI exercise is meant to be a learning tool, as much as an analysis, these scenarios provided insight into how changes to program implementation may impact the benefit to the organization.

Results

The objective of this Phase 1 project was to develop a return on investment (ROI) tool for health care organizations to evaluate the financial benefits of remote patient monitoring (RPM) programs. The ROI of RPM tool was developed in conjunction with five diverse health care organizations (see Appendix A) and input from other stakeholders. The resulting model was applied by each of the five health care organizations to test and validate the ROI of RPM tool. The ROI evaluations for the five organizations used some forward-looking assumptions regarding patient enrollment and staffing requirements, but incorporated actual outcomes seen from their current programs to calculate the financial returns.

ROI of RPM calculations, assumptions, and results for each of five organizations are presented in the following pages and a summary of projected five-year ROI for each organization is shown below. ROI was calculated as (total cost of program- savings or return)/total cost of program.

Summary: Five-Year ROI of RPM Projections

Return on Investment Analysis of Remote Patient Monitoring Programs
Implemented within Five Health Care Organizations

Organization	Year 1	Year 2	Year 3	Year 4	Year 5
Centura	2.57	2.88	3.54	3.81	3.92
Dignity Health	0.38	2.92	4.09	4.76	5.19
HealthCare Partners	1.3	7.24	12.66	14.41	18.90
Sharp HealthCare	1.63	1.66	1.68	1.69	1.70
VA Central California	0.14	0.16	0.18	0.20	0.22

CENTURA

Patient Enrollment

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Total Patient Enrollment:	1650	2250	3750	5625	7500
Concurrent Patient Enrollment:	220	300	500	750	1000
Intervention Months:	1.5				

Technology

Items	Cost	Comments
Rental Cost/Month:	\$92	\$75/unit at 500 units
Cellular Data/Month/Unit:	\$15	
ASP Hosting Fee/Month/Unit:	\$10	
Misc. Annual Costs:	\$2,500	Vendor support fee

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
% of patients on cellular	50%	50%	60%	60%	70%
Landline/Patient:	825	1125	1500	2250	2250
Cellular/Patient:	825	1125	2250	3375	5250
Landline Cost/Patient:	\$153	\$153	\$128	\$128	\$128
Cellular Cost/Patient:	\$176	\$176	\$150	\$150	\$150

Staffing

<u>Management</u>		<u>Variable</u>	
Position	Percent Effort	Position	Salary
Director, Telehealth:	100%	Monitoring RN:	\$89,500
Manager, Telehealth:	100%	Technical Support:	\$52,000
Admin Coordinator:	25%		
Total Management Resources:	\$238,000		110

Cost Summary

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
<u>Patient Enrollment:</u>					
Patient Enrollment:	1650	2250	3750	5625	7500
Concurrent Patient Enrollment:	220	300	500	750	1000
<u>Technology & Other Operating Costs:</u>					
Total Technology Cost:	\$274,131	\$372,906	\$531,250	\$795,625	\$1,076,875
Technology Costs/Patient:	\$166	\$166	\$142	\$141	\$144
<u>Personnel Costs:</u>					
Monitoring RN:	\$196,900	\$268,500	\$447,500	\$671,250	\$895,000
Technical Support:	\$104,000	\$141,818	\$236,364	\$354,545	\$472,727
Management Resources	\$238,000	\$238,000	\$238,000	\$238,000	\$238,000
Total Personnel Cost:	\$538,900	\$648,318	\$921,864	\$1,263,795	\$1,605,727
Personnel Cost/Patient:	\$327	\$288	\$246	\$225	\$214
<u>Total Cost:</u>					
Total Operating Cost:	\$813,031	\$1,021,224	\$1,453,114	\$2,059,420	\$2,682,602
Operating Cost/Patient:	\$493	\$454	\$387	\$366	\$358

CENTURA

Outcomes

Sample Size:	87	
	<i>PRE</i>	<i>POST</i>
Hospitalizations:	14.46	7
Outpatient Visits:		
Hospitalization rate:	16.62%	8.05%
Inpatient Admissions Cost/Patient:	\$1,745	\$845
Outpatient Visits Cost/Patient:		
Home Care Visits Cost Averted/Patient:	\$861	
Total Return/Patient:	\$1,761	

