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REVIEW

Reviewing the Advances in Remote Therapeutic and Physiological Monitoring and Applicability for Chronic Pain Management

One Hyuk Ra*, Brian S Sou*, Jocelyn Streid*, Derick Davis*, Juan Pablo Solano Romero*, Roderick King Jr*, Jacob Michael Lurie*, Kevin Vu*, David J Oh*, Christopher L Robinson*, R Jason Yong*, Ken WK Lee*, Mohammed Issa*

Department of Anesthesiology, Perioperative and Pain Medicine, Harvard Medical School, Brigham and Women's Hospital, Boston, MA, USA

*These authors contributed equally to this work

Correspondence: Christopher L Robinson, Department of Anesthesiology, Perioperative and Pain Medicine, Brigham and Women's Hospital, 850 Boylston Street, Suite 320, Chestnut Hill, MA, 02467, USA, Email christopherrobinsonmdphd@outlook.com

Abstract: Remote therapeutic (RTM) and remote physiological monitoring (RPM) in chronic pain management are new Current Procedural Terminology (CPT) codes introduced in the last decade in an effort to capture continuous patient data in the outpatient setting. RTM and RPM facilitate steady patient engagement and real-time data collection, offering a comprehensive overview into potentially both subjective patient experiences and outcomes and objective physiological measures. This review delves into the benefits of these technologies, including improved patient outcomes, and addresses challenges such as data security and technological literacy. Furthermore, examples from other specialties in medicine are given to draw possible conclusions of how it may be used in chronic pain. The potential of RTM and RPM to enhance chronic pain management is contingent upon careful consideration of ethical and regulatory issues and has the potential to provide the objective data that the field of pain may need.

Keywords: remote therapeutic monitoring, remote physiologic monitoring, chronic pain

Introduction

Remote therapeutic (RTM) and remote physiological monitoring (RPM) allow physicians and patients to interface while not being in the same physical location (Table 1). Both came into prominence prior to the COVID-19 pandemic. In 2019, Medicare coverage was first approved for RPM Current Procedural Terminology (CPT) codes with RTM to later follow in 2022 for non-physiologic monitoring.[1] The pandemic significantly increased their use, allowing healthcare providers to gain valuable physiological and self-reported data from their patients even when in-person visits were difficult or impossible to schedule.[2] In addition, RTM and RPM can signal to providers when physiological data may warrant timely intervention or indicate the success or failure of an ongoing intervention. Given the dearth of literature for chronic pain management, this review sets out to examine the applications of remote monitoring (RM) by drawing examples from other specialties and the needed information for accurate billing to properly utilize RM.

Applications of RTM

Tracking Outcomes

RTM enables patients to self-report numerous non-physiological data back to their healthcare providers (ie, physicians and non-physician providers), such as responses to therapy, adherence to exercise regimens, and functional status, primarily from applications on smartphones and other electronic devices, such as wearable devices. These data are usually not uploaded automatically, and the patient must provide this feedback themselves. One study among veterans

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Table 1 Overview of Key Differences Between RTM and RPM

	Remote Therapeutic Monitoring (RTM)	Remote Physiological Monitoring (RPM)
Devices (examples)	• Smartphone applications and tablets	• Electrocardiograph devices, blood pressure cuffs, and pulse oximeters
Data	• Non-physiological, patient reported	• Physiological
Billers	• Only physician providers	• Physicians AND non-physician providers
Descriptions	**CPT Codes**	
Initial setup and patient education	• 98975	• 99453
Collection, transmission, and report/review of data to/by provider	• 98976, 98977, 98978*	• 99454
RM services by provider (1st 20 minutes over 30-day period)	• 98980	• 99457
Additional 20 minutes of RM services	• 98981	• 99458
Interpretation of report	• 99091	• 99091

Notes: *98976 (respiratory), 98977 (musculoskeletal), 98978 (cognitive behavioral therapy). Data from these studies.[3,4]

with musculoskeletal pain examined a multi-pronged digital platform involving education, cognitive behavioral therapy, and prescribed exercises.[5] Exercises were monitored via motion tracking, allowing for treatment modifications and accountability.[5] Patients demonstrated significant improvements across all measured outcomes, including pain, function, and mental health.

