HealthSnap

HealthSnap 2024 Outcomes Report:

The Impact of Remote Patient Monitoring and Chronic Care Management on Clinical Outcomes

An analysis of the clinical impact of remote patient monitoring and chronic care management on hypertension, obesity, and type II diabetes management.

July 2024

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HITRUST®

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About HealthSnap

HealthSnap is an integrated Virtual Care Management (VCM) platform that helps healthcare organizations improve patient outcomes, reduce utilization, and diversify revenue streams through Remote Patient Monitoring (RPM), Chronic Care Management (CCM), and Principal Care Management (PCM) programs. HealthSnap partners with 150+ health systems and provider organizations across 33 states and has remotely monitored and managed over 100,000 patients.

Key Results

Measuring Success

To assess the effectiveness of HealthSnap's RPM and CCM programs, we examined data from **41,940** eligible patients who met the criteria of being on the program for **90** days and actively transmitting RPM data. Our analysis involved comparing each patient's initial **7** data transmissions (baseline) with the average of their most recent **7** transmissions. The findings are as follows:

Blood Pressure

23.8mmHg

Systolic BP reduction

14.5mmHg

Diastolic BP reduction

Patients with stage 2 levels of systolic blood pressure (SBP) and diastolic blood pressure (DBP)

Blood Glucose

56.8mg/dL

Average reduction in Fasting blood glucose

Diabetic patients with poor glucose control

Body Weight

81.4%

Achieved long-term reductions in body weight

Patients using Remote Patient Monitoring (RPM) for weight loss

The Impact on Chronic Disease Outcomes

HealthSnap's RPM and CCM improvements have been shown to have profound effects on overall health, including:

Reduced Chronic Disease Risks

Lower blood pressure and blood glucose reduce the risk of heart disease, stroke, and complications from diabetes.

Fewer Hospital Visits

Better-managed conditions lead to fewer emergency room visits and hospitalizations.

Improved A1c Levels

For diabetics, better blood sugar control leads to lower A1c levels, reducing the risk of severe complications.

Protection of Eyes and Kidneys

Improved blood pressure and glucose levels help prevent damage to the eyes and kidneys.

Economic Benefits

Better health management translates to significant savings in healthcare costs due to reduced need for medical interventions, hospital stays, and emergency care. In addition translates to economic stability with decreased medical expenses ease the financial burden on patients and healthcare systems.

Enhancing Healthcare Access and Equity

HealthSnap's remote monitoring bridges gaps in healthcare access and equity. Patients can receive consistent care regardless of location, making healthcare accessible to underserved populations. In addition, leveling the playing field for all patients by providing equal opportunity to manage and improve their health between in-office visits.

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Introduction

This white paper provides a detailed analysis of the effectiveness of HealthSnap's digital health strategies for the remote monitoring and management of blood pressure, blood sugar, and body weight. These strategies encompass CCM and RPM programs, all facilitated through an EHR-integrated Virtual Care Management platform. HealthSnap's platform enables interoperability between RPM medical devices, clinical staff notes, and provider Electronic Health Records (EHRs).

HealthSnap's model incorporates licensed and trained clinical staff who use evidence-based, patient-centered care methods. The primary objectives are to increase patient engagement, enhance patient self-efficacy and health literacy, and improve care coordination. Additionally, the system includes triaged alert management to ensure timely and appropriate responses to patient needs. This comprehensive approach aims to optimize the management of chronic conditions in a remote setting, ultimately leading to personalized care gap closure, improved care coordination, reduced cost of care, optimal health outcomes, and improved patient satisfaction.

Methodology for RPM of Blood Pressure

Effects on Hypertension Management

Aggregate, retrospective, de-identified health data was exported from the HealthSnap data portal to evaluate the efficacy of the RPM program for blood pressure management. A minimum of **90** days on the program was set as the initial inclusion criterion, based on internal analyses indicating that this period is necessary to observe adherence to care plans and the effects of data-driven clinical decisions and medication adjustments. This criterion reduced the dataset to **39,988** patients monitored for blood pressure.

Patients were categorized based on engagement levels using the Centers for Medicare & Medicaid Services criteria for RPM participation eligibility, which stipulates approximately **50%** (16 days in a 30-day period) participation for related billing. We defined "engaged" patients as those with a Transmission Index (TI), the percentage of days a patient transmits data during a month, greater or equal to **50%**, and "less-engaged" patients as those with a TI less than **50%**. Patients who transmitted data on only one day were excluded from the analysis entirely.
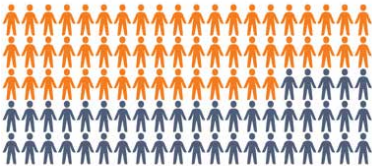
Results: Blood Pressure & Patient Engagement

This resulted in **22,037** engaged patients (**55.2%**), with an average TI of **74.8%**, and **17,951** less-engaged patients (**44.8%**), with an average TI of **24.3%** (Figure 1). Both groups exhibited significant reductions in systolic blood pressure (SBP) compared to baseline (p<0.0001). Less-engaged patients experienced an average SBP reduction of **5.8** mmHg, while engaged patients saw a significantly greater reduction of **8.3** mmHg (p < 0.0001) (Figure 2).

Less-engaged patients (n=17,951) experienced a decrease in SBP from 138.2 mmHg to 132.4 mmHg, resulting in a reduction of 5.8 mmHg. In contrast, engaged patients (n = 22,037) exhibited a greater improvement, with SBP decreasing from 135.5 mmHg to 127.3 mmHg, amounting to a reduction of 8.3 mmHg (p < 0.0001) (Figure 3).

Figure 1

ENGAGED PATIENTS (TI 74.8%)
N = 22,037
55.1%

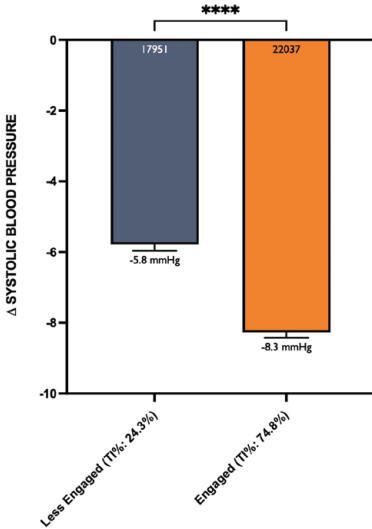LESS-ENGAGED PATIENTS (TI 24.3%)
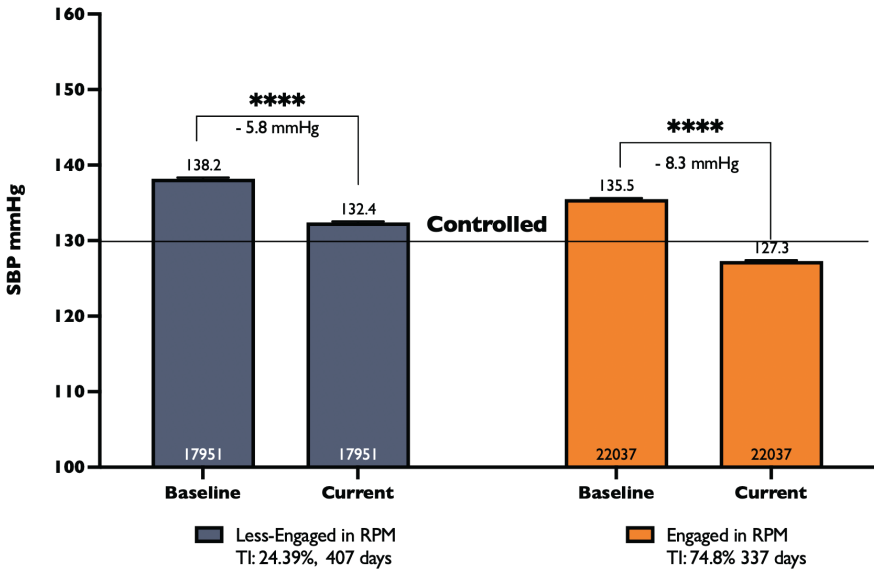N = 17,951
44.8%

Figure 2

****

Δ SYSTOLIC BLOOD PRESSURE

17951 — -5.8 mmHg

22037 — -8.3 mmHg

Less Engaged (TI%: 24.3%)　Engaged (TI%: 74.8%)

Figure 3

Systolic Blood Pressure
All Patients
First vs Last Data Transmission

Less-Engaged in RPM
TI: 24.39%, 407 days

Engaged in RPM
TI: 74.8% 337 days

Relationship Between RPM Transmission Index (TI%) and Hypertension Management

Internal data suggests that the frequency of data transmission is positively correlated with improved blood pressure control. Using machine modeling and predictive analytics, it has been observed that each 1% increase in the TI is associated with an approximate 0.07 mmHg decrease in SBP.

To investigate the effects of frequency and consistency of data transmission, we categorized all patients with initial hypertensive measurements (**≥130**/**80 mmHg**) into quartiles based on their TI%. The results demonstrated significantly greater SBP improvements with higher frequencies of data transmission. Patients in Quartile 1, with a TI of **10-24.3%**, exhibited an average reduction of **6.9** mmHg (n=**7,173**). Those in Quartile 2, with a TI of **24.4-52.3%**, showed an average reduction of **9.8** mmHg (n=**7,153**). Quartile 3, consisting of patients with a TI of **52.4-75.4**%, experienced an average reduction of **11.4** mmHg (n=**7,179**). Finally, patients in Quartile 4, with the highest TI of **75.5-100**%, had the most substantial improvement, with an average reduction of **13.7** mmHg (n=**7,197**) (Figure 4)

