

Cellular Blood Pressure Monitoring Benefits from a Long-term/Large-scale Remote Patient Monitoring (RPM) Study

Abstract

To enhance patient monitoring participation and improve chronic condition management for some of its hypertensive patients, a renowned cardiology consultant group located in New York Metropolitan area has been actively recruiting Medicare patients to participate in its Remote Patient Monitoring (RPM) program. The practice chose ForaCare's RPM devices and software solution, due to its suitability for their more senior patients, many of whom have limited technical experience.

The RPM solution, which includes user-friendly cellular monitoring devices (such as the D40g) and integrated software (Fora's 24/7 HealthView), streamlines the onboarding and training process for both caregivers and patients, leading to greater patient satisfaction and the potential for better program outcomes. One of many successes of the study was the ability to collect credible real-time data transmissions for each patient, allowing caregivers to quickly survey trends to intervene promptly as needed, resulting in personalized patient care to address short- and long-term complications.

The goal of this study was to evaluate the effectiveness of the RPM program in lowering blood pressure among hypertensive patients. Analysis of the ongoing study from data collected from 2,509 participants and 736,134 blood pressure measurements collected between 2018 and 2024 demonstrated a significant reduction in both systolic and diastolic blood pressure within the initial three to six months of program enrollment and remained stable or decreased slightly between one and four years after joining the RPM program. The integration of RPM mobile health technology with the cardiology consultants' medication care policies and protocols facilitates the importance of patient adherence to self-measured blood pressure monitoring, resulting in better clinical outcomes for hypertensive patients.

Background

A. Introduction of remote patient monitoring (RPM) services

RPM and telehealth, also known as telemedicine, are innovative care delivery models that utilize technology to provide healthcare services remotely. Telehealth enables patients to access healthcare services through video chats, phone calls, or messaging, reducing the need for in-person visits while ensuring timely medical attention. RPM falls under the umbrella of telehealth, where healthcare providers monitor patients from a different location utilizing cellular enabled medical devices like weight scales, blood pressure meters^{1,2}, pulse oximeters, and blood glucose meters, outside the medical care environment. RPM involves tracking, monitoring, and managing patient information remotely, allowing individuals to receive attentive, high-quality care for chronic illnesses, serious injuries, or other conditions from the comfort of their own homes. RPM technology empowers healthcare providers to gather and analyze health information using cellular enabled devices from patients, thereby eliminating the need for face-to-face appointments or in-person testing. Although RPM is not a new practice, its popularity continues to rise due to its convenience for patients and its potential to enhance patient care.

a) Eligibility to Receive RPM Services

RPM is especially efficient for individuals with chronic illnesses, who often have multiple concurrent conditions and require regular monitoring. For these patients, frequent visits to medical facilities can be time-consuming and logistically challenged, especially for those with disabilities. RPM alleviates these burdens by allowing patients to receive care from the comfort of their homes, reducing unnecessary medical appointments and promoting independence while minimizing the risk of complications.

b) Eligibility to Provide RPM Services

RPM services can be provided by physicians, qualified healthcare professionals, healthcare coordinators, by collaborating with device manufacturers, care management companies, and other healthcare facilities, such as home health agencies. However, different models of RPM services are defined under the CPT reimbursement codes^{3,4}.

In the realm of RPM services, the collection and evaluation of patient data are limited to physicians or qualified healthcare professionals. However, certain RPM services, such as remote physiologic monitoring, can be provided by physicians, qualified healthcare professionals, or clinical staff under the general supervision of the physician.

In the 2021 Final Rule, the Centers for Medicare & Medicaid Services (CMS) expanded the scope of RPM services to include auxiliary personnel, in addition to clinical staff, under the general supervision of the billing physician or practitioner⁵. Auxiliary personnel are non-clinical staff who are employees of the facility. They are authorized to perform specific RPM services, including initial set-up and patient education services, as well as providing the devices used by patients to monitor and record data under the physician's supervision.

B. The Benefits of RPM Services.

RPM services offer several advantages in healthcare⁵. They enable real-time monitoring of patients outside traditional clinical settings, enhancing patient engagement and adherence to treatment plans. Additionally, it fosters personalized care, improves patient outcomes, and lowers healthcare costs by reducing complications and promoting proactive management of chronic conditions.

