

**OBJECTIVE:** To integrate a remote monitoring program for patients with heart failure into existing patient-provider interactions (to detect pre-decompensatory trends in between face-to-face encounters and provide automated coaching and education to support the physician's plan of care) to measure whether the program impacted all-cause admissions and total costs.

**PARTICIPANTS:** Adult patients with stage II or higher heart failure enrolled in Medicare Advantage insurance programs with an Optum risk score greater than 10, managed by an Independent Practice Association. (Ref. Table 1.)

- 1,719 total participants, 635 high-risk at baseline with Optum risk score  $\geq 20$ .
- 11-months mean length intervention time.
- Average age (77 years) | 46% male
- Average Optum risk score of 19.9 with avg. 12-month prior expenditure of \$1,094 per month for intervention group and \$943 for control group.

**INTERVENTION:** Remote home monitoring program including biometric measurements, automated coaching for self-care, and automated monitoring surveys delivered via telephonic interactive voice response.

**DESIGN:** Prospective, non-randomized intervention cohort with a propensity matched observational control arm.

**MAIN MEASURES:** Hospital admissions (per 1000 patients per year), total healthcare costs, return-on-investment (ROI) measured as the total cost difference divided by cost of implementing program and change in blood pressure (for hypertensive intervention patients only).

**134 fewer admits/1,000 than control population**

**TABLE 1.** Baseline characteristics of intervention and control patients, before and after propensity score matching.

	Before Matching		After Matching	
	Control (n=8,083)	Intervention (n=1,784)	Control (n=1,719)	Intervention (n=8,083)
Optum Risk Score, Mean	19.8	20.8	19.6	20.2
Mean monthly costs in 12-month baseline period, Mean	\$1334	\$1218	\$943	\$1094
Males, N (%)	3880 (48%)	3718 (46%)	808 (47%)	791 (46%)
Age in years, Mean	76	76	77	76

**TABLE 2.** Utilization and cost outcomes. Cost outcomes are presented as return on investment (ROI) ratios in place of absolute dollar values.

	Estimated difference in difference (intervention vs. control, post vs. pre) [95% CI]	p-value
<b>All Study Patients</b>		
Hospital admissions per 1000 patients per year	-134 [-198, -73]	<0.0001
ROI	2.68 [1.17, 5.08]	0.005
<b>High Risk Patients</b>		
Hospital admissions per 1000 patients per year	-157 [-265, -53]	0.003
ROI	4.60 [1.84, 8.20]	0.004

**TABLE 3.** Blood pressure outcomes for patients in the intervention group were hypertensive at index date. Patients with systolic hypertension and diastolic hypertension were analyzed separately, and patients could be included in both columns if both systolic and diastolic pressures were not at goal at baseline. Initial blood pressure was defined as avg of measures taken during first 10 days of the intervention, and final blood pressure defined as the average of measures taken during the last 50 days of observation.

	Patients with systolic hypertension (n=523)	Patients with diastolic hypertension (n=152)
Initial blood pressure in mm/Hg, Mean (SD)	159 (13)	97 (7)
Final blood pressure in mm/Hg, Mean (SD)	144 (19)	87 (11)
Difference between final and initial blood pressure in mm/Hg, Mean	-15	-10
Patients whose final blood pressure was lower than initial, %	82%	85%
Patients with final blood pressure meeting JNC8 guidelines, %	50%	61%

**KEY RESULTS:** Significantly fewer hospitalizations than expected:

- (-134 per 1000 patients per year, 95% CI=-198 to -73, p<0.001)
- Lower costs resulting in a significant ROI (2.68, 95% CI = 1.17 to 5.08, p=0.005).
- A subgroup of higher-risk patients showed even greater reductions in admissions and cost.
- Patients with hypertension at baseline showed average reductions of -15mmHg and -10mmHg in systolic and diastolic pressures, respectively.

**RESULTS:** Patients in the intervention group had significantly fewer hospitalizations per year than expected based on:

- Control group (-134 per 1000 patients per year, 95% confidence interval = -198 to -73, p<0.0001) in the post-intervention period
- Significantly lower total costs resulting in an estimated ROI of 2.68 (95% confidence interval = 1.17 to 5.08, p=0.005) (Table 2).
- In the subgroup analysis of only those patients with high risk scores at baseline ( $\geq 20$ ), the reduction in hospitalizations was even greater (-157 per 1000 patients per year, 95% CI = -265 to -53, p=0.003) and the estimated ROI was even higher (4.60, 95% CI = 1.84 to 8.20, p=0.004). Of the 1,719 intervention patients, 523 were systolically hypertensive at baseline.
- Of these 519, 82% had improvement in avg blood pressure from the beginning to end of period, with 50% meeting JNC8 guidelines by end.
- Of the 1,719 enrollees, 97 were diastolically hypertensive at baseline.
- Of these 97, 85% had some improvement in avg blood pressure in the most recent 50 days, with 61% falling within JNC8 guidelines in that time.

**CONCLUSIONS:** These results support the efficacy of a consistent, well-defined approach to acting on information generated by remote monitoring processes to mitigate the exacerbations of heart failure in a timely, impactful way to reduce admissions and costs and improve outcomes.

**2.7**  
average ROI across all acuity tiers

**4.6**  
ROI for high-risk tranche