

**COMPETITIVE LANDSCAPE AND MARKET ANALYSIS OF REMOTE
PATIENT MONITORING SERVICES IN US**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfilment for the award of the degree of
Master of Business Administration (MBA)

in

Hospital and Health Management

by

DR. RENNY THOMAS IYPE

Under the Supervision and Guidance of

DR. VINOD KUMAR

2022

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DECLARATION BY STUDENT

I hereby affirm that this dissertation titled “**Competitive landscape and market analysis of remote patient monitoring services in US**” is the bonafide record of my original work of research. I declare that it has not been approved/submitted to any other existing university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Dr. Renny Thomas Iype

(Signature)

Name of Student

Dr.Renny Thomas Iype

Date : 24.06.2022

CERTIFICATE

This is to certify that Dr. Renny Thomas Iype in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur has successfully completed his internship at IIHMR University during March 22, 2022 to June 19, 2022.

Dr. Vinod Kumar
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School Dean:
IIHMR University, Jaipur

Date :

Place :

CERTIFICATE

This is to certify that dissertation titled “**Competitive landscape and market analysis of remote patient monitoring services in US**” is a record of the work of research undertaken by Dr.Renny Thomas Iype in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

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ABSTRACT

Remote patient (RPM) monitoring is a part of the telehealth market. RPM is employing digital technologies to gather medical or other types of health data from people in one place and securely transfer that data electronically to healthcare professionals in another place for assessment and recommendations.

RPM programmes can be used to collect typical physiological data such as vital signs, weight, blood pressure, and heart rate. Once patient data has been acquired, it is sent to a doctor's office via a customised telehealth computer system or software application that can be downloaded and installed on a computer, smartphone, or tablet.

The increased demand is due to the growing elderly population. The main drivers of this market's expansion are the need to increase healthcare access, the cost advantages of telehealth and remote patient monitoring, the benefits of RPM in easing the strain on medical resources, technological advancements in telecommunications, the rise of chronic diseases, and rising investments in telehealth and RPM. However, throughout the anticipated time, market expansion is anticipated to be constrained by regional variations in regulatory requirements, healthcare fraud, and unofficial social media usage patterns.

This remote patient monitoring technology will have a crucial impact in India also in coming years. With few 5-9 start-ups working on RPM market, this sector will see progress in the coming few years after the US.

Technology companies like Philips and major tech giants like Apple, Microsoft are working in the healthcare sector to improve the RPM services. Companies like Vitals technologies have their own Tego equipment to monitor blood pressure in emergency room situations. RPM has a clear indication in the emergency room as well.

Keywords: Remote patient monitoring, RPM key players, RPM market overview

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Abbreviations

AHA	American Hospital Association
CDC	Centre for disease control and Prevention
CGM	Continuous Glucose Monitoring
HER	Electronic health records
HRSA	Health resources and services administration
METI	Ministry of Economy, trade and Industry
PHI	Protected Health Information

1.INTRODUCTION

Remote patient monitoring, or RPM, is a part of the telehealth mark. RPM is employing digital technologies to gather medical or other types of health data from people in one place and securely transfer that data electronically to healthcare professionals in another place for assessment and recommendations.

Vital signs, weight, blood pressure, and heart rate are typical physiological data that can be gathered with RPM programmes. A customised telehealth computer system or software application that may be downloaded and installed on a computer, smartphone, or tablet is used to transmit patient data to a doctor's office once it has been gathered. ^[2]

RPM enables care professionals to track patient activities and vital signs from a distance or even at different time points. Connected electronic devices record patient vitals and transmit them to the caregiver. Patients are connected to an external monitoring centre through a central system that feeds information from sensors and monitoring equipment.

The market for remote RPM is anticipated to grow at a CAGR of 38.2 percent from USD 23,201.4 million in 2020 to USD 117,103.5 8 million by 2025. The main factors propelling the growth of this market are the increasing geriatric population and the increasing need to increase healthcare access. However, throughout the anticipated time, market expansion is anticipated to be impeded by regional regulatory variances, healthcare fraud, and informal social media usage practises.

The market for RPM is divided into software & services and devices depending on the product. 71.7 % of the market for remote patient monitoring worldwide was accounted for by the software and services sector in 2019. The significant market share in this area is mostly attributable to the increased reimbursement for RPM programmes and the rise in chronic illnesses, which has resulted in a global expansion of RPM service use.

In 2019, North America held the biggest market share for remote patient monitoring (61.6%), followed by Europe (19.5 percent). Because of the growing number of chronic diseases, the desire to cut healthcare costs, and the growing elderly and general population, North America holds a sizable portion of the global RPM market.

On the other hand, the market in the Asia Pacific region is anticipated to experience the greatest CAGR over the forecast period. Growing ageing populations, better healthcare infrastructure, brisk economic expansion, and rising living standards in emerging APAC nations like China and India present market players with lucrative growth prospects.

Some major companies operating in RPM market are BioTelemetry, Inc. (US), Medtronic (Ireland), OMRON Healthcare (Japan), GE Healthcare (US), Cerner Corporation (US), Abbott Laboratories (US), Resideo LifeCare (US), ALTEN Calsoft Labs (France). Preventice Solutions

(US), Bio-Beat Technologies (Israel). VitalConnect (US), Welch Allyn (US). Teladoc Health Inc. (US), Dexcom Inc. (US), Rhythm Technologies, Inc. (US), and VivaLNK Inc. (US).