All quartiles exhibited significant improvements in SBP. Notably, Q4 showed a nearly 100% greater magnitude of improvement (p < 0.0001), underscoring the importance of frequent and consistent data transmission in the effective management of hypertension.
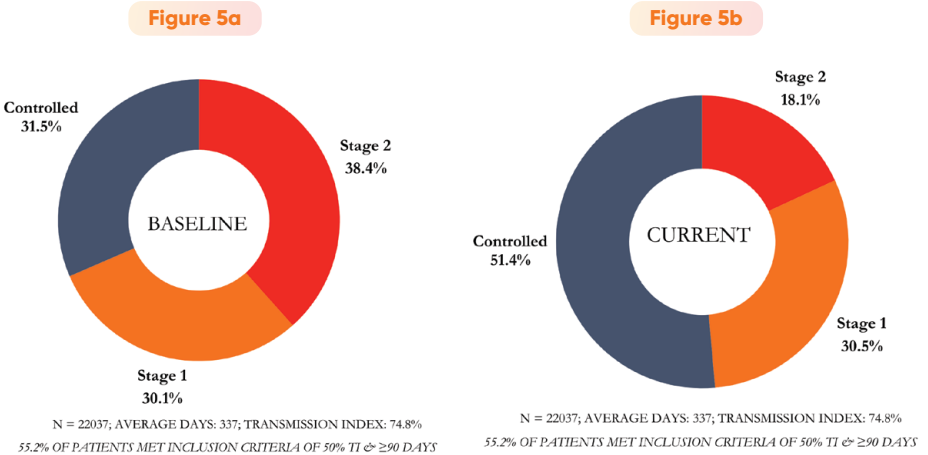

Figure 4

**Change in Systolic Blood Pressure
With Data Transmission
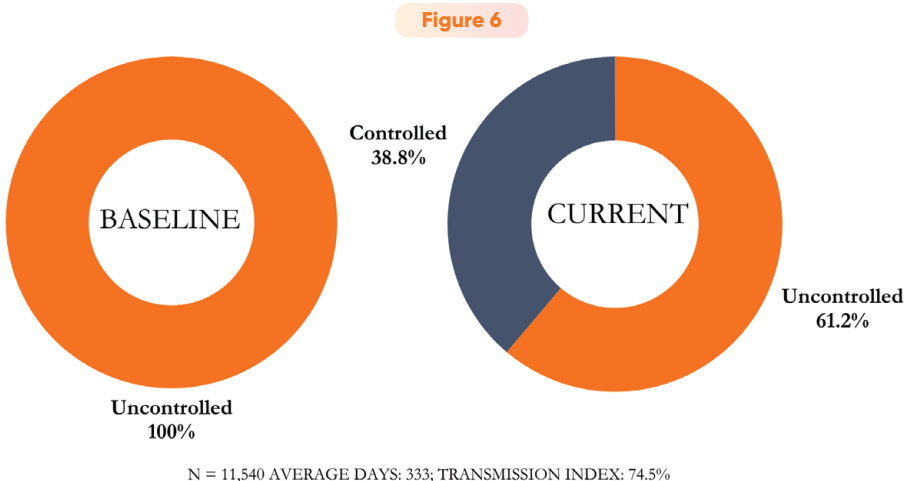All Hypertensive Patients
N = 28,702**
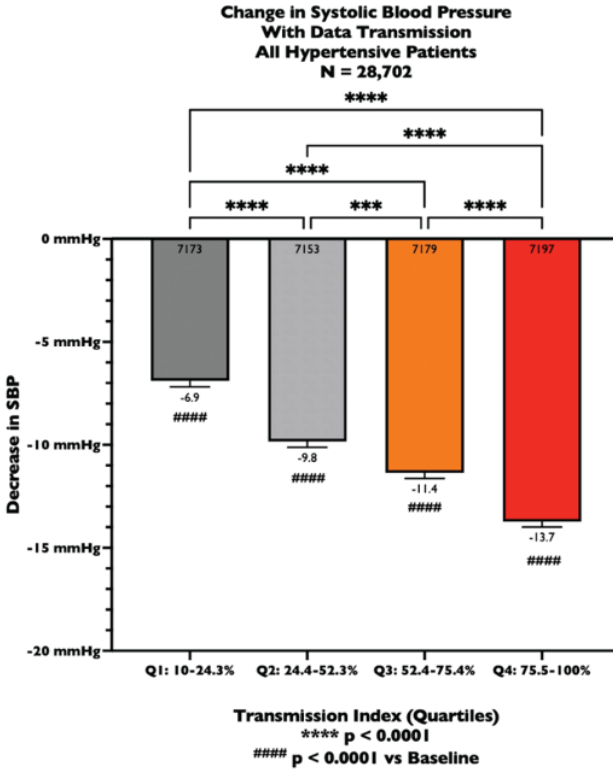
Relationship Between RPM Transmission Index (TI%) and Hypertension Management

Among the **22,037** patients who met the inclusion criteria of having a TI of at least **50%** and being on the program for a minimum of 90 days, we averaged their first seven data transmissions to establish baseline blood pressure measures. Patients were categorized as "control" if their baseline SBP was **<130 mmHg** and/or their diastolic blood pressure (DBP) was **<80 mmHg**. Consequently, **6,952** patients (**31.5%**) were within the control range, **6,624** patients (**30.1%**) had stage 1 hypertension, and **8,461** patients had stage 2 hypertension (Figure 5a).

By the end of the second quarter of 2024, these baseline measures were compared to the average of the most recent seven data transmissions, revealing significant improvements: **11,332** patients (**51.4%**) were in the control range, **6,714** patients (**30.5%**) had stage 1 hypertension, and **3,991** patients (**18.1%**) had stage 2 hypertension (Figure 5b).


Figure 5a

BASELINE

Controlled 31.5%
Stage 2 38.4%
Stage 1 30.1%

N = 22037; AVERAGE DAYS: 337; TRANSMISSION INDEX: 74.8%
55.2% OF PATIENTS MET INCLUSION CRITERIA OF 50% TI & ≥90 DAYS

Figure 5b

CURRENT

Stage 2 18.1%
Controlled 51.4%
Stage 1 30.5%

N = 22037; AVERAGE DAYS: 337; TRANSMISSION INDEX: 74.8%
55.2% OF PATIENTS MET INCLUSION CRITERIA OF 50% TI & ≥90 DAYS

Of the **11,540** patients who exhibited uncontrolled hypertension—defined as an average SBP **≥130** mmHg or DBP **≥80** mmHg based on their first seven data transmissions — **4,472** patients (**38.8%**) now have controlled blood pressure, averaging **<130** mmHg SBP and **<80** mmHg DBP across their most recent seven data transmissions. Additionally, **84.2%** of the patients from this group show improved SBP in their most recent seven data transmissions. (Figure 6)

Figure 6

BASELINE

Uncontrolled 100%

CURRENT

Controlled 38.8%
Uncontrolled 61.2%

N = 11,540 AVERAGE DAYS: 333; TRANSMISSION INDEX: 74.5%

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Among the **8,476** patients who averaged **≥140** mmHg SBP or **≥90** mmHg DBP across their baseline of seven data transmissions, **5,726** patients (**67.8%**) have improved to levels below Stage 2 hypertension (**<140** mmHg SBP and **<90** mmHg DBP) as measured by the average of their most recent seven data transmissions. Additionally, **88.2%** of these patients with Stage 2 hypertension at baseline have shown improved SBP in their most recent seven readings compared to baseline. (Figure 7)
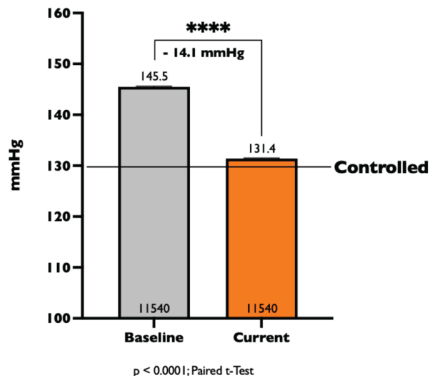
Figure 7

BASELINE

Stage 2
100%

CURRENT

Stage 2
32.2%

< Stage 2
67.8%
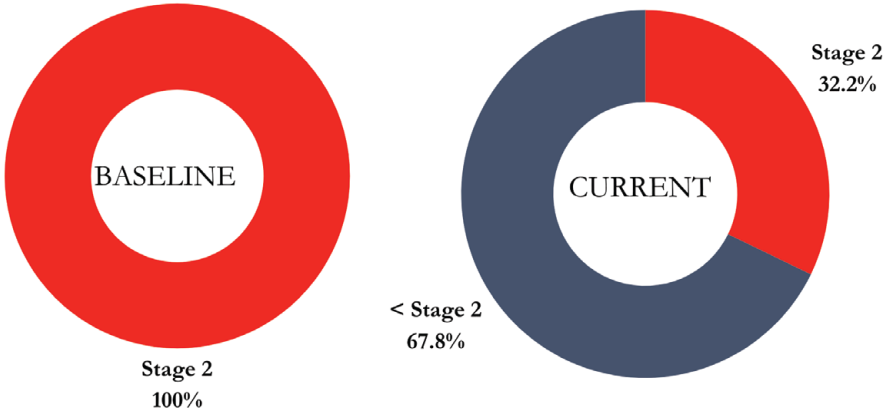
N = 8446; AVERAGE DAYS: 333; TRANSMISSION INDEX: 74.3%

RPM-Induced Improvements Among Patients with Uncontrolled Hypertension

As previously mentioned, to control for day-to-day variability and the learning effect, we compared the average of the first seven data transmissions to the most recent seven data transmissions. Patients with baseline hypertension (**≥130** mmHg SBP or **≥80** mmHg DBP) demonstrated an improvement in SBP by **14.1** mmHg, decreasing from **145.5** mmHg to **131.5** mmHg (p < 0.0001; n = **11,540**) (Figure 8).