Adherence

RTM can also encourage patients to adhere to therapeutic regimens by incorporating gamification into its user interface.[6,7] Some platforms use points and leaderboards to reward patients for active participation, introducing community support and competition to encourage adherence.[6] One application targeted patients after total knee or hip arthroplasty, rewarding patients with digital badges with every 5% increase in average step count from their baseline, and a randomized control trial demonstrated that the program decreased risk of rehospitalization.[8] These programs often also incorporate automated nudges to encourage participation, particularly when patients may have lapsed in therapy for more than a day or two.

RTM technology has been explored in surgical literature as a tool to encourage therapy adherence and access during the critical post-operative period. A systematic review examining RTM after total knee arthroplasty found that RTM-facilitated telerehabilitation allowed for personalized exercise regimens, graded increase of activity over time, and improved access to care in the setting of post-operative mobility limitations.[9] One randomized control trial that compared digitally based remote physical therapy to in-person outpatient physical therapy in post-operative total knee arthroplasty patients found no difference in function, pain outcomes, or patient satisfaction, while those in the RTM arm experienced the additional benefits of no additional expenses or travel time.[10]

Real-Time Pain Assessments

Accurate pain assessment is imperative to effective pain management. For example, conventional scales, such as the visual analog scale (VAS) and the numeric rating scale (NRS), remain useful but are limited by their episodic nature.[11] Moreover, traditional pain assessment methods, including periodic clinic visits and static questionnaires, offer limited insights into the dynamic nature of pain. Digital tools, such as mobile applications and wearable technologies, present

new opportunities for continuous pain assessment and collection.[12–14] When patients log pain intensity, location, and quality in real time, then data capture ensures that patient-reported pain metrics reflect their immediate experiences rather than retrospective estimations. This continuous monitoring method may allow for a more accurate understanding of pain patterns, triggers, and fluctuations over time.

Lastly, applications can track contextual factors, such as activity levels, mood, emotions and medication adherence, to develop a more granular picture of the multifactorial nature of pain and its evolution. Some examples of these pain monitoring applications include PainScale, which helps combine pain tracking with educational resources; CatchMyPain, allowing users to draw pain regions and document triggers; MyPainDiary, tracking multiple pain parameters and generates reports for clinicians, amongst others, SAiWELL that provides real-time health data that can connect to a multitude of FDA-cleared devices.[15]

Applications of RPM

Tracking Outcomes

RPM grants healthcare providers the ability to obtain real-time information pertaining to the physiological status of their patients, facilitating the transfer of critical vital signs, including oxygen saturation and heart rate, and a variety of other data, such as heart rhythm, body weight, and blood glucose. These data are often automatically sent to healthcare providers and allow for remote and real-time decision-making.[16] RPM utilizes wearable devices that detect vital signs, electrocardiograph devices, blood pressure cuffs, pulse oximeters, and other technologies that streamline the transmission of data to providers.[3] Wearable devices, such as Fitbit, have demonstrated high compliance and satisfaction among patients with operative spinal pathologies, suggesting such remote monitoring (RM) is feasible and could have clinical utility.[14]

Though still a relatively new application for healthcare providers, studies have demonstrated RPM's ability to track a multitude of physiologic parameters to aid in the management pain syndromes. One current study from investigators in Norway proposed a protocol for a randomized controlled trial that will utilize heart rate monitoring via wearable heart rate sensors to detect pain in non-verbal patients with autism spectrum disorder and intellectual disability.[17] Additionally, a case of a 46-year-old male patient with chronic low back pain from severe central and lateral recess stenosis at the L4/5 level due to a central disc protrusion was reported evaluating data over a two-year period. The patient wore an Oura ring with physiologic parameters collected including heart rate, heart rate variability, respiratory rate, step count, and sleep duration. The recorded physiologic data paralleled the subjectively reported measures of pain. Notably, certain objective measures aligned with specific key events in that two-year period. For example, daily average step count increased after the patient had undergone an L4/5 microdiscectomy.[18]

A study involving 46 patients with fibromyalgia assessed the impact of a yoga-based exercise program on a variety of outcomes, including sleep efficiency as measured by wrist actigraphy (Actiwatch 2). Although actigraphy did not detect a significant change in sleep efficiency, it was found that greater sleep efficiency after the program was correlated with decreased fatigue and increased self-reported physical activity.[19]