I. Benefits of RPM Services for Healthcare Providers:

As technology continues to advance, RPM services are increasingly gaining prominence in the healthcare sector. For healthcare providers, adopting RPM services brings a range of advantages, from enhancing care efficiency to reducing healthcare costs.

a) Proactive Patient Care Management

RPM services empower healthcare providers to proactively manage patient care. By continuously monitoring vital signs such as blood pressure, heart rate, and blood glucose levels, providers can detect early signs of health decline and intervene promptly as needed. This early intervention not only reduces complications but also allows for personalized treatment plans, ultimately improving patient outcomes and satisfaction. Additionally, RPM enables healthcare providers to actively manage chronic conditions by closely monitoring patients' health status and adjusting treatment plans accordingly, leading to better disease management outcomes. By remotely monitoring vital signs and other health indicators, RPM facilitates the early detection of acute conditions for better

chronic disease management, enabling proactive management. These integrated capabilities of RPM contribute to enhanced patient care, promoting better health outcomes and overall satisfaction.

b) Enhanced Treatment Efficacy and Efficiency

RPM services can reduce the need for frequent in-person visits, and benefit both healthcare providers and patients in saving time and resources. This optimization of care delivery enhances overall efficiency by allowing healthcare providers to closely monitor patients' health conditions remotely and intervene promptly when necessary. Early detection of health issues enables healthcare providers to develop personalized treatment plans, therefore improving overall patient outcomes and satisfaction.

c) Increased Patient Engagement

RPM services encourage greater patient engagement by involving individuals in their own care journey. Through self-monitoring and data sharing, patients become active participants in their healthcare management, which leads to enhanced adherence to treatment plans and improved health outcomes. Healthcare providers equip patients with RPM devices and grant access to health data, fostering a sense of responsibility and involvement. This enables patients to manage their health conditions, track vital signs, and communicate effectively with healthcare providers, ultimately boosting overall satisfaction and adherence to treatment plans.

d) Medical Resource Optimization

Healthcare providers can prioritize high-risk patients and allocate resources more effectively by utilizing real-time data through RPM services. This approach not only enhances medical efficiency but also minimizes unnecessary resource usage, thereby significantly improving the quality of medical care.

e) Reduced Healthcare Costs

RPM services offer healthcare providers significant cost-saving opportunities by enabling early intervention, reducing hospitalizations and promoting proactive management of chronic disease. By reducing emergency room visits and hospitalizations, RPM can help healthcare providers reduce the burden of complications and emergency care. This results in enhanced resource allocation and alleviates financial burdens on patients and healthcare systems.

II. Benefits of RPM Services for Patients:

RPM services offer numerous benefits for patients, including increased convenience, improved access to healthcare, enhanced quality of care, and better management of chronic conditions. By allowing patients to monitor their health from the comfort of their own homes and providing real-time access to healthcare providers, this leads to better health outcomes, reduced hospitalizations, greater engagement, and awareness of their health.

a) Convenient and Better Disease Management

RPM services allow patients to conveniently monitor and manage their health conditions from their own homes. This not only reduces the need for frequent visits to hospitals or clinics but also saves

time and travel costs for patients. Furthermore, RPM services allow for better healthcare management through regular monitoring of vital signs and health data. The patients can detect changes or trends in early stage, which enables proactive measures to reduce complications and the ability to maintain optimal health.

b) Improved Quality of Life

RPM services can improve patients’ quality of life by empowering them to take a more active role in managing their health. With timely interventions and increased oversight of their health metrics, patients often feel more in control, which can reduce the stress and anxiety linked to their chronic conditions.

c) Real-time Intervention

RPM enables healthcare providers to receive patients' data in real-time, allowing for timely medical intervention. This real-time monitoring and intervention can help prevent health conditions from worsening, reducing the need for hospitalizations and emergency room visits, and ultimately improving patient outcomes.

d) Enhanced Self-management

RPM services empower patients to actively participate in their own healthcare management process. By regularly monitoring their health status and receiving feedback from healthcare providers, patients can make informed decisions about their health and take proactive steps to manage their conditions effectively, leading to improved self-management skills and confidence in managing their health.

C. Models of RPM Services Defined By CPT® Codes

RPM services encompass a range of healthcare monitoring and management activities, which are classified and billed according to CPT reimbursement codes. The following table lists the CPT codes representing various RPM services and their descriptions:

CPT code	RPM Services Descriptions
99453	Initial Setup, Patient Education and Patient Consent. The RPM services under CPT code 99453, includes both the setup of devices and patient education on utilizing devices for RPM. This CPT code also accounts for the time dedicated to the initial setup process, providing the initial explanation of the care plan, demonstrating the functionality of any included devices, and establishing a treatment schedule.
99454	Data Collection CPT code 99454 pertains to the monthly remote monitoring of patients, which includes the provision and utilization of medical devices for remotely collecting and tracking patient-generated health data. Patients need to use the monitoring medical devices and transmit at least 16 days of measurement readings within a month. This primarily refers to the transmission of measurement data and does not include the time spent on patients’ education or device setup. Additionally, healthcare providers must set up system alerts for extreme readings and missed measurements to streamline monitoring and care.
99457 99458	Patient Monitoring and Interaction CPT codes 99457 and 99458 includes reviewing patient readings, maintaining and recording

CPT code	RPM Services Descriptions
	care plans and notes, as well as engaging in interactive calls with patients. Meanwhile, CPT 99457 covers the initial 20 minutes of monitoring period in a month, while CPT 99458 covers each additional 20 minutes period thereafter.
99091	Data Analysis from Physicians. CPT code 99091 covers essential tasks in RPM. It includes 30 minutes of clinical time between patients and physicians per month for interpreting the transmitted readings, along with at least one face-to-face communication via office visit or video telehealth.

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Materials and Methods

Providers and study site:

A cardiology consultant group, located at Lake Success, NY 11042

Devices:

FORA D40g 2-in-1 Blood Glucose plus Blood Pressure Monitoring System

The FORA D40g, a cellular enabled 2-in-1 blood pressure + blood glucose monitoring system, was given to select patients based on cardiology consultant criteria during the enrollment process. The D40g was used to track and analyze the systolic and diastolic blood pressure, and pulse rate of patients over a specific time frame. After the measurement was taken by the patient, the D40g automatically uploaded the health data to the FORA 24/7 HealthView platform via cellular technology. To understand how the Remote Patient Monitoring program and the D40g was used to benefit patients over time, the following steps must be followed.

Patients were selected based on the following policy and procedure.

A. Patient Enrollment

Existing policies and procedures were established as followed to identify eligible participants with hypertension and other comorbidity, such as diabetes. and enrolled patients into the RPM program.

Step 1: Patient Identification and Selection

The physician in charge has identified patients based on their health conditions or disease state and compliance for enrollment in RPM. Insurance eligibility was determined by whether the patient's insurance would cover remote patient monitoring.

Step 2: Education and Consent

Participants were provided with educational materials about RPM, including benefits, usage instructions, and compliance rules, to ensure the physician has discussed the RPM program with the patient, obtained verbal consent for enrollment based on their condition or disease state.

Step 3: Obtain Doctors Order

The physicians in charge would write an order to enroll patients into the RPM program based on their health conditions, disease state, compliance, and insurance eligibility to ensure coverage for remote patient monitoring.

Step 4: HealthView Data Collection

A monitoring provider creates a patient profile in FORA 24/7 HealthView, provides a device to the patient, and records the device serial number, the physician's name, and the written or verbal consent for RPM enrollment.

Step 5: Patient Training

Before participant left the doctor's office, ensured the device was properly connected to the FORA HealthView platform for data transmission, educated the patient on accurate measurement techniques, set expectations for the device usage frequency, and obtained consent for a minimum of 16 readings and monthly phone or email check-ins. Non-compliant participants would be excluded from the program.

Step 6: Program Initiation

Participants took their first reading with the monitoring provider staff member to ensure accurate data transmission as the proof of the initiation of the RPM program while they were still in the office.