Figure 8

Systolic Improvements
Hypertensive Patients
avg. of first 7 vs last 7 transmissions

****
- 14.1 mmHg

145.5
131.4

Controlled

11540   11540
Baseline   Current

p < 0.0001; Paired t-Test

Additionally, these patients improved DBP from **84.6** mmHg to **76.6** mmHg, a reduction of **8.0** mmHg (p < 0.0001) (Figure 9), and mean arterial pressure (MAP) from **104.9** mmHg to **94.9** mmHg, a decrease of **10** mmHg (p < 0.0001) (Figure 10).
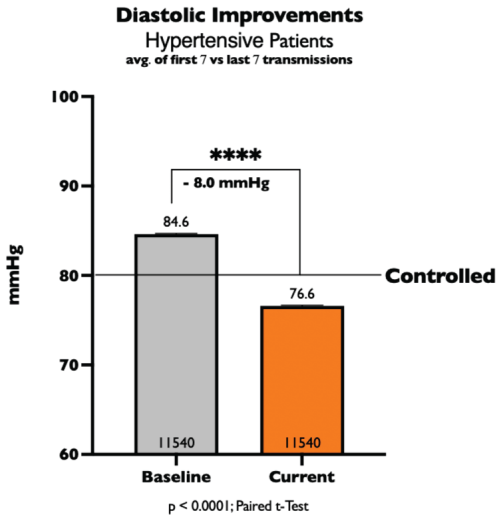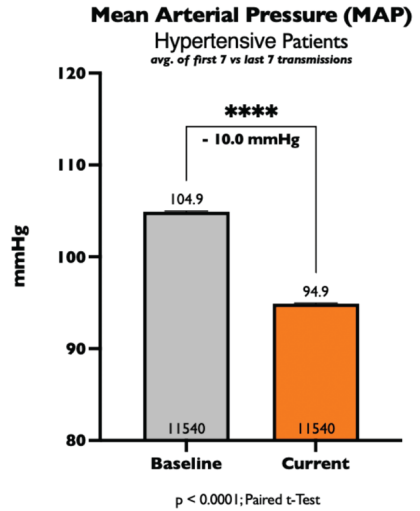
Figure 9

Diastolic Improvements
Hypertensive Patients
avg. of first 7 vs last 7 transmissions

****
- 8.0 mmHg

84.6
76.6
Controlled
11540
11540

Baseline   Current

p < 0.0001; Paired t-Test

Figure 10

Mean Arterial Pressure (MAP)
Hypertensive Patients
avg. of first 7 vs last 7 transmissions

****
- 10.0 mmHg

104.9
94.9
11540
11540

Baseline   Current

p < 0.0001; Paired t-Test

RPM-Induced Improvements Among Patients with Systolic and Diastolic Stage 2 Hypertension

Patients with Stage 2 hypertension (SBP **≥140** mmHg and DBP **≥90** mmHg) demonstrated significant improvements. SBP decreased by **23.8** mmHg (Figure 11), DBP improved from **96.8** mmHg to **82.3** mmHg (Figure 12), a reduction of **14.5** mmHg, and MAP decreased by **17.6** mmHg, from **116.9** mmHg to **99.3** mmHg (Figure 13). All improvements were statistically significant at p < 0.0001.
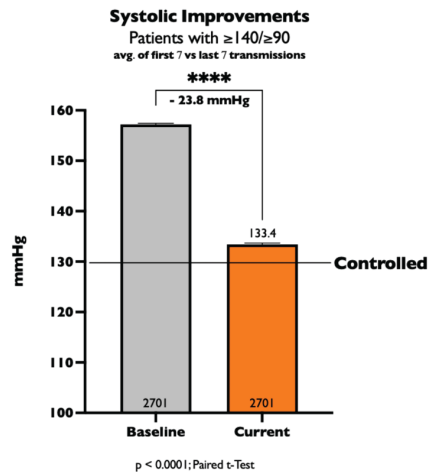
Figure 11

Systolic Improvements
Patients with ≥140/≥90
avg. of first 7 vs last 7 transmissions

****
- 23.8 mmHg

133.4
Controlled
2701
2701

Baseline   Current

p < 0.0001; Paired t-Test

Figure 12

Diastolic Improvements
Patients with ≥140/≥90
avg. of first 7 vs last 7 transmissions

****
- 14.5 mmHg

96.8 (Baseline)
82.3 (Current)

Controlled

2701 / 2701

p < 0.0001; Paired t-Test

Figure 13

Mean Arterial Pressure (MAP)
Patients with ≥140 & ≥90
avg. of first 7 vs last 7 transmissions

****
- 17.6 mmHg

116.9 (Baseline)
99.3 (Current)

2701 / 2701

p < 0.0001; Paired t-Test

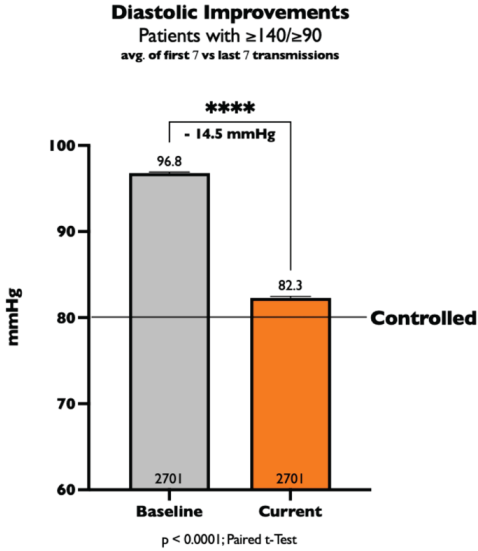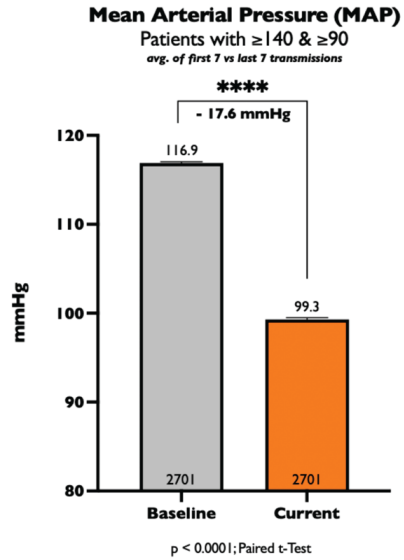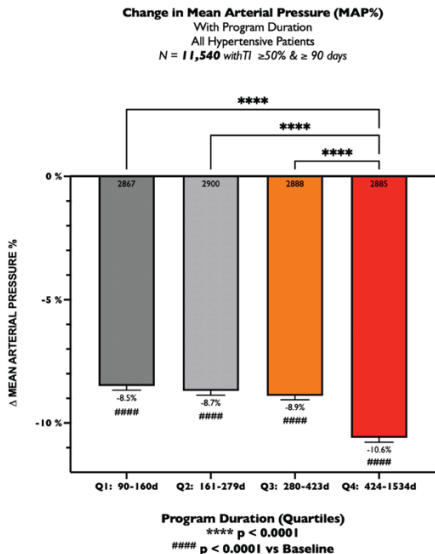## Relationship Between RPM Program Duration and Changes In Mean Arterial Pressure

Lastly, we examined the effects of program duration on blood pressure improvements among the **11,540** patients with baseline hypertension (SBP **≥130** mmHg or DBP **≥80** mmHg) by comparing their most recent seven data transmissions and categorizing the RPM program duration into quartiles. Improvements in MAP percentages were analyzed across these quartiles: Quartile 1 (**90-160** days, **-8.5%**, n = **2,867**); Quartile 2 (**161-279** days, **-8.7%**, n = **2,900**); Quartile 3 (**280-423** days, **-8.9%**, n = **2,888**); and Quartile 4 (**424-1,534** days, **-10.6%**, n = **2,885**). All improvements were highly significant compared to baseline (p < 0.0001), and Quartile 4 exhibited significantly greater improvements in MAP percentage than all other quartiles (p < 0.0001; (Figure 14).

Figure 14

Change in Mean Arterial Pressure (MAP%)
With Program Duration
All Hypertensive Patients
N = **11,540** *withTI ≥50% & ≥ 90 days*

2867 / 2900 / 2888 / 2885

-8.5% #### / -8.7% #### / -8.9% #### / -10.6% ####

Q1: 90-160d   Q2: 161-279d   Q3: 280-423d   Q4: 424-1534d

Program Duration (Quartiles)
**** p < 0.0001
p < 0.0001 vs Baseline

Methodology for Fasting Blood Glucose RPM

Effects on Blood Glucose Management

Many patients are enrolled in RPM programs for blood glucose management due to various clinical needs. In our analysis of de-identified health data, we focused on patients with hyperglycemia, defined by fasting blood glucose (FBG) levels in the diabetic range (**≥125** mg/dl). We categorized **1,458** diabetic patients, who met the inclusion criteria of at least **90** days in the program and a TI of **≥50%**, into two groups based on their initial FBG levels: mild hyperglycemia (**125–179** mg/dl) and severe hyperglycemia (**≥180** mg/dl).

Results: Fasting Blood Glucose (mg/dl)

Among **1458** diabetic patients, **439** have reduced their fasting blood glucose below the diabetic range (Figure 15), as the baseline FBG among the diabetic patients decreased by **16.5** mg/dl (p < 0.0001) when comparing the first seven data transmissions to the most recent seven data transmissions (Figure 16).
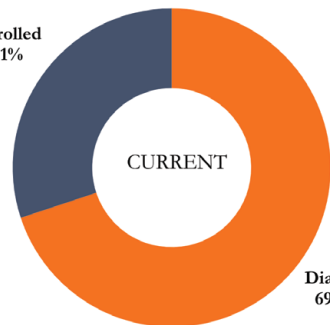
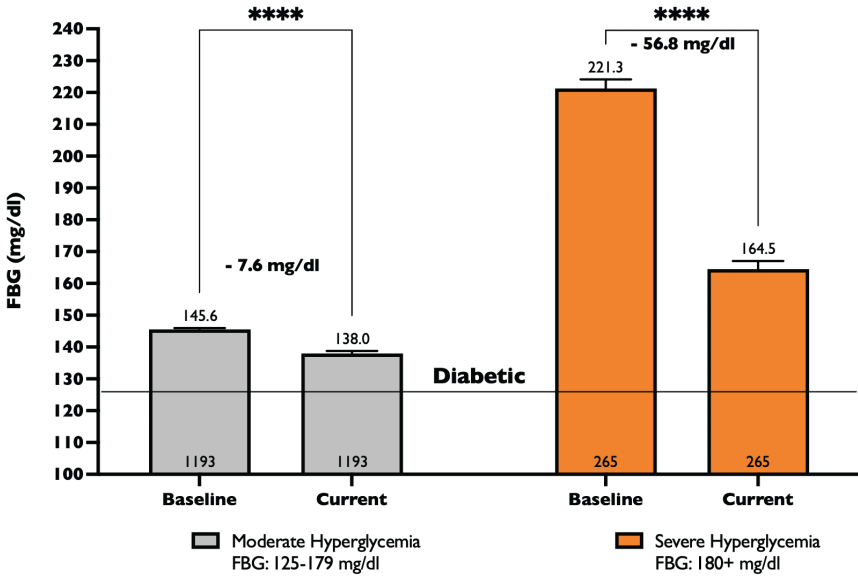**Figure 15**