Summary - ROI

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Patient Enrollment:	1,650	2,250	3,750	5,625	7,500
Total Operating Costs:	\$813,031	\$1,021,224	\$1,453,114	\$2,059,420	\$2,682,602
Reduction in hospitalizations	\$1,485,569	\$2,025,776	\$3,376,293	\$5,064,440	\$6,752,586
Home visits costs averted	\$1,419,990	\$1,936,350	\$3,227,250	\$4,840,875	\$6,454,500
Total Return:	\$2,905,559	\$3,962,126	\$6,603,543	\$9,905,315	\$13,207,086
ROI:	2.57	2.88	3.54	3.81	3.92

DIGNITY HEALTH

Patient Enrollment

Current Enrollment:	50				
Year 5 Enrollment Goal:	750				
			Intervention Months:	6	
	Year 1	Year 2	Year 3	Year 4	Year 5
Total Patient Enrollment:	50	225	400	575	750
Concurrent Patient Enrollment:	25	113	200	288	375

Technology

Items	Cost				
Rental Cost/Month:	\$120				
Cellular Data/Unit/Month:	\$15				
Misc. Costs/Patient:	\$15				
% of patients on cellular	35%				
	Year 1	Year 2	Year 3	Year 4	Year 5
Landline/Patient:	33	146	260	374	488
Cellular/Patient:	18	79	140	201	263
Landline Cost/Patient:	\$735				
Cellular Cost/Patient:	\$825				

Personnel

<u>Management/Fixed</u>		<u>Variable</u>	
Position	Salary	Position	Salary Patients/Resource
Manager:	100%	Monitoring Nurse	\$108,160 125
VP:	25%		
Clinical Support:	\$32,448		
Telehealth Deployment Technician:	\$35,000		
Total Management Resources:	\$297,448		

Cost Summary

	Year 1	Year 2	Year 3	Year 4	Year 5
<u>Patient Enrollment:</u>					
Total Patient Enrollment:	50	225	400	575	750
Concurrent Patient Enrollment:	25	113	200	288	375
<u>Technology & Operating Costs:</u>					
Total Technology and Operations Costs:	\$38,325	\$172,463	\$306,600	\$440,738	\$574,875
Total Technology and Operations Costs/Patient:	\$766.50	\$766.50	\$766.50	\$766.50	\$766.50
<u>Personnel Costs:</u>					
Monitoring RN:	\$21,632	\$97,344	\$173,056	\$248,768	\$324,480
Management Resources:	\$297,448	\$297,448	\$297,448	\$297,448	\$297,448
Total Personnel Cost:	\$319,080	\$394,792	\$470,504	\$546,216	\$621,928
Personnel Cost/Patient:	\$6,382	\$1,755	\$1,176	\$950	\$829
<u>Total Cost</u>					
Total Operating Cost:	\$357,405	\$567,255	\$777,104	\$986,954	\$1,196,803
Operating Cost/Patient:	\$7,148	\$2,521.13	\$1,943	\$1,716	\$1,596

DIGNITY HEALTH

Outcomes

Sample Size:

51

	<u>PRE</u>	<u>POST</u>
Total Hospitalizations:	83	35
Outpatient Visits:		

Hospitalization rate:

163%

69%

Inpatient Admissions Cost/Patient:	\$17,088	\$7,206
Outpatient Visits Cost/Patient:		

Total Return/Patient:

\$9,882

Summary - ROI

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Patient Enrollment:	50	225	400	575	750
Total Operating Costs:	\$357,405	\$567,255	\$777,104	\$986,954	\$1,196,803
Total Return:	\$494,118	\$2,223,529	\$3,952,941	\$5,682,353	\$7,411,765
ROI:	0.38	2.92	4.09	4.76	5.19

HEALTHCARE
PARTNERS

Cost Summary

	Year 1	Year 2	Year 3	Year 4	Year 5
Patient Enrollment:					
Total Patient Enrollment:	90	268	445	623	800
Concurrent Patient Enrollment:	45	134	223	311	400
Technology & Other Operating Costs:					
Total Technology and Operations Costs:	\$31,594	\$2,105	\$2,617	\$3,128	\$3,639
Total Technology and Operations Costs/Patient:	\$351.05	\$7.87	\$5.88	\$5.02	\$4.55
Personnel Costs:					
Telehealth Coordinator:	\$37,000	\$37,000	\$37,000	\$46,250	\$45,880
Nurses:	\$98,400	\$98,400	\$98,400	\$123,000	\$122,016
Management Resources:	\$4,920	\$4,920	\$4,920	\$4,920	\$4,920
Total Personnel Cost:	\$140,320	\$140,320	\$140,320	\$174,170	\$172,816
Personnel Cost/Patient:	\$1,559	\$525	\$315	\$280	\$216
Total Cost					
Total Operating Cost:	\$171,914	\$142,425	\$142,937	\$177,298	\$176,455
Operating Cost/Patient:	\$1,910.16	\$532.43	\$321.21	\$284.82	\$220.57

Outcomes

Sample Size:	70	
	PRE	POST
Hospitalizations:	48	22
Outpatient Visits:	446	581
Hospitalization rate:	68.57%	31.43%
Inpatient Admissions Cost/Patient:	\$8,529	\$3,909
Outpatient Visits Cost/Patient:	\$765	\$996
	Change Pre-Post	
	(\$4620)	
	\$231	
Total Return/Patient:	\$4,388	

Summary

	Year 1	Year 2	Year 3	Year 4	Year 5
<i>Patient Enrollment:</i>	90	268	445	623	800
<i>Total Operating Costs:</i>	\$171,914	\$142,425	\$142,937	\$177,298	\$176,455
<i>Total Return:</i>	\$394,948	\$1,173,872	\$1,952,797	\$2,731,721	\$3,510,646
ROI:	1.30	7.24	12.66	14.41	18.90

SHARP

Patient Enrollment

Current Enrollment:	80				
Year 5 Enrollment Goal:	160				
			Intervention Months:	2.6	
	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Total Patient Enrollment:	80	100	120	140	160
Concurrent Patient Enrollment:	17	22	26	30	35

Technology

Items	Cost				
	Landline	Cellular			
Rental Cost/Month:	\$165	\$305	Currently waived		
Data Charges/Month:	\$30	\$55	Currently waived		
Call Center/Month/Patient:	\$55	\$140			
Shipping, Refurbishing/Patient:	\$190				
Misc. Costs/Patient:	\$25				
% of patients on cellular	20%				
	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Landline Patients:	64	80	96	112	128
Cellular Patients:	16	20	24	28	32
Landline Cost/Patient:	\$358		Not including equipment rental & data charges		
Cellular Cost/Patient:	\$579				

Staffing

<u>Management</u>			<u>Variable</u>		
Position	Percent Effort		Position	Loaded Salary	Patients/Resource
Senior Level VP:	3%		Health Coach:	\$115,300	40
Total Management Resources:	\$4,000				

Cost Summary

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Patient Enrollment:					
Total Patient Enrollment:	80	100	120	140	160
Concurrent Patient Enrollment:	17	22	26	30	35
Technology & Operating Costs:					
Total Technology and Operating Costs:	\$32,176	\$40,220	\$48,264	\$56,308	\$64,352
Total Technology and Operating Costs/Patient:	\$402.20	\$402.20	\$402.20	\$402.20	\$402.20
Personnel Costs:					
Health Coach:	\$49,963	\$62,454	\$74,945	\$87,436	\$99,927
Management Resources:	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000
Total Personnel Cost:	\$53,963	\$66,454	\$78,945	\$91,436	\$103,927
Personnel Cost/Patient:	\$675	\$665	\$658	\$653	\$650
Total Cost					
Total Operating Cost:	\$86,139	\$106,674	\$127,209	\$147,744	\$168,279
Operating Cost/Patient:	\$1,077	\$1,067	\$1,060	\$1,055	\$1,052

SHARP

Outcomes

Sample Size:

80

	<u>PRE</u>	<u>POST</u>
30 Day Hospitalizations:	15	8
Total Hospitalizations:	83	61
Outpatient Visits:	17	51

Hospitalization Rate:

104%

76%

Inpatient Admissions Cost/Patient:

\$10,894

\$8,006

Outpatient Visits Cost/Patient:

\$26

\$77

Total Return/Patient:

\$2,837

Summary - ROI

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Patient Enrollment:	80	100	120	140	160
Total Operating Costs:	\$86,139	\$106,674	\$127,209	\$147,744	\$168,279
Total Return:	\$226,920	\$283,650	\$340,380	\$397,110	\$453,840
ROI:	1.63	1.66	1.68	1.69	1.70

VA CENTRAL CALIFORNIA

Patient Enrollment

Current Enrollment:	375				
Year 5 Enrollment Goal:	500				
					Intervention Months: 12
	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Total Patient Enrollment:	375	406	438	469	500
Concurrent Patient Enrollment:	375	406	438	469	500

Technology

Items	HealthHero	IVR			
Cost per device:	\$488				
Re-use per device:	3				
Device cost per use:	\$163				
Shipping, Refurbishing/Patient:	\$100				
Data cost/month:	\$27.75	\$27			
Misc. Costs/Patient:	\$0	\$0			
% of patients on IVR	16%				
	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
HealthHero Patients:	315	341	368	394	420
IVR Patients:	60	65	70	75	80
Health Hero Cost/Patient:	\$596				
IVR Cost/Patient:	\$324				

Staffing

<u>Management</u>		<u>Variable</u>	
Position	Percent Effort	Position	Loaded Salary / Patients/Resource
Program Manager:	25%	Care Coord RN	\$113,987 / 100
Lead Nurse:	100%		
Program Support Assistant:	100%		
Physician Manager:	5%		
Medical Director:	5%		
Total Management Resources:	\$229,480		

VA CENTRAL CALIFORNIA

Cost Summary

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
<u>Patient Enrollment:</u>					
Total Patient Enrollment:	375	406	438	469	500
Concurrent Patient Enrollment:	375	406	438	469	500
<u>Technology & Operating Costs:</u>					
Total Technology and Operating Costs:	\$207,075	\$224,331	\$241,588	\$258,844	\$276,100
Total Technology and Operating Costs/Patient:	\$552.20	\$552.20	\$552.20	\$552.20	\$552.20
<u>Personnel Costs:</u>					
Care Coord RN:	\$427,451	\$463,072	\$498,693	\$534,314	\$569,935
Management Resources:	\$229,480	\$229,480	\$229,480	\$229,480	\$229,480
Total Personnel Cost:	\$656,931	\$692,552	\$728,173	\$763,794	\$799,415
Personnel Cost/Patient:	\$1,752	\$1,705	\$1,664	\$1,629	\$1,599
<u>Total Cost</u>					
Total Operating Cost:	\$864,006	\$916,884	\$969,761	\$1,022,638	\$1,075,515
Operating Cost/Patient:	\$2,304	\$2,257	\$2,217	\$2,182	\$2,151

Outcomes

Sample Size:	49	64
	<u>CONTROL</u>	<u>INTERVENTION</u>
30 Day Hospitalizations:	0	2
Total Hospitalizations:	18	9
Outpatient Visits:	420	418
Hospitalization Rate:	37%	14%
Inpatient Admissions Cost/Patient:	\$3,857	\$1,477
Outpatient Visits Cost/Patient:	\$1,029	\$784
Total Return/Patient:	\$2,625	

Summary - ROI

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Patient Enrollment:	375	406	438	469	500
Total Operating Costs:	\$864,006	\$916,884	\$969,761	\$1,022,638	\$1,075,515
Total Return:	\$984,526	\$1,066,569	\$1,148,613	\$1,230,657	\$1,312,701
ROI:	0.14	0.16	0.18	0.20	0.22

Discussion

Results from this project indicate that the ROI of RPM tool was able to accurately capture all the inputs and outcomes for the programs, and provide a framework for organizations to examine the value of these programs. The tool was not only useful for program managers to evaluate the return from the program in terms of dollars, but also to easily see where the program could be made more efficient. Going forward, it appears that this analysis will be useful in helping health care organizations improve care, improve health outcomes, and lower costs—aligning with the Triple Aims of the National Quality Strategy. Results further support use of RPM to lower avoidable hospitalization rates—aligning with provisions of the Affordable Care Act.

Next Steps

Phase 2 of this project will transform the conceptual model built as part of Phase 1 into an interactive, user-friendly and publicly available web-based tool. Phase 2 will also include beta testing of this web-enabled tool, development of a manual to guide use of the tool, and a national launch of the tool to stimulate its use in conducting ROI of RPM analyses.