B. Monitoring and Documentation

The objective of this step is to effectively monitor health metrics, ensure patient compliance, set out-of-range parameters as ordered by the physician, and document all patient interactions.

Step1: Defining Roles

Selected among the staff with monitor roles such as:

1. Alerts and Alarms Management
2. Patient Compliance
3. Disease State
4. Tracking Minutes and Data Transmissions
5. Medication Management and Referrals

Step 2: Program Amendments

If any modifications were needed to a patient's monitoring program, scheduled an in-person follow-up visit within 4 to 6 weeks to ensure continuity of care and proper adjustment to the updated program.

Step 3: Billing

Caregivers monitored patient uploads to ensure compliance with the 16-day requirement set by the Centers for Medicare and Medicaid Services (CMS)⁴ and recorded patient conditions, service time, and interactions to provide the necessary documentation for RPM program requirements. Monthly billing summaries were then generated to cover both device and care services.

C. Patient Communication

All staff members followed cardiologist's protocol and complied with HIPAA regulations when communicating with a patient. Before interacting with the patient, staff should familiarize themselves with the patient data to understand the reasons for RPM program enrollment and ensure the accuracy of the

information in FORA HealthView, including date of birth, condition or disease state, follow-up appointments, and medication. The monitoring provider contacted the patients after the first week of enrollment in the RPM program, maintained ongoing communication to highlight the benefits of RPM services and encouraged program compliance for better health management. The providers called the participants once a month to check their well-being, handled refill requests, reviewed program compliance, and follow-up appointments.

D. Data Analysis

From 2018 to 2024, a total of 736,134 blood pressure data of 2,509 participants in this study were tracked and analyzed. Since each patient could join the program at different times, each participant's first data upload was treated as "The First Day in the Program" and the total "Enrolled Days" for each participant were determined. The number of weeks enrolled for each participant were calculated by the total number of days participated and divided by seven, which is the total number of weeks the participants were in the program. The average of systolic and diastolic blood pressure data of each week for each participant was analyzed. The clinical outcome was determined based on the comparison to the first week each participant was enrolled in the program. The following trend charts were made based on the average values.

Results

A. Systolic Blood Pressure

More than five years of follow-up data showed that participants' average systolic blood pressure began to be significantly under control within three months of joining the RPM program and remained stable or decreased slightly between one and four years after joining the RPM program (Figure 1. and Table 1.).

Figure 1. Trends in average systolic blood pressure after joining the RPM program by week.