BASELINE

Diabetic
100.0%

Figure 16

p < 0.0001; Paired t-Test

Controlled
30.1%

CURRENT
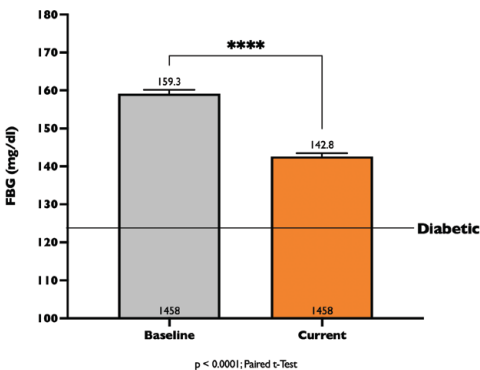
Diabetic
69.9%

Patients with mild hyperglycemia (FBG = **125–179** mg/dl) showed an improvement of **7.6** mg/dl (p < 0.0001), while those with severe hyperglycemia (FBG **≥ 180** mg/dl) exhibited a significant reduction of **56.8** mg/dl (p < 0.0001), decreasing from **221.3** mg/dl to **164.6** mg/dl; (Figure 17).

Figure 17

Relationship Between RPM Program Duration and Management of Diabetes (FBG)

Furthermore, the duration of the RPM program had a notable impact on FBG percentage improvements when examining quartiles based on days of program duration and comparing these improvements to baseline. The quartiles were as follows: Quartile 1 (**90–203** days, **–5.5%**), Quartile 2 (**204–287** days, **–6.7%**), Quartile 3 (**288–372** days, **–9.0%**), and Quartile 4 (**373–1,021** days, **–11.9%**). All improvements were significant compared to baseline (p < 0.0001) (Figure 18)

Figure 18
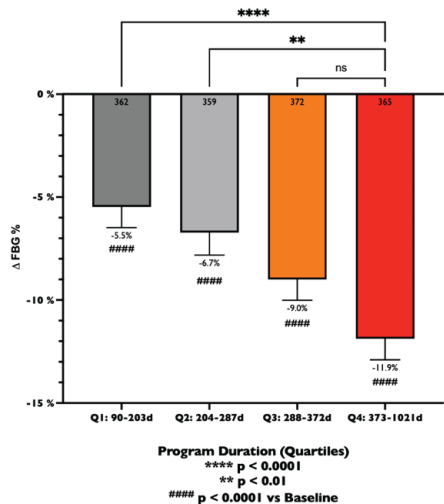
Methodology & Analysis of Body Weight RPM for Managing of Obesity

Effects on Weight Loss & Management of Obesity

Although most patients placed under body weight monitoring by their providers are being observed for acute changes related to heart failure, chronic kidney disease, sarcopenia/frailty, or drug-associated side effects, a smaller subset of patients are monitored as part of an obesity and weight management program. Thus, we analyzed **494** patients undergoing RPM specifically for weight management, where significant clinical improvements were observed. Patients experienced an average weight reduction of **8.8** lbs (p < 0.0001) over an average monitoring duration of **324** days (Figure 19). Notably, **81.4%** of these patients succeeded in achieving weight loss (Figure 20). To account for daily fluctuations, we compared the averages from the first seven measurements to the most recent seven measurements, establishing a robust pattern of weight loss correlated with the duration of program engagement.
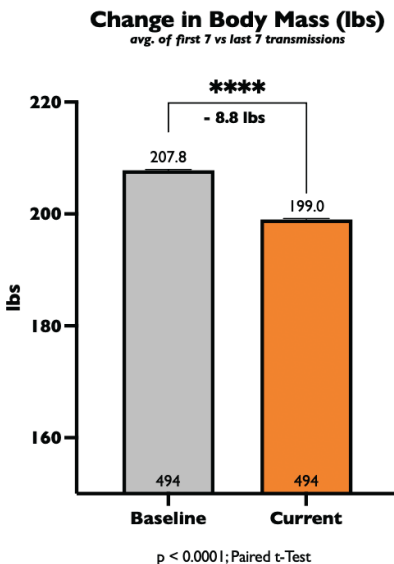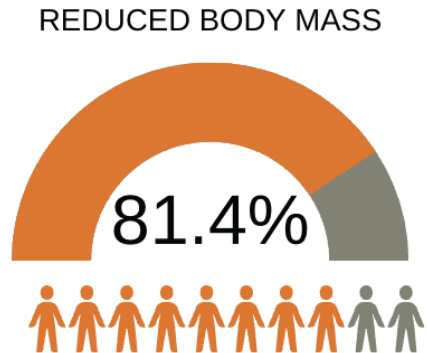
Figure 19

Change in Body Mass (lbs)
avg. of first 7 vs last 7 transmissions

****
- 8.8 lbs

207.8
199.0

494 (Baseline)
494 (Current)

p < 0.0001; Paired t-Test

Figure 20

REDUCED BODY MASS

81.4%

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Relationship Between RPM Program Duration & Transmission Index and Management of Obesity

When dissecting the data by program duration quartiles, the quartile with patients who had been in the program the longest (Q4: **403-1071** days) showed that these patients lost over **300%** more body weight than those in Quartile 1, who had been participating for the shortest period (Q1: **90-185** days), translating to **6.7%** vs. **1.8%** of their total body mass (Figure 21). Furthermore, when comparing across quartiles of data transmission, patients who transmitted RPM data with the highest frequency (Quartile 4 of data transmission: **87.4-100%**) observed a greater decrease in body weight, highlighting a significant correlation between data engagement and weight loss outcomes (Figure 12). This suggests that program duration and regular participation may play a role in the efficacy of RPM as part of a clinical weight loss strategy.

Figure 21

Change in % Body Mass
With Program Duration
Weight Loss Patients

**

| 122 | 125 | 123 | 124 |
-1.8% | -2.5% | -4.9% | -6.7%

Δ Body Mass %

Program Duration (Quartiles)
Q1:90-185d   Q2: 186-283d   Q3: 284-402d   Q4: 403-1071d

** p < 0.01

Figure 22

Change in % Body Mass
With Transmission Index (TI)
Weight Loss Patients

| 124 | 123 | 122 | 125 |
-3.2% | -3.3% | -4.1% | -6.2%

Δ Body Mass %

TI% (Quartiles)
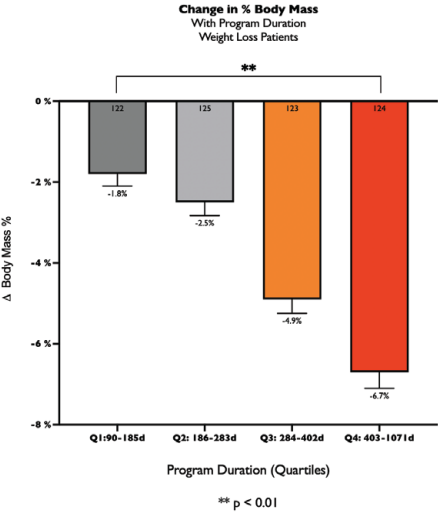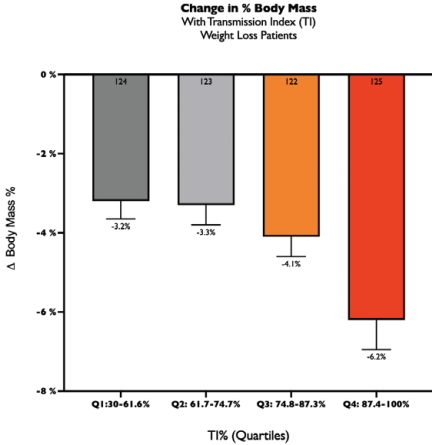Q1:30-61.6%   Q2: 61.7-74.7%   Q3: 74.8-87.3%   Q4: 87.4-100%

Conclusion

HealthSnap's data-driven approach to virtual care management has yielded promising results, with significant improvements observed in blood pressure measures, particularly among engaged patients. By emphasizing patient engagement and data transmission consistency, the efficacy of RPM supports its potential as a standard of care for managing hypertension. This underscores the broader potential of digital health strategies in improving patient outcomes. Additionally, the RPM program has demonstrated impressive advancements in diabetes management, with notable reductions in fasting blood glucose levels among diabetic patients. Furthermore, the integration of weight management strategies within virtual care management has contributed to combating obesity, underscoring the comprehensive benefits of HealthSnap's approach.

Future studies could explore the impacts of RPM on reducing health events, mortality, and comorbidities, and its role in decreasing healthcare utilization. Moreover, investigations should consider how these strategies can enhance access to care for underserved populations, addressing disparities in health equity.

"We found that by keeping people out of the emergency room, by keeping them out of the hospital, providing them with quicker access to the primary care or specialist office should their condition deteriorate – that HealthSnap RPM and CCM does decrease the total cost of care and increase quality and experience for our patients."

Bill Gerard, MD

EVP, Value Based Care & Clinical Integration at Prisma Health, and CEO of inVio Health Network

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Montefiore

Mount Sinai
MEDICAL CENTER

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Luminis Health

RUSH

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USF Health

Capital Cardiology
ASSOCIATES

Texas Kidney
INSTITUTE

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Nephrology Specialists, P.C.

Care Station
MEDICAL GROUP

PROGRESSIVE
Health of Delaware
YOUR WELLNESS CENTER

Brookhaven Heart

mahaskahealth

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