Appendix A: Remote Patient Monitoring Program Descriptions

The Center for Technology and Aging (CTA) has supported, via grant funding and oversight, a variety of technology demonstrations with health care and aging services organizations across the country to implement successful technologies that are ready for adoption. During 2010-2012, CTA sponsored a Remote Patient Monitoring (RPM) Technology Diffusion Grant Program that included seven grantees, many of which focused on RPM for improving congestive heart failure (CHF) management. Five of the seven grantees participated in this ROI of RPM project and are described in the following pages. The grantees represent a spectrum of health system models, including safety net providers, home health service agencies, commercial medical groups, and an integrated health system.

Centura Health at Home Remote Patient Monitoring Project

Centura Health at Home (CHAH) implemented the remote patient monitoring program as an adjunct to their pre-existing 24/7/365 clinical call center activities. CHAH utilized Cardiocom monitoring technology. The RPM program augmented CHAH's pre-existing telehealth services and broadened the patient base that was served by telehealth. CHAH targeted patients in Denver with Diabetes, COPD, or CHF and aimed to reduce hospital readmissions and improve quality of life for patients.

Overall RPM Project Goals

- Augment the telehealth continuum at Centura Health at Home by merging 24/7/365 call center activities with telehealth, and broaden the telehealth program eligibility beyond home-care eligible patients.
- Decrease the rate of recidivism of 30-day readmissions at Centura Health Hospitals – St. Anthony's Central, St. Anthony's North, Parker Adventist, Littleton Adventist and Porter Adventist Hospital.
- Increase the quality of life for patients as measured through the Quality of Life Survey SF-36.
- Increase the number of patients served in the telehealth program.

RPM Collaborators

Internal collaboration with iPN, an internal physicians group at Centura

Targeted Consumer/Patient Population(s)

CHAH patients in Denver, CO with Diabetes, COPD, or CHF

RPM Program Results

- Sixty-two percent reduction in frequency of rehospitalizations
- Increase in Quality of Life for subset of patients
- Positive patient satisfaction and self-management
- Reduction in frequency of home RN visits from two-three visits per week to 2.69 visits per 60-day period

RPM Approach

24/7/365 clinical call center linked with telehealth monitors (CardioCom). Patients participating in the project were stratified into two categories. The first group used remote patient monitoring technologies and had access to the 24/7 clinical call center. A second tier of patients who did not qualify for the Medicare homebound benefit and tended to be more physically capable of caring for themselves received telephonic telehealth care through clinical call center follow-up. The average length of time that patients are enrolled in the remote monitoring with clinical call center support program is 60 days. Patients transmit monitoring data on a daily basis and sometimes more than once daily if the condition requires close monitoring. For the second tier, clinical call center RNs set up weekly calls over a 3-week timeframe, after discharge to review medication lists and management, compare medications to discharge orders, and educate patients using a teach back technique that highlights patients' level of understanding regarding their condition and what it means in terms of lifestyle behaviors.

Sustainability and Replicability Plans

CHAH is expanding the program to a larger number of patients and is considering linking this project with new models of care organization and delivery, such as the patient-centered medical home and an accountable care organization. Within CHAH, the RPM program is being expanded to senior living communities. In particular, a feasibility study for a multi-user telehealth unit for residents within The Gardens at St. Elizabeth facility in Denver is underway. At the state level, CHAH used the emerging evidence base for telehealth in its work with the Home Care Association of Colorado to pass Telehealth Rule 8.520. The law now allows direct payment for Medicaid patients in the remote patient monitoring intervention receiving home care telehealth services.

Organization Overview

Centura Health at Home has 1,200 employees and serves people in their homes across the state of Colorado. The Centura Health at Home continuum of care includes home care, telehealth services, rehabilitation therapies, palliative care, both in-patient and home hospice services and seven senior living communities offering independent living, assisted living, nursing home care, memory care and adult day programs.

Dignity Health Remote Patient Monitoring Project

Dignity Health (formerly Catholic Healthcare West) utilized the Philips TeleStation to expand a pre-existing telephone based monitoring program and better enable elderly California residents to remain in a healthcare setting of their choice while self-managing chronic diseases and heart failure.