Real-Time Pain Assessments

Similar to RTM, RPM can also be used as an option to obtain more frequent and consistent information regarding patients' pain scores, and then potentially help guide outpatient treatment plans. For instance, investigators implemented the use of a home telemonitoring system in a group of 108 cancer patients. Those in the intervention group received text messages and automated phone calls to report their NRS pain scores with scores of ≥ 5 triggering an alert to a specialized oncology nurse to then contact the patient and assess the pain. Those in the telemonitoring group utilized more analgesic medication than those in the control group.[20] With the information provided by RM systems, some investigators are also developing models to help predict changes in pain. In a small group of patients who had undergone spinal cord stimulator implantation, primarily for low back pain, the physiologic data obtained from a wearable device (Apple Watch) was used to generate machine learning models to predict daily pain scores.[21]

In pain medicine, a key contributor to pain perception is sleep quality. A validity study evaluated six commonly used wearable devices: Apple Watch S6, Garmin Forerunner 245 Music, Polar Vantage V, Oura Ring Generation 2, WHOOP 3.0, and Somfit. All devices were found to reliably track sleep timing and duration.[22] In a systematic review, physiologic parameters such as heart rate and sleep patterns obtained from wearable devices demonstrated a positive correlation with self-reported pain scores.[23] The ability to provide continuous objective data may mitigate the inherent biases of numerical pain scales and provide a targeted management plan for each patient at each moment in time.

The integration of RPM into web-based and mobile health platforms enhances the patient experience by providing a digital map that synchronizes biometric data with patients' activity, pain intensity, and pain trajectory. A pilot study utilizing a mobile phone app, Pain ROADMAP, demonstrated clinically significant improvements in activity modification, productivity, pain intensity, and pain medication use.[24] Additional studies have revealed that phone applications with alarms that alert providers when certain parameters occur (either through RPM or patient-reported symptoms) improve overall pain outcomes through rapid detection and subsequent treatment adjustment and behavior modification, without affecting reported clinician burden.[25]

Billing

While RTM and RPM are currently separate entities in terms of billing and reimbursement and cannot be billed together by the same provider, there is potential for both forms of RM to be used in tandem or by separate providers to achieve more holistic, patient-centered care.[26–28] Currently, RTM and RPM can be billed concurrently with several care management services/providers, if time and effort are not double counted, including chronic care management, transitional care management, behavioral health integration, principal care management, and chronic pain management, allowing these services to integrate with other longitudinal care models.[29] Reimbursement is not without its limitations. Though some payors may mirror the requirements of Medicare, others may not cover or only cover RM for specific chronic conditions and restrict it to specific specialists.[30,31] Moreover, Medicaid only reimburses RM in roughly half of the states and has restrictions.[30] If not already overburden, proper documentation and following the specific set of requirements are needed to ensure reimbursement.[28]

Initially, patients will be set up with their devices, trained, and educated on the software and physical instruments, which must be defined by the FDA as medical devices and ordered by a qualified healthcare practitioner (Table 1). This initial setup and patient education are covered by CPT 98975 for RTM, which applies to only the respiratory and musculoskeletal systems. The initial setup and patient education for RPM are covered by 99453. These two programs offer distinct advantages; however, in general, for both forms of monitoring, it should be noted that their CPT codes require at least sixteen (16) days of data transmitted in a 30-day period. This pertains to at least one medical device, billed only once per provider, and per patient. Both are one-billable services per episode of care as defined by the initiation of the service and ending with completion of the targeted treatment goals.

The CPT codes pertaining to the review and monitoring of data again are different for RTM and RPM. However, both require that such parameters be collected over a 30-day period and neither require an in-person patient interaction. CPT code 98976 covers RTM for the respiratory system, whereas 98977 and 98978 cover the musculoskeletal system and CBT monitoring, respectively. These codes apply to the scheduled monitoring of the RTM device and supply. CPT 99454 applies to RPM for collection of physiologic data such as, but not limited to, pulse oximetry recordings, heart rate, and weight. These steps in monitoring help understand patient engagement and adherence to their therapies. Again, these codes can be billed every 30 days per patient, per provider when at least 16 days out of the 30 have been collected.

The first 20 minutes of management for RTM data are covered by CPT 98980 with each subsequent 20-minute increment covered by CPT 98981. For RPM, the initial 20 minutes of treatment planning is covered by 99457 and 99458 for each subsequent 20-minute interval. These CPT codes require that eligible providers who can bill Medicare (including, but not limited to physicians, nurse practitioners, and physician assistants and may vary by private payor policies) has an interactive, virtual communication with the patient or their caregiver.[28,32] Notably, if other evaluation or management services are provided to a patient, these CPT codes cannot be used on the same day. CPT 99091 is for the analysis, interpretation, and report of the data collected for both RTM and RPM. These CPT codes can only be billed once every 30 days.

Limitations

Confidentiality and Safety

Despite the potential benefits, there are serious concerns regarding confidentiality and the safe storage of protected health information. RM requires the transmission of sensitive information via a digital network, typically encrypted, and storage on web-based platforms, which are susceptible to breach of access, with currently no breaches as of date.[33] Confidentiality is of particular concern in the healthcare industry as it is among the sectors most affected by data breaches. In data collected by the Privacy Rights Clearinghouse from January 2005 to October 2019, the healthcare industry recorded the highest number of data breaches among all sectors studied accounting for over 50% of all data breach incidents.[34] Data breaches in the healthcare industry are the costliest of all industries, averaging more than $9 million per breach.[35] Adding to the complexity is the issue of legal liability when breached data is transmitted or stored with the services of third-party providers.

It is important to note that, with the physiologic data provided by RM systems, there are some important questions that will need to be asked regarding the role of pain providers in reporting abnormalities that may reflect potentially life-threatening pathologies. For example, in the REMOTE-AF trial, investigators compared a wearable device to an implantable loop recorder in the detection of atrial tachyarrhythmias.[36] Hypothetically, if a chronic pain patient with a wearable monitor developed a measurable and reportable cardiac arrhythmia, what role would the pain provider have in evaluating and triaging the patient? As the field continues to develop, these questions will hopefully have clearer answers.

Access

Concerns regarding poor technological literacy, limited device and/or internet access, and integration into existing workflows further limit the effective implementation of RM. Proficiency with technology is a frequently cited challenge in the successful implementation of telehealth and remote based care particularly in the elderly population.[37] Individuals ≥65 years of age represent a proportion of patients with ≥1 chronic conditions. Thus, their successful participation in RM programs is paramount to achieving full-scale implementation.[38] Mechanisms to combat this lack of proficiency include but not limited to providers spending more time with patients or having the representative of the company continue education if time or reimbursement are limiting factors.

Similarly, individuals with limited digital access represent a challenge to remote patient monitoring programs. In one study of over 105 million homes in the United States in 2019, 21% were without a smartphone with a data plan for wireless internet and 14% were without any digital access at all, with rural and low-income households most affected.[39] Solutions for increasing access include community outreach health programs, which may require state and federal funding to implement, or providing rebates or waivers for the wearables to make them affordable. Furthermore, integrating data from RTM and RPM into established systems may be burdensome and time-consuming if not appropriately designed with the proper infrastructure, leading to increased burnout rates among providers.[40] To combat this potential for burnout due to data overload, the monthly data reports and check-ins can be done by a third-party providing a streamlined report. Despite the possible added layer of work, survey data of primary care providers and patients demonstrated a generally favorable perception of RTM and RPM.[40,41] Solutions such as Embrace One facilitates RM and BioVantage provides the monthly check-in service for a nominal fee.[42,43] When the data is collected and the patient is contacted, a summary is provided to the provider in a concise manner that can be reviewed efficiently while minimizing the burden allowing for full utility of RM and increasing revenue for the practice.[42]

Ethical and Regulatory

Per Medicare guidelines, RM has three main components associated with separate codes and payments: patient education with device setup, device supply, and treatment management. A 2024 review performed by the Department of Health and Human Services found that 43% of Medicare patients who received patient monitoring did not receive at least one of these components, with 12% not receiving treatment management.[44] These findings

are concerning regarding the appropriate usage, fraud, and the need for greater regulatory oversight. As the rules and regulations of RM continue to grow and change, ethical considerations surrounding data ownership, particularly when third-party vendors are utilized, equity of access, and informed consent will remain critical topics of discussion.

Conclusion

With RTM and RPM, the care provided by pain physician can now extend beyond the walls of the clinic, providing real-time tracking and treatment responses, and another source of revenue to the provider. Despite these benefits, there are concerns regarding the safety and confidentiality of the data collected including equitable access to all patient groups. Concerns are justified in terms of data overload, but it is up to the reporting parties to develop readouts that enhance care not overload the physician. As the field advances, addressing ethical, regulatory, and safety considerations will be crucial to maximizing the patient's benefits of RM in chronic pain management while properly utilizing the data to support the continued reimbursement of these treatment modalities core to the field.

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It is amazing what you can accomplish if you do not care who gets the credit. - Harry S Truman.

Disclosure

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