Continuous Remote Patient Monitoring as a Scalable Intervention

to Improve Blood Pressure and Glucose Control in Chronic Populations

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Introduction

Hypertension and diabetes remain two of the most pervasive chronic conditions in the United States, together affecting the majority of older adults and contributing significantly to cardiovascular, renal, and metabolic morbidity and mortality (Centers for Disease Control and Prevention [CDC], 2023a). Nearly half of U.S. adults have hypertension, and over 38 million Americans are living with diabetes —many of whom remain undertreated or poorly controlled due to gaps in monitoring, delayed therapeutic adjustments, and systemic barriers to care (Centers for Disease Control and Prevention [CDC], 2023b; Million Hearts®, 2023). Remote Patient Monitoring (RPM), particularly when implemented as a continuous intervention, offers a scalable solution to transform chronic disease management by enhancing accessibility, reducing clinical inertia, and improving patient engagement, self-efficacy, and health literacy.

RPM typically involves the prescription of a cellular-enabled device—such as a blood pressure cuff or glucometer—based on medical necessity. Patients transmit physiologic data from home in real time to licensed clinical staff and their care team. These teams monitor customizable alert thresholds, proactively engage with patients, and coordinate care with providers to deliver timely, personalized interventions. RPM workflows often include:

- Continuous longitudinal monitoring
- Tailored care plans focused on medication adherence and lifestyle modification
- Education to promote self-efficacy and health literacy
- Documentation and communication that bypass administrative burdens

Importantly, RPM circumvents common limitations of in-clinic measurement, including masked controlled hypertension and white coat syndrome, which can lead to under- or overtreatment (American Academy of Family Physicians, 2021).

Why Continuous Monitoring Matters

Hypertension and glycemic dysregulation tend to worsen with age. However, continuous RPM demonstrates that patients can achieve sustained improvements in blood pressure and glucose control over time. Unlike episodic clinic visits, RPM provides a longitudinal view, allowing clinicians to track trends, adjust treatment more precisely, and maintain momentum in behavior change.

Methods

This analysis examined patients with uncontrolled hypertension—defined as baseline systolic blood pressure **(SBP) ≥140 mmHg** or diastolic blood pressure **(DBP) ≥90 mmHg**—who had been enrolled in RPM programs and transmitted data at a rate of at least **16 days per 30-day period** (qualifying for CPT code 99454). Patients received education and support from licensed clinical staff, who reviewed readings, engaged patients in real-time conversations, and reinforced care plan adherence. Blood pressure improvement (ΔSBP/ΔDBP) was calculated as the difference between the average of the first 7 transmitted readings and the average of the most recent 7 transmitted readings, minimizing daily variability and accounting for learning curves.

For glucose, patients with elevated baseline fasting blood glucose **(FBG >125 mg/dL)**, as determined by their physician, were prescribed monitoring with a pre-configured, cellular-enabled glucometer. Patients were instructed to record fasted readings daily in the morning. Only patients with at least 14 transmitted glucose readings were included in the analysis. Glucose improvement (ΔFBG) was computed as the difference between the first 7 and most recent 7 morning readings, using the same methodology as for blood pressure.

Blood Pressure & Program Duration

These results suggest that meaningful SBP reductions emerge as early as <100 days, but begin to clearly diverge around the 450-day mark. Patients who remained engaged with RPM for 450 days or more experienced the most substantial reductions in systolic blood pressure, averaging over 18 mmHg in improvement. The consistency in effect size beyond this point underscores the durable benefits of long-term engagement.

A similar trend is observed with diastolic blood pressure. Although improvements are evident early in the monitoring period, significant divergence in DBP reductions begins at approximately 450 days. Patients monitored for more than 600 days achieved a mean DBP reduction of over 15 mmHg—an outcome that aligns with high clinical relevance and potential cardiovascular risk reduction.

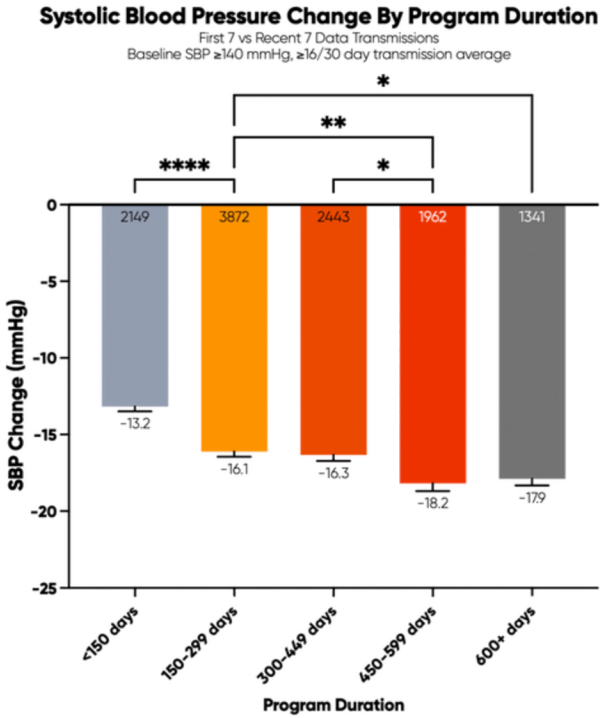

Figure 1. Mean Change in Systolic Blood Pressure by Program Duration

This bar graph shows the average change in systolic blood pressure (SBP) among patients with baseline SBP ≥140 mmHg and consistent engagement (≥16 of 30 days transmission), grouped by program duration. Sample sizes (n) are shown within each bar. Patients active for **450–599 days (n = 1,962)** and **600+ days (n = 1,341)** showed the greatest improvements, averaging **–18.2 mmHg and –17.9 mmHg**, respectively. Error bars represent standard error of the mean (SEM). Asterisks indicate statistically significant differences between groups: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{****}p < 0.0001$.

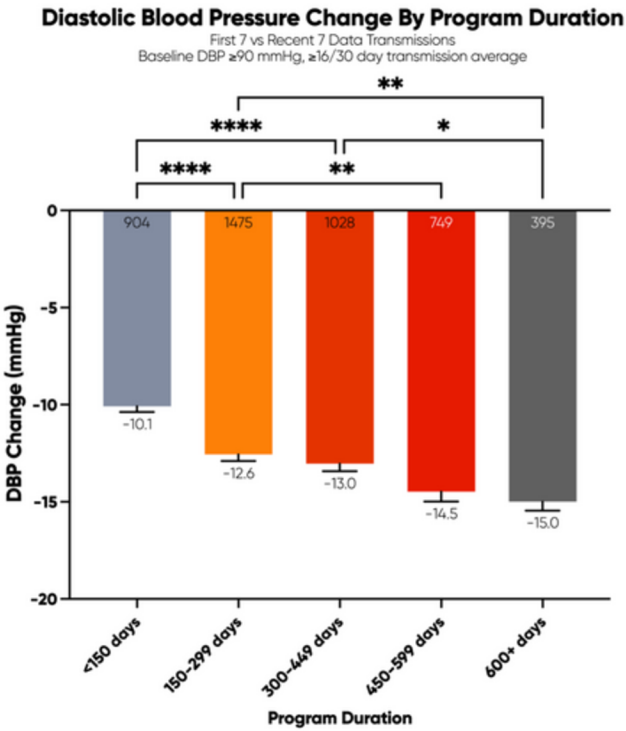

Figure 2. Mean Change in Diastolic Blood Pressure by Program Duration

This bar graph displays the average change in diastolic blood pressure (DBP) among patients with baseline DBP ≥90 mmHg and consistent engagement (≥16 of 30 days transmission), grouped by program duration. Sample sizes (n) are shown within each bar. Blood pressure reductions became more pronounced after approximately **450 days** and remained substantial beyond **600 days (n = 395, Δ = –15.0 mmHg)**. The most significant improvement was observed in the **600+ day group (n = 749, Δ = –15.0 mmHg)**. Error bars represent standard error of the mean. Asterisks denote significance from pairwise comparisons: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$, $^{****}p<0.0001$.