Figure 1.1: Graphical representation of RPM categorisation based on Product, 2020 VS 2025(USD Million)

2.REVIEW OF LITERATURE

- This study shows the how the remote patient monitoring service in the US helped delay emergency room visits and how telemedicine app is digitising and automating the critical tasks which reduces hospital administrative task thereby expanding the usage of remote monitoring services in the coming years.
- This study gives the recommendations on recent development in remote patient monitoring service market and future challenges, how we can cope up with these challenges

3. AIM

- To understand the competitive landscape of remote patient monitoring service in US

4. RESEARCH QUESTIONS

- What is the current market analysis of RPM (DROC) and key players in remote patient monitoring services in US?

5. OBJECTIVES

- To analyse and estimate the market of remote patient monitoring services in the United States region?
- To understand the competitive landscape associated with the remote patient monitoring service market
- To assess the drivers and challenges of the market

6. METHODOLOGY

Study design

Secondary research based on the relevant articles in reputed peer-reviewed journals

Total of 11-15 secondary sources/databases were accessed for the analysis.

Following aspects to be extensively studied in the secondary research:

- o Overview of the current status in the remote patient monitoring services market including a brief history

Important current trends and focus of current research

- o Emerging/future trends

- o Opportunities, challenges, and limitations

Study design: Descriptive cross-sectional study

Inclusion – all the start-ups and established players in the US

Exclusion – Companies outside of US, emerging companies incorporated after April 2022 and secondary data before Jan 2015 is excluded.

Duration of study

24 March ,2022 to 15 June ,2022

7. RESULTS

DRIVERS

1. Increase in the geriatric population and expanding access to healthcare facilities

Telehealth and telemedicine can also expand healthcare systems in rural, remote, and war-torn areas. In the majority of countries, the rural population is far larger than the urban population. On the same scale, most countries also show an uneven distribution of healthcare, with most facilities located in cities. For example, in South Africa, majority of the populations (Approx 43%) resides in rural areas, with just 1 physician per 7,700 people (Source: WHO). For such cases, remote patient monitoring offers various benefits such as reductions in travel cost and the round-the-clock availability of medical care via videoconferencing electronic consultation, and wireless communications.

Table 1.1: Snapshot of the rise in the aging population over the years (Million)

Region	Number of persons aged 65 or over (Millions)	Percentage increase between 2019 and 2050	
	2019	2050	
Global	702.9	1,548.9	120
Sub-Saharan Africa	31.9	101.4	218
Northern Africa and Western Asia	29.4	95.8	226
Central and Southern Asia	119.0	328.1	176
Eastern and Southeastern Asia	260.6	572.5	120
Latin America and the Caribbean	56.4	144.6	156
Australia and New Zealand	4.8	8.8	84
Oceania, excluding Australia and New Zealand	0.5	1.5	190
Europe and Northern America	200.4	296.2	48

Source: Department of Economic and social affairs (United Nations) – World population ageing 2019

Mostly long term impacting diseases are major global causes of mortality and disability and significant drivers of the increase in annual healthcare expenses, according to the US Centers for Disease Control and Prevention (CDC). Non-communicable diseases (NCDs) are responsible for almost 41 million deaths year, or 71% of all fatalities worldwide, according to the WHO. Up to 17.9 million people each year die from CVD, which is followed by cancer (9.0 million), respiratory disorders (3.9 million), and diabetes (1.6 million).

Chronic diseases must be continuously monitored and treated to stop their progression. Remote patient monitoring has demonstrated the ability to reduce emergency room visits, readmission in hospitals and improved clinical outcomes.

The growth of the geriatric population will definitely increase the demand for healthcare services and will increase the burden of healthcare services on the government. This in turn will be a benefitting factor for the RPM market as it will increase the reach and overall access to healthcare services.

2. Cost effectiveness

Remote patient monitoring saves the cost of care. The health care sector could save USD 700 billion in the next 15 to 20 years by deploying remote patient monitoring technologies in conjunction with electronic health records, according to the National Broadband Plan created by the Federal Communications Commission (FCC) (EHR). Using fewer physical visits to the patients every few hours, doctors are more productive during consultation hours with the RPM

solution. By lowering re-admissions, using fewer medical supplies, and increasing staff engagement, RPM and telemedicine can help cut operating costs. By allocating these resources to additional patients, hospitals may work more effectively and earn more money.

Table 1.2: Table showing the potential limit to save in future

DISEASE	CHALLENGE
Hypertension	USD 100 billion total savings with optimal blood pressure control
Hyperlipidemia	USD 60 billion savings with 95% adherence
Asthma	USD 20 billion in avoidable healthcare costs in severe asthma
Depression	USD 83 billion in costs associated with untreated depression

Telehealth and RPM portray a low-cost model of treatment/consultation than the conventional model. The high cost of traditional healthcare practices increases the financial burden on patients. Telehealth and RPM can significantly save on hospitalization expenses, as online healthcare providers can identify and resolve health issues before they deteriorate. For instance, in its March 2017 report, the Rural Broadband Association estimated the average cost saving using telehealth to be USD 20,841 per medical facility in the US and as much as USD 104,564 per facility in California.

3. RPM has shown proