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At the Tipping Point: Remote Patient Monitoring's Potential to Revolutionize Health Care Delivery

Center for **Connected** Medicine

Imagine a world where health monitoring is as seamless and routine as getting out of bed in the morning and drinking a cup of coffee. From birth to our last day on earth, individuals are connected to an always-on yet passive network of sensors, wearables, and digital devices that continuously track our vital signs, our developmental milestones, and our emerging health conditions. The system doesn't just monitor us, it communicates directly and silently with AI-powered health monitoring systems under the watchful eyes of trained clinicians and providers that analyze the data in real-time and direct us and our health care providers to act accordingly. The system also builds a rich view of patients and insurance members that leads to better understanding of their health, long-term wellness, and condition management. This is a foundational element of population health.

With the rise of sophisticated bio-peripherals, implantable devices, and multi-channel sensors, this remote patient monitoring (RPM) network anticipates issues before they surface, enabling greater insights of the health of patients and members. Readings that are out of line with a patient's and member's baseline health metrics — a small yet noticeable elevation in blood pressure or intermittent, unnoticed irregular heart rhythms — are identified early as subclinical signals of trouble, triggering proactive preventive measures or care adjustments based on one's genetic profile, lifestyle, health history, and other factors. Complex and adaptive AI algorithms, trained on billions of case studies, clinical scenarios, and data points can distinguish between what are benign fluctuations of biomarkers and what are early signs of emerging health conditions, to notify the individual and their health care provider only when intervention or action is truly needed.

Are we at this level of universal, predictive health care today? No, but we're rapidly approaching a world where payers and providers can offer individualized, lifelong care at a tremendous scale. However, realizing this vision will require a fundamental shift in health care models, roles, and engagement with patients. RPM has made significant progress during the last decade, but there could be so much more to come.

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Introduction

The Center for Connected Medicine (CCM) is focused on highlighting transformative health care trends, and today, one of the most significant shifts is happening through the development, integration, and adoption of artificial intelligence (AI) and remote patient monitoring (RPM) technology and systems.

Health care systems in the U.S. continue to face a barrage of entrenched and emerging care challenges including heightened demands and financial pressures that put sustainability into question, and shifting patient expectations about how a health care system cares for them. A wider adoption and more universal acceptance of RPM offers a promising solution by means of enhancing access to care, expanding preventive measures, and improving outcomes for many acute care and chronic health care needs. By allowing providers to monitor patient health metrics behind the scenes, whether in real time or asynchronously, without the in-person visits to existing brick-and-mortar locations, RPM has the ability to extend care beyond traditional health care settings and modes of operation. RPM also drives benefits to payers by supporting of care management, better managing chronic diseases, and helping with care-gap closure rates.

Make no mistake, though, the precepts and utility of RPM have just as much potential application to in-hospital care monitoring as it does for at-home or outpatient care. This is an important aspect to highlight, one that often is either glossed over or left out of the conversations around where, when, and why RPM ought to have a presence.

So, what is RPM? First, consider that RPM is often misunderstood or misconstrued. Unlike telemedicine, which involves direct virtual interactions between providers and patients typically via video calls, RPM can collect patient data passively and asynchronously through any number of devices or platforms that can reliably connect to broadband internet or high-speed cellular networks. This patient data can be shared with health care providers who can review and act on it without requiring a live patient-provider interaction. RPM's potential lies in its ability to enable proactive, preventive care and enhance chronic disease management through continuous, data-driven insights at scale. Additionally, AI is scaling RPM and fundamentally transforming its capabilities. This construct also applies to in-hospital care, though with different ends or applications.

With advances in consumer electronics and high-speed wireless networks, advanced data analytics capabilities, AI and algorithms capable of processing vast troves of data, and wearable technology, RPM is becoming more feasible and accessible.

The devices and technologies that can be wielded to bring RPM to the masses already exist with numerous benefits. They are nearly universal in adoption and acceptance, and don't cost health care systems time, effort, and capital to create or figure out how to get into the hands of patients. That work has been done for health care systems by tech companies such as Apple® and Google®, Fitbit®, and many others.

Yet, despite its readily understood promises and growing body of evidence around its efficacy, RPM adoption has been slower than anticipated due to a wide range of factors — technological, operational, reimbursement challenges, inertia, lack of imagination, and others.

This CCM report explores RPM's evolution, current role and impact in health care, the barriers that continue to hinder its more widespread use, and the innovations that could further expand its adoption — at small and large scales.

The CCM wishes to acknowledge the contributions of Andrew Watson, MD, MLitt, FACS, FATA, who shared his valuable insights and extensive experience in the development of this report. Dr. Watson is an actively practicing surgeon, senior medical director at UPMC Health Plan, and leader in developing telemedicine and remote patient monitoring strategy across UPMC. He is also the past president of the American Telemedicine Association. Our sincerest thanks.

The Growing RPM Market

The market for RPM technology and services is expanding rapidly as health care systems, faced with rising patient volumes and increasing chronic disease rates, invest in technologies and data infrastructure that support proactive, continuous patient care. Growth also is being driven by payer demand for complete data sets that enable more effective care management, chronic disease management, and risk adjustment. Globally, the RPM market was valued at approximately $71.9 billion in 2023, with projections to reach $207.5 billion by 2028. This market value represents the total revenue generated by companies involved in producing RPM technology — such as wearable devices, monitoring equipment, and software — as well as services that support RPM infrastructure in health care systems.

Drivers of RPM demand include its value in chronic disease management, such as diabetes care, where continuous monitoring can play a central role in how well patients are able to self-manage their condition and avoid the more severe consequences to long-term health from suboptimal glucose control. Diabetes management efforts through RPM-type methods has seen fairly broad adoption, with approximately 47% of type 2 diabetes patients reporting better health outcomes via RPM. Health care providers and payers are increasingly viewing RPM as a means to reduce costs by minimizing in-person visits, enhancing patient outcomes, and alleviating the strain on scare health care resources, particularly the shortage of specialists available relative to an aging population and the increasing percentage of people with chronic or multiple complex health care needs.

In the U.S., hospitals currently make up the majority of RPM adoption, but the home health care sector is projected to grow at the fastest rate through 2031. This growth reflects RPM's potential in home-based care, allowing patients to manage health conditions from their environments.

From a global perspective, North America leads RPM adoption due to established health care infrastructure and supportive reimbursement policies, but other regions of the world are likely to grow at similar rates due to expanding health investments and aging populations with lots of chronic medical needs.

As RPM continues to gain traction, driven by patient acceptance, advances in AI, cost-effective wearable technology, and improved data analytics, the stage is set for a future where real-time, patient-centered monitoring becomes one of the central pillars of health care across the lifespan.

Technological Foundations and Early Promise

RPM initially gained attention as a tool for managing chronic conditions, reducing readmission rates, and decreasing emergency room visits, all of which offer significant benefits to patients, payers, and the health care system.

The earliest iterations of RPM technologies were designed to provide patient data to health care providers in real-time, enabling early interventions for patients at risk of complications from chronic conditions such as diabetes, hypertension, and heart failure.

Technological advancements in consumer electronics — such as smartphones, wearable devices, and mobile apps — have enhanced RPM's accessibility. Devices such as blood pressure cuffs, glucose monitors, and pulse oximeters can now integrate seamlessly with mobile platforms, allowing patients to transmit data to their health care providers with minimal effort.

The consumer electronics industry's role in RPM has been and will continue to be instrumental in making the initial setup costs affordable. Wide availability of reliable consumer devices and broadband enables health systems to implement RPM on a larger scale by reducing the need for specialized hardware solutions and the costly infrastructure needed to support that kind of framework.

The following sections lay out the role RPM has had in health care and signals opportunities for the future impact could be with dedicated attention and investment.

Cost-effective, Scalable, and Asynchronous

RPM's potential for scalability can allow providers to manage larger patient populations with richer data sets without requiring a proportional increase in clinical resources. By shifting certain aspects of care to a digital platform, RPM reduces the need for in-person visits, ultimately lowering health care costs. The projected growth in the RPM market reflects this trend, as health systems and payers seek more efficient methods to deliver chronic care.

RPM empowers patients and members to take control of their health management on their schedule, which has proven especially valuable for those with complex health needs. A 2023 report from Healio revealed a 300% increase in RPM adoption among providers between 2021 and 2023, with significant gains in patient satisfaction and health outcomes. By allowing patients to monitor and transmit their data without in-person appointments, RPM can support the shift to more patient-centric care models, especially when it comes to managing the existence of multiple chronic conditions and comorbidities.

Clinical Outcomes and Quality of Care

Many studies conducted to date show that RPM affords substantial efficacy in helping to manage certain chronic diseases, including hypertension, heart failure, diabetes, and COPD. For example, a 2024 published study in JAMA Network Open on remote blood pressure monitoring found RPM's structured care approach reduced emergency visits and improved long-term outcomes for patients at risk of hypertension-related complications. Similarly, a systematic review published in BMJ Open in 2021 documented that RPM reduced hospital admissions by 21% for chronic disease patients, which highlights its ongoing role in preventing or mitigating acute care episodic needs.

UPMC Case Study: Postpartum Hypertension Monitoring

UPMC's postpartum hypertension monitoring program is a prime example of RPM's potential to enhance patient care, especially in high-risk populations. Developed to support mothers at risk for postpartum hypertension complications, this ongoing RPM initiative remotely monitors blood pressure from hospital discharge through six weeks postpartum, the most critical period after giving birth when the risk of hypertensive disorders can be significant.

Patients enrolled in the program receive remote blood pressure monitors and regular prompts to measure their blood pressure at home. Data is automatically transmitted to health care providers who track patients' metrics and adjust treatment as needed without requiring in-person visits. This approach reduces the burden on new mothers and provides clinicians with consistent and timely data to support interventions.

In the first published study on the program — in Obstetrics and Gynecology in 2019 involving more than 400 participants — the program demonstrated high compliance, with 88% attending follow-up appointments and 94% of patients expressing satisfaction with the RPM model. Nearly half of the participants in the study required remote adjustments to their antihypertensive medications, underscoring RPM's effectiveness in managing conditions remotely. By allowing for proactive treatment adjustments, the program helped prevent severe complications and reduced the need for emergency interventions or readmissions.

The UPMC postpartum hypertension RPM program exemplifies how RPM can be tailored for specific conditions and high-risk periods, significantly improving access, convenience, and quality of care. Since it was created, the program, one of the largest and most successful use cases of RPM to date in the U.S., has tracked more than 1.7 million care days. Results such as this support the potential for similar RPM applications in other post-acute and chronic care settings where proactive monitoring can reasonably be assumed to reduce complications, enhance patient satisfaction, and improve long-term health outcomes.

> "Postpartum hypertension is one of the most preventable complications of pregnancy — when it's caught early. RPM has been instrumental in helping us stay ahead of the curve with timely interventions. Not only that, but patients also report feeling more connected to their care teams through RPM, demonstrating how remote monitoring can bring personalized care to patients wherever they are."
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> **Andrew Watson, MD, MLitt, FACS, FATA**
> **UPMC**

Barriers and Limitations to Widespread Adoption

As RPM technology continues to demonstrate clinical and operational benefits, its broader integration into health systems faces substantial hurdles. While RPM has shown value in targeted, high-risk applications, such as UPMC's postpartum hypertension program, scaling these successes into standard practice reveals several key obstacles. Barriers to RPM adoption arise across operational, technical, and regulatory dimensions — each contributing to a health care system that is currently biased toward traditional, in-person care models.

One of the largest challenges lies in adapting clinical operations to manage RPM's continuous, asynchronous data flow. Traditional health care relies on synchronous interactions between patients and providers, while RPM requires new workflows that can handle regular monitoring and data-driven alerts on a scalable level. RPM forces payers and providers alike to rethink how to react to data, using touch and tune digital interactions in short order to handle questions instead of sending members to the emergency room. This rethinking can also apply to the use of in-home urgent care or short video visits to check on patients or members displaying out-of-range data. Beyond operational structures, RPM adoption is further hindered by limited reimbursement models, regulatory inconsistencies, and issues with interoperability across devices and electronic health record (EHR) systems.

Together, these barriers reveal the need for both organizational change and policy evolution to build a system where RPM can operate sustainably at scale. Addressing these areas will be essential for RPM to realize its full potential as a transformative tool in health care.