Glucose & Program Duration

Among **1,924** patients with baseline FBG >125 mg/dL and ≥14 transmitted measurements, meaningful glucose reductions were observed as early as **<150 days**. However, more sustained and substantial improvements were observed with longer participation. Patients engaged for **600+ days** achieved a mean glucose reduction of **−19.76 mg/dL** (SEM ±1.84), significantly greater than the **−7.85 mg/dL** (SEM ±1.88) reduction seen in patients engaged for **<150 days** ($p < 0.0001$).

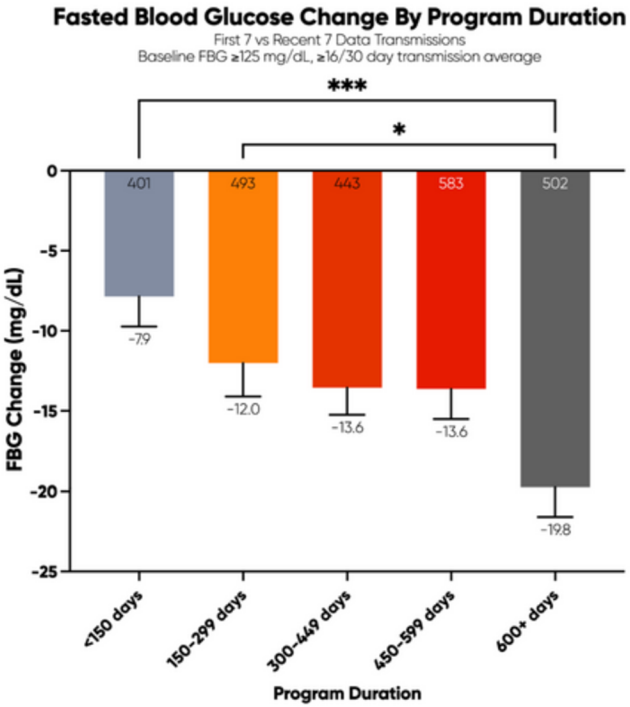

Figure 3. Mean Change in Fasted Blood Glucose by Program Duration

This bar graph shows the average change in fasting blood glucose (FBG) among patients with baseline FBG ≥125 mg/dL and consistent engagement (≥16 of 30 days transmission), grouped by program duration. Sample sizes (n) appear within each bar. The most substantial improvement was observed in the 600+ day group (n = 502, Δ = −19.8 mg/dL), nearly double the reduction seen in the <150 day group (n = 401, Δ = −7.9 mg/dL). Error bars indicate standard error of the mean. Statistical significance is denoted as follows: $^{*}p<0.05$, $^{***}p<0.001$

RPM & Duration

Impact on BP and Glucose

	SBP (Patients with ≥140 mmHg)			DBP (Patients with ≥90 mmHg)			FBG (Patients w >125 mg/dl)		
Duration	Δ SBP (mmHg)	SEM	*n*	Δ DBP (mmHg)	SEM	*n*	Δ FBG (mg/dL	SEM	*n*
<150 days	-13.17	0.3	*2149*	-10.08	0.3	*904*	-7.85	1.9	*401*
150–299 days	-16.11	0.3	*3872*	-12.56	0.3	*1475*	-12.02	2.1	*493*
300–449 days	-16.33	0.4	*2443*	-13.05	0.4	*1028*	-13.55	1.7	*443*
450–599 days	-18.19	0.5	*1962*	-14.48	0.5	*749*	-13.63	1.9	*583*
600+ days	-17.89	0.4	*1341*	-14.99	0.5	*395*	-19.76	1.8	*502*

Table 1. Mean Changes in Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and Fasting Blood Glucose (FBG) by Program Duration

This table presents the mean change, standard error of the mean (SEM), and sample size (n) for SBP, DBP, and FBG across five program duration categories. Patients included in the SBP and DBP analyses had baseline readings of **≥140 mmHg** and **≥90 mmHg**, respectively, while those in the FBG analysis had baseline fasting glucose **>125 mg/dL**.