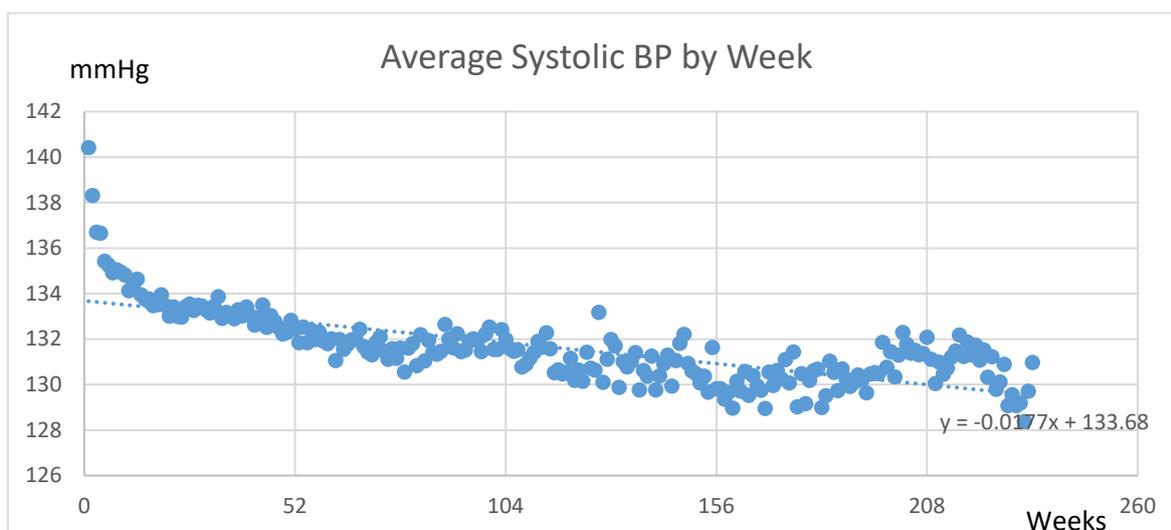


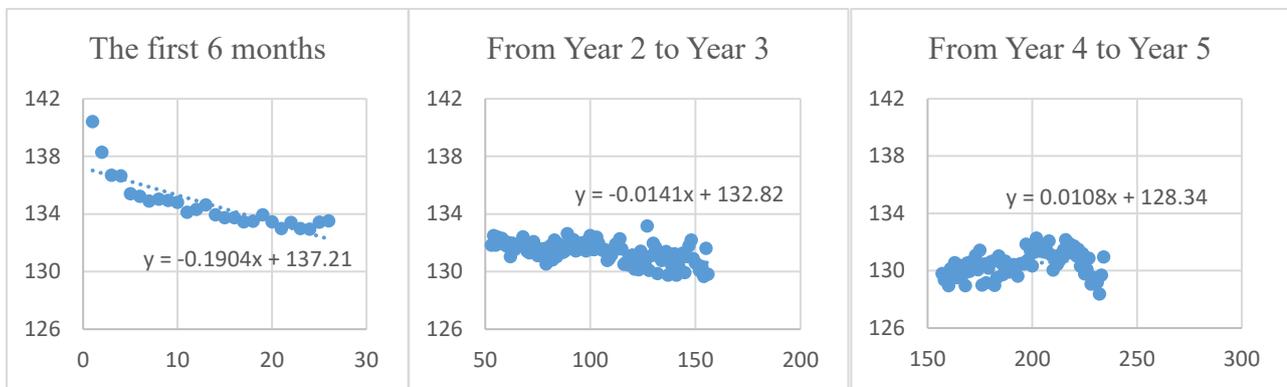
Table 1. Comparison of average systolic blood pressure differences between the first week and different time points after joining the RPM program up to the first 52 weeks.

Week Number in the program	Systolic Blood Pressure (mmHg)	Difference from the first week (mmHg)
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	Mean	Max	Min	SD	
1	140.4	224	85	±17.4	—
4	136.7	214	92	±15.3	-3.7
8	135.0	210	87	±15.2	-4.4
12 (3 months)	134.3	202	87	±14.7	-6.1
26 (6 months)	133.5	201	92	±14.2	-6.9
52 (1 year)	132.4	200	97	±13.9	-8.0

Follow-up data over five years showed that participants' average systolic blood pressure began to be significantly controlled within the first six months of joining the RPM program (regression slope: -0.1904) and stabilized after 2 years of joining the RPM program (regression slope: -0.00141 for 2nd to 3rd years and 0.0108 for 4th to 5th years) (Figure 2).

Figure 2. Trends in average systolic blood pressure after joining the RPM program by different time points.



B. Diastolic Blood Pressure

Follow-up data over five years showed that participants' average diastolic blood pressure began to be significantly controlled within the first six months of joining the RPM program (regression slope: -0.1186) and remained stable between the second and third years of joining the RPM program (regression slope: -0.0024). Average diastolic blood pressure began to gradually decrease in the third year after joining the RPM program (regression slope: -0.0373) (Figure 3. and Figure 4.).

Figure 3. Weekly trends in average diastolic blood pressure after joining the RPM program.