Overall RPM Project Goals

- Build a network of distance health service delivery based on reliable, easy-to-use, integrated technology that supports equitable access for patients and efficiency for clinicians.
- Improve quality of care and clinical outcomes to include early detection, and intervention and reductions in avoidable hospitalization.
- Improve patient compliance with medications, diet, weight monitoring and symptom management.
- Improve physician engagement and patient satisfaction.

RPM Collaborators

The program was conducted internally at Dignity Health.

Targeted Consumer/Patient Population(s)

Older adults (>60 yr old) with Class II, III or IV congestive heart failure, prior hospitalization within six months, multiple ED encounters within six months prior to referral, residing in the Central California Coastal area and receiving health services at the county hospital and health clinics.

RPM Program Results

The RPM program resulted in a reduction in re-hospitalizations, as well as improved patient self-efficacy scoring and patient satisfaction with the technology.

Dignity Health RPM Program Results (Re-Admissions within 30 Days)			
Facility	FY 2010 All CHF Patients	Feb-Sep 2011 All CHF Patients	Feb-Sep 2011 RPM Patients
Arroyo Grande	19.0%	14.0%	0%
French Hospital	19.6%	17.5%	0%
Marian Medical Center	23.0%	21.0%	12.0%

RPM Approach

Philips TeleStation was used to monitor patients' weight at home for a 6-month period. Regular RN monitoring was coupled with a home visit to install the technology and introduce the patient to the technology.

Sustainability and Replicability Plans

Demonstrated ROI savings will allow sustainability of the program. Dignity Health has the potential to expand the program throughout its Home Health Division including 17 home health agencies and 8 hospices, in California, Arizona, and Nevada.

Organization Overview

Dignity Health is comprised of more than 40 hospitals, as well as more than 60,000 caregivers and staff who deliver care to diverse communities across Arizona, California and Nevada. Founded in 1986 and headquartered in San Francisco, Dignity Health is the fifth largest hospital provider in the nation and the largest hospital system in California.

HealthCare Partners Remote Patient Monitoring Project

HealthCare Partners (HCP) utilized a telephone-based home monitoring technology in order to reduce health utilization and enhance quality of life for elderly patients with chronic disease. Consumers/patients that were targeted in this RPM project were over 65 years of age and had chronic obstructive pulmonary disease (COPD) and other chronic diseases. For the ROI of RPM project, HCP provided data on a subgroup of patients that had heart failure.

Overall RPM Project Goals

- Reduce health utilization; ED/UC visits, bed days, admissions, readmissions at 30-days.
- Provide clinical parameters to health providers that help prevent chronic disease exacerbations.
- Provide user-friendly technology that permits older adults to live in their chosen residence.
- Ease the burden/stress of caregivers treating patients with chronic disease.

RPM Collaborators

Physicians and allied health professionals at HealthCare Partners Medical Group (HCP).

Targeted Consumer/Patient Population(s)

Older adults (≥ 65) with chronic disease (i.e., COPD, CHF, CAD, diabetes, HTN)

RPM Program Results

The IVR technology and IVR reports expanded the clinical capacity of RNs to manage 200 patients with 5% triggering follow-up after every IVR survey. The project has shown reduced costs per patient, per month. Savings off-set program implementation expenses by reducing health costs, i.e., decreased admissions/readmissions, bed-days, and ED/UC visits. Project results also indicate that patients were very pleased with the telehealth system based on 1) their ability to stay in the residence of their choosing, 2) they reported greater engagement in their health, 3) they had a formal caregiver watching over them and acting upon their symptom survey responses, and 4) the technology's ease of use (telephone). Finally, clinical staff reported high satisfaction with the ease of use, saved time, ability to keep track of patient's symptoms, and the ability to intervene before the clinical symptoms became urgent/emergent.

RPM Approach

TeleVox interactive voice response (IVR) technology was used where patients answer 9 COPD symptom and wellness questions 2-3 times a week through phone calls. Responses were analyzed and live care management phone calls from RNs were conducted as needed. IVR technology supplemented an existing patient-centric COPD program to help identify and reduce disease exacerbations in between regular care management calls and appointments.