Integration into Existing Health Care Systems

For RPM to become a standard of care, health systems must incorporate RPM data into routine workflows, allowing clinicians to monitor and act on data seamlessly. Without such an operational model, RPM data can become an additional burden, with continuous data streams demanding attention from clinical staff. Some health systems are beginning to allocate dedicated "RPM review blocks" in clinician schedules, integrating RPM data directly into EHR systems to streamline review. Dedicated call centers also can help to triage alerts and handle out-of-range data to ensure safe and immediate care.

Reimbursement and Financial Viability

Reimbursement policies continue to be a critical barrier to RPM's sustainability. Although the Centers for Medicare and Medicaid Services (CMS) and private payers are introducing new reimbursement codes for RPM services, rates often do not fully cover the costs of monitoring. A 2024 report from Healthcare IT News indicated that upcoming CPT codes might support RPM's expansion financially by better-aligning reimbursement with service needs. However, broader financial viability will likely depend on integrating RPM into value-based care models that reward preventive, cost-saving measures.

Addressing Health Equity

While RPM has the potential to expand access to care, disparities in access remain a concern, particularly for low-income and rural populations with limited broadband access. Policy initiatives that promote broadband access and support digital health technologies for underserved communities are essential to ensure RPM's benefits reach diverse populations and do not exacerbate health inequities.

The Necessity of a Comprehensive Clinical Operations Model

To fully realize the potential of RPM at scale, a dedicated and structured clinical operations model is a mandatory requirement for any individual health care system looking to broadly implement RPM tools for large swaths of its patient population. Traditional health care models are built around synchronous patient interactions, where clinicians interact directly with patients in real-time in an office, clinic, hospital, or another care setting.

RPM deployed at scale generates continuous, asynchronous data, which introduces multiple new demands for data monitoring, triage, and timely intervention. The traditional models and modes of health care simple are not designed to incorporate RPM at systemic levels.

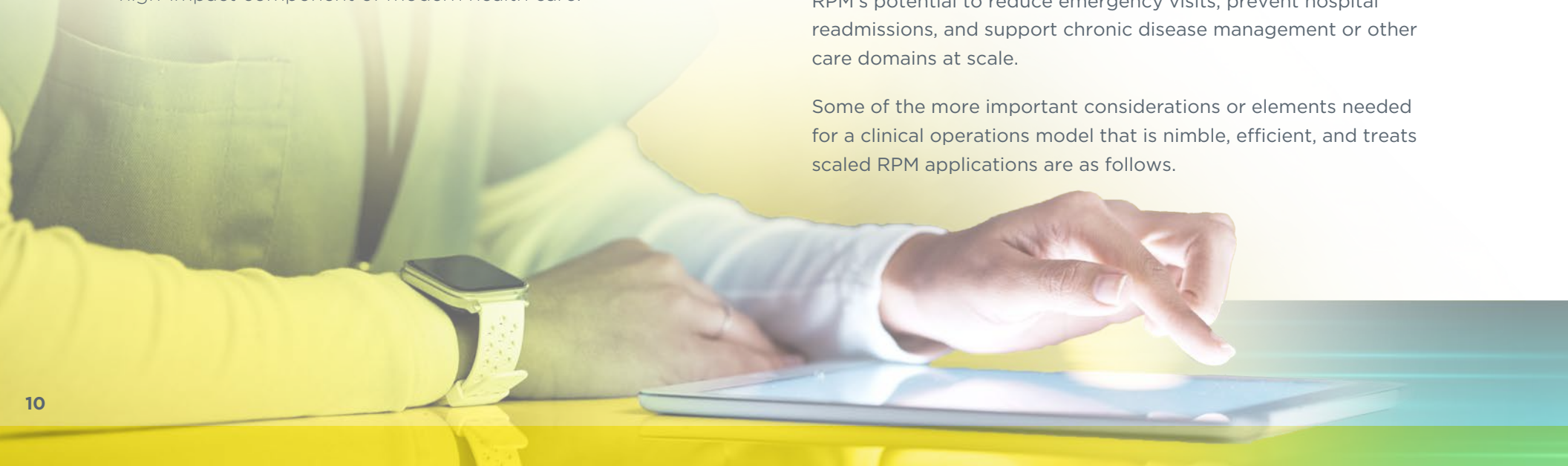
These new demands require developing a clinical operational framework that effectively integrates RPM data into care routines, and that can enable RPM to function as a sustainable, high-impact component of modern health care.