Improvements in both blood pressure and glucose control were evident across all duration categories but became most pronounced after **12 months** of continuous engagement. The greatest reductions in SBP **(−18.2 mmHg; 450d+)**, DBP **(−15.0 mmHg; 600d+)**, and FBG **(−19.8 mg/dL; 600d+)** were observed in patients enrolled for 450 to over 600 days. These findings suggest a dose-response relationship between duration of RPM participation and physiologic improvement, with durable benefits emerging most significantly beyond the 1-year mark.

Discussion

The clinical value of sustained blood pressure control is well established. In a landmark meta-analysis by Ettehad et al. even modest reductions in blood pressure were associated with substantial reductions in major adverse cardiovascular events (MACEs), including stroke, myocardial infarction, and cardiovascular death. Specifically, a 10 mmHg reduction in SBP was associated with a **20%** reduction in the risk of cardiovascular events (Ettehad et al., 2016). Applying these findings to the current data, the observed mean SBP reductions suggest not only clinical control but also significant downstream cost savings.

The ability of RPM to lower healthcare costs stems from multiple factors:

- Reduced incidence of preventable events (e.g., stroke, heart failure)
- Fewer emergency visits and inpatient admissions
- Reduced need for specialist referrals through more efficient primary care management
- Less administrative burden from repeat in-clinic measurements and blood pressure re-checks
- Greater patient self-efficacy, health literacy, and ownership of care

From a clinical and physiologic standpoint, chronic conditions such as hypertension and diabetes are characterized by persistent, behaviorally and metabolically driven dysregulation (Soleimani et al., 2023). As such, it is clinically intuitive—and supported by empirical data—that continuous, longitudinal remote monitoring is better suited to detect and respond to trends in disease burden than episodic, in-clinic assessments. In-office blood pressure readings are vulnerable to transient effects such as white coat hypertension, while apparent glycemic control around scheduled visits may be confounded by short-term adherence behaviors not reflective of daily patterns. In contrast, RPM enables a stable, ambulatory data stream that captures the cumulative effects of treatment, adherence, and lifestyle over time, offering a more precise and actionable view of disease dynamics.

The 2025 Peterson Center on Healthcare report, Evolving Remote Monitoring: An Evidence-Based Approach to Coverage and Payment, offers a rigorous and well-structured policy analysis of RPM use in Medicare populations (Peterson Center on Healthcare, 2025). We commend the Center for highlighting the importance of evidence-driven reimbursement and recommending strategies that prioritize clinically meaningful applications.

However, our findings diverge in important ways from those cited in the report:

- While Peterson concludes that most blood pressure improvements occur within six months of RPM enrollment, our analysis reveals that systolic and diastolic reductions continue to deepen beyond 12 months, with peak effects observed between **400–600** days.
- In contrast to the Peterson summary that RPM has limited utility in glucose control, our data demonstrate consistent and statistically significant reductions in FBG through **600+** days ($p < 0.0001$), with the greatest improvement among long-term participants.

These differences may reflect more contemporary cohorts, higher baseline disease burden, or greater consistency in engagement. Regardless, our findings suggest that for patients with uncontrolled hypertension and diabetes, sustained RPM is not only clinically effective but may far exceed the short-term benefit windows assumed in current policy models.

Conclusion

RPM represents a powerful, reimbursable, and scalable strategy for improving blood pressure and glycemic control in high-risk patient populations. Unlike one-time interventions, RPM creates a continuous therapeutic relationship between patients and their care team. This white paper demonstrates that the longer a patient stays connected through RPM, the more substantial and sustained their improvements become. Particularly among patients with baseline **SBP ≥140 mmHg, DBP ≥90 mmHg**, or **FBG >125 mg/dL**, those engaged for >6 months achieved dramatic and statistically significant improvements. These findings should guide the clinical community and policymakers to support RPM as a foundational element in chronic disease care.

Citations

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