Sustainability and Replicability Plans

HCP has shown reduced costs per patient, per month with its patient-centric disease program. By reducing health costs (decreased admissions/readmissions, bed-days, ED/UC visits), HCP is planning to maintain the program. Continued savings can occur as the chronic disease IVR technology program is expanded on a broader scale. HCP is also identifying dual-eligible, Medi-Medi patients who may benefit from remote monitoring technologies thereby impacting greater numbers of patients.

Organization Overview

HealthCare Partners Medical Group (HCP) is an accountable care organization that takes global capitation risk in Southern California, Florida, and Nevada. As one of the largest providers of senior health care in Southern California, HCP has staff model clinics and independent physician association (IPA) delivery systems for approximately one million patients. HCP uses a coordinated care model for a culturally diverse patient population with a wide array of socioeconomic classes, comorbidities, and ages. Approximately half of HCP's patients are treated by 750 general practice physicians who are employed in a staff-model health maintenance organization; the remainder is cared for by 1,900 clinicians from regional affiliated IPAs. HCP employs a coordinated care model aimed at enhancing innovative, high-quality, cost effective care designed to serve diverse patient population with a wide array of cultural and socioeconomic classes and varying degrees of health status and ages.

Sharp HealthCare Foundation Remote Patient Monitoring Program

Sharp HealthCare implemented a remote patient monitoring program that aimed to improve quality of life and reduce hospitalizations for older adults with heart failure and a history of readmissions within 30-days of hospital discharge. Sharp utilized Cardiocom's Telescale for in-home daily monitoring of symptoms and weight, complemented by support from the local RPM nurse health coach and Cardiocom's telemonitoring nurses.

Overall RPM Project Goals

- Reduce 30-day unplanned readmit rates.
- Reduce direct costs associated with readmissions among senior patients, clinically related acute care readmits.
- Improve coordination of care between hospital and physician office (the primary opportunity for preventing unnecessary hospital admissions).
- Improve the quality of life for patients managing CHF by keeping them well managed in the home setting.
- Increase hospital and emergency room capacity for the community by providing effective care for chronic care patients in the community care model.

RPM Collaborators

Physicians and allied health professionals at Sharp HealthCare; Community Partner: San Diego Beacon Community.

Targeted Consumer/Patient Population(s)

Older adults (≥ 60) with Class II or III stage heart failure, high utilizers of the ED, history of readmissions within 30-days of discharge from hospital, who are in the underserved group for health insurance: Medi-Cal, County Medical Services, Molina, Medicare/Medi-Cal, Self-pay, and Medicare FFS. Targeted location: San Diego, CA.

RPM Program Results

Sharp HealthCare's RPM Program compared the outcomes of enrolled patients diagnosed with primary, secondary or tertiary heart failure with a reference group of similarly diagnosed patients, with the same payor mix, who were not enrolled in the RPM program. There were significant differences in care utilization between groups. RPM 30-day readmission rate was 10%, compared with a 20.7% rate for the reference group. These results continued into the 90-day post index-discharge time frame: RPM group 90-day readmission rate was 21.2%, compared with 39.6% for the reference group. Patient Maintenance Activation: A SCHFI score above 70 is indicative of patient activation in maintenance of heart failure symptoms. Only 2% of all patients at enrollment met the threshold for maintenance activation, whereas 98% of all patients met the threshold at the end of the program. Patient Confidence: A SCHFI score above 70 is indicative of patient activation in confidence in the ability to care for their heart failure symptoms by themselves (self-care confidence). Only 19% of all patients met the threshold for confidence at enrollment, whereas 92% of all patients met the threshold at the end of the program.

RPM Approach

Cardiocom's Telescale for 90-day intervention of daily monitoring of symptoms and weight; support from the local RPM nurse health coach and vendor's telemonitoring nurses for variances in weight or symptoms; two home visits – one at the beginning of program to ensure proper use of equipment and personalize program to the patient and one at the end to facilitate graduation from the program; and daily reminder of medication compliance via the device.

Sustainability and Replicability Plans

The program is being continued in that it provides the opportunity to realize continued financial benefits by serving a broader population and successfully reduces unplanned hospital readmissions.