The Rationale for a Dedicated RPM Model

Unlike traditional care settings, RPM generates a steady stream of real-time data that often requires immediate triage and response, 24 hours a day and outside of regular clinic hours. Without a specialized model to manage these continuous inputs, health systems face risks such as data overload, alert fatigue, and clinician burnout, not to mention lapses or lags in patient care needs and their downstream consequence. A dedicated RPM operations framework addresses these challenges by structuring roles, workflows, and resource allocations specifically for the use of RPM, ensuring that data is processed efficiently, and interventions occur when needed. Further, the addition of AI in RPM systems will significantly reduce operational burden and cost of daily work.

By developing such a model, health care systems can utilize RPM data proactively, identifying early warning signs before they escalate, optimizing patient care without increasing workload, and maintaining focus on high-priority cases. This approach enhances RPM's potential to reduce emergency visits, prevent hospital readmissions, and support chronic disease management or other care domains at scale.

Some of the more important considerations or elements needed for a clinical operations model that is nimble, efficient, and treats scaled RPM applications are as follows.



Key Components of an Effective RPM Operations Model

Dedicated Monitoring Roles: An efficient and smooth operating RPM operation requires designated roles specifically focused on managing data. For instance, coordinators or monitoring specialists can oversee patient data as it flows into the system, allowing for efficient triage and prioritization of alerts. These specialists act as the first line of data monitoring, reviewing information, and determining when clinician intervention is necessary. In such a model, clinical staff are only notified of high-risk alerts, reducing the risk of alert fatigue and freeing them to focus on direct patient care.

Structured Workflow and Data Triage Processes: A centralized workflow model, akin to an "air-traffic control" system, is an appropriate analogy for the continuous, systematic monitoring of RPM demands. RPM coordinators, trained to assess health data trends and modeling output, can manage and flag potential risks without immediate physician oversight. Data can then be routed according to risk level or other factors determined in advance, with moderate alerts forwarded to nursing staff and high-risk alerts escalated to the primary care or subspecialist team. This stratified approach can ensure patients are monitored effectively while keeping clinician involvement targeted and manageable.

Clinician Training and Time Allocation: For RPM to integrate smoothly, clinicians must be specifically trained to work within this type of model. RPM data interpretation, triage processes, and remote patient engagement techniques differ from traditional patient interaction skills taught during medical school and training and refined through experience. In addition, clinicians require allocated time to review RPM data, ideally within a structured "RPM review block" in their schedules. Creating dedicated time for RPM tasks in clinical schedules is required to avoid overburdening staff and ensure consistent patient monitoring over time.

Continuous Evaluation and Iterative Improvement: Implementing an RPM operations model requires continuous evaluation to identify workflow bottlenecks and improve triage efficiency. Regular assessments, feedback loops, and data quality checks are essential to refining the RPM process over time, ensuring it remains aligned with patient needs and clinical capacities.

> "The missing link in RPM's evolution is the absence of a robust clinical operations framework. While the technology is ready, the structures for integrating it seamlessly into routine clinical workflows are yet to be built. If we can accomplish this — and AI is essential to managing the data — we'll address alert fatigue and burnout while empowering clinicians to focus on patient care and make decision proactively, not reactively."
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> **Andrew Watson, MD, MLitt, FACS, FATA**
> **UPMC**

Future Directions and Potential

As RPM technologies advance, the ability to continuously monitor patients in real-time, paired with predictive analytics, holds promise for more proactive and preventive care models. This future vision of RPM is grounded in extending care beyond conventional clinic walls, utilizing wearables, AI, and streamlined data to make care more responsive and personalized. This is truly swimming upstream in health care's journey to better health and wellness, as payers and providers strive to catch problems earlier and prevent avoidable problems through awareness.

By expanding RPM into new areas, such as acute and in-hospital care, health systems are discovering additional applications that enhance patient safety and outcomes.

RPM's Role in Acute and In-Hospital Care

Traditionally, RPM has been associated with outpatient and chronic care. However, in-hospital applications, often referred to as "surveillance monitoring," are gaining attention for their ability to provide continuous, background monitoring in general wards. Instead of relying on intermittent checks, RPM in acute care settings can capture patient metrics — such as oxygen saturation and heart rate — in real time. This model allows clinicians to respond faster to early signs of deterioration, addressing risks like sepsis, respiratory distress, or arrhythmias before they escalate.

A 2023 pilot program implementing RPM for general care wards demonstrated its value in improving response times while minimizing "alarm fatigue." By filtering alerts based on severity, RPM systems can help clinicians focus on the most pressing cases, leading to safer, more efficient patient monitoring.

Expanding RPM into in-hospital care also supports high-risk populations, such as postoperative patients and those receiving sedatives, by providing a safety net that detects potential complications early. This possible broader use of RPM reflects its value as a continuous care model regardless of the setting in which its used, integrating preventive measures across outpatient and acute care environments.

Predictive Analytics and AI Integration

As AI capabilities advance, RPM's predictive analytics likely will allow providers to forecast health issues before symptoms emerge. Future systems may leverage vast datasets, combining patient history, real-time health metrics, and AI-driven insights to identify risk factors that signal early deterioration. For example, RPM systems equipped with AI could detect subtle signs of sepsis, acute kidney injury, or respiratory distress in a hospital setting, enabling earlier, life-saving interventions.

Predictive capabilities are expected to become a standard feature of RPM platforms by 2027, enhancing the ability of health systems to prevent acute episodes and manage chronic diseases in outpatient settings more effectively. In both outpatient and in-hospital settings, this predictive element can help optimize resources, reduce emergency interventions, and improve patient outcomes.

Expansion of Wearable and Consumer Technology

The role and use of wearable devices are going to grow within mainstream health care and in RPM programs, providing an accessible, less intrusive way to monitor vital signs continuously. For in-hospital applications, wearables offer a practical solution for monitoring patients in medical and surgical units, reducing the need for stationary monitoring equipment. Patients in rehabilitation or postoperative care can also benefit, as wearables allow health care teams to track their recovery without patients being attached to stationary hardware.

Analysts project that by 2027, wearable technology will be incorporated into 60% of RPM programs, creating new opportunities for proactive, real-time monitoring across both acute and outpatient settings. This wearable integration aligns with RPM's broader trajectory to offer data-driven care while improving patient comfort and mobility.

Policy and Regulatory Evolution

Satisfactory and sustainable regulatory frameworks and reimbursement policies are needed to ensure the large-scale future viability of RPM systems. In the U.S., CMS has introduced several new RPM reimbursement codes in recent years, and experts expect this trend to continue as RPM as a discipline matures and its use becomes more widespread. At the federal policy level, in the upper echelons of the CMS, there appears to be clarity of vision around the benefits of adopting large-scale RPM efforts, but it will take time for this vision to be translated into concrete policy and rules changes favorable to accelerating broad adoption of RPM efforts and health care systems being adequately compensated for the work. Additionally, federal and state policies that support broadband access, high-speed wireless connectivity, and digital health adoption will continue to be needed in order to ensure equitable RPM accessibility and sustainability across diverse patient populations, geographies, and time scales.

Conclusion

RPM is at a transitional moment in how it may be harnessed to change how health care is delivered. With advances in technology and policy, RPM has the potential to transform health care into a more proactive, continuous, and data-driven field.

As RPM becomes more integrated into clinical workflows, its role in preventive care and long-term health management has every possibility to redefine health care as we know it. To achieve this vision, health systems, payers, policymakers, and technology companies must address the remaining substantive challenges, supporting RPM's evolution into a foundational aspect of modern health care.

The transformation means truly moving upstream in the care journey leading to the best possible early awareness of diseases, promotion of health, and prevention of unnecessary events. And as technology advances, including the use of camera-based blood pressure readings, the incorporation of speech into RPM, and camera-based medication reconcillation, health care will realize the next wave of RPM technological innovation.

Contributors

Andrew Watson, MD, MLitt, FACS, FATA, UPMC

Marc Poljak, Writer

Doug Freeman, Senior Manager of Digital Marketing, Center for Connected Medicine

Alex Nixon, Senior Research Analyst, Center for Connected Medicine

Val Harrison, Director, Center for Connected Medicine

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