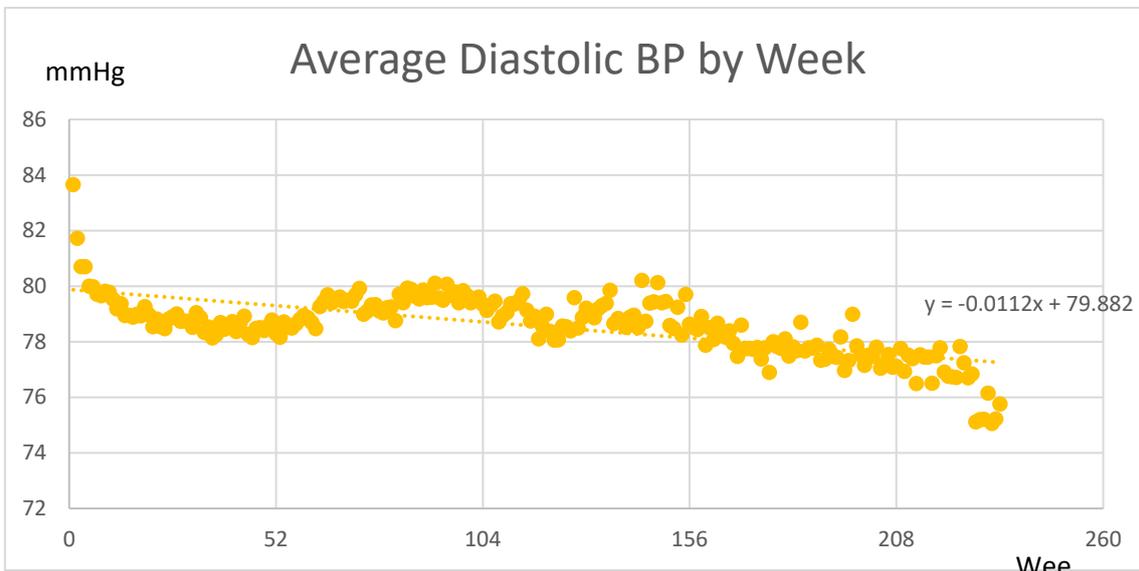
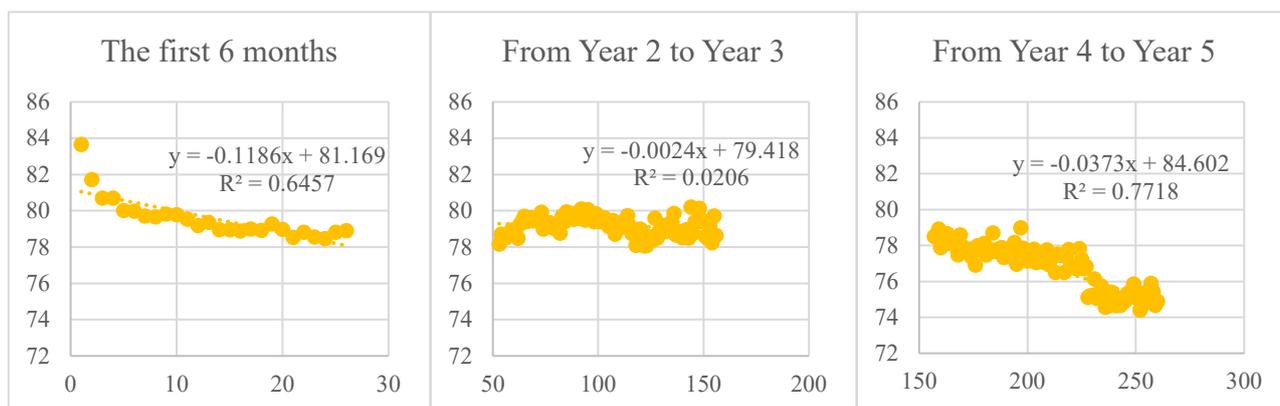


Figure 4. Trends in average diastolic blood pressure after joining the RPM program by different time points.



Conclusion

The 7-year study with a total of 2,509 participants demonstrated that both systolic and diastolic blood pressures were significantly under control within three months after enrolling into the RPM program and remained stable or even continued to decrease slightly between one and four years after joining the RPM program. In addition, the results indicated an average reduction of 8 mmHg in systolic blood pressure during the first year of the Remote Patient Monitoring (RPM) program. Furthermore, the combination of cellular technology with RPM services effectively involved patient participation in self-measured blood pressure monitoring. This RPM program also showed that medical staff could interact with patients with hypertension easily and reach short-term and long-term blood pressure goals. In conclusion, ForaCare's RPM mobile health technologies combined with cardiology consultant's medication policies and practice protocols significantly reduced patients' blood pressure readings resulting in improved patient health outcomes.

References:

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