Organization Overview

Sharp HealthCare is a not-for-profit integrated regional health care delivery system based in San Diego, California. Sharp HealthCare includes four acute-care hospitals, three specialty hospitals and two affiliated medical groups, plus a full spectrum of other facilities and services. Sharp is comprised of 2,600 physicians, including more than 1,000 physicians in their two affiliated medical groups — Sharp Rees-Stealy and Sharp Community Medical Group — and more than 14,000 employees.

Veterans Administration Central California Health Care System Remote Patient Monitoring Program

Utilizing the Health Buddy appliance, the Veterans Administration Central California Health Care System (VACCHCS) implemented a remote patient monitoring program for older veterans with a diagnosis of chronic heart failure and a history of recent hospital admissions. Each patient was expected to utilize the Health Buddy for 12 months. Hospitalizations, emergency department visits, and patient satisfaction data were gathered.

Overall RPM Project Goals

- Improve access to cost-efficient quality healthcare delivery using RPM technology.
- Improve medication reconciliation and medication adherence.
- Decrease inpatient admissions/ bed days used (acute/ semi acute/ nursing home) and mortality.
- Improve patient satisfaction.

RPM Collaborators

The program utilized internal staff at VACCHCS.

Targeted Consumer/Patient Population(s)

Older veterans with a diagnosis of CHF who had >1 hospital admission or ER visit in the previous 24 months. Patients had been identified from the VACCHCS Heart Failure Registry. Patients reside in a large geographical area that includes five counties in Central California that are designated as “Rural” and “Medically Underserved.”

RPM Program Results

Utilizing the t-test, the following statistically significant differences were found between the intervention (Health Buddy) and the control groups:

- Number of CHF related admission (mean of 0.08/12 months for intervention versus 0.16/12 months for control, P 0.033)
- Number of CHF related hospital bed days (mean of 0.16/12 months for intervention versus 0.71/12 months for control; P < 0.001)
- Total 30-day readmission (mean of 0.11/12 months for intervention versus 0.02/12 months for control; P 0.011)

RPM Approach

Health Buddy remote monitoring appliance and Medication Possession Ratio (MPR) evaluations. Approximately 113 patients with a diagnosis of CHF and significant morbidity (multiple hospital admissions or ER visits) enrolled in to the program. Sixty-three patients were randomly assigned to receive the Health Buddy telemonitoring with care coordination and 50 patients were assigned to the control group. Patients in the Health Buddy group completed a total of 12 months of telemonitoring.

Sustainability and Replicability Plans

Successful quality improvement projects are rapidly communicated and shared between Veterans Health Administration (VHA) sites. Results from this RPM program are being presented to local, regional, and national leaders in the VA system.

Organization Overview

VHA is the nation's largest integrated health care system and operates over 1,400 sites, including hospitals, clinics and nursing homes. The main VACCHCS facility is located in Fresno, CA. The VHA has the largest Care Coordination/Home Telehealth (CCHT) program in the world. Its purpose is to coordinate the care of veteran patients with chronic conditions and avoid their unnecessary admission to long-term institutional care. The VHA's model uses a care coordinator who supports and monitors a panel of 100–150 patients, with a focus on empowering patients to take roles in self-management. VHA's telehealth program has resulted in successful outcomes including patient satisfaction and reductions in bed days of care and hospital admissions.

Project Collaborators

The Center for Technology and Aging (CTA) is a non-profit organization whose purpose is to advance the diffusion of technologies that help older adults lead healthier lives and maintain independence. CTA has supported, via grant funding and oversight, a variety of technology demonstrations with health care and aging services organizations across the country to implement successful technologies that are ready for adoption. In the Remote Patient Monitoring (RPM) grant cycle, CTA supported seven organizations in the adoption of RPM technologies, many of which focused on using RPM for improving congestive heart failure (CHF) management. While all sites expected to sustain their RPM programs, they did not incorporate financial analyses needed to convince senior management at their respective organizations that the RPM program was sustainable.

The Center for Connected Health (CCH) at Partners Healthcare works to create a new model for healthcare delivery by developing programs and innovative strategies to move care from the hospital or doctor's office into the day-to-day lives of patients. CCH has over 15 years of experience in implementing and evaluating technology-enabled programs in chronic conditions. The CCH partnered with CTA and its grantees to develop the ROI model for using RPM technologies with CHF patients leading to the development of a ROI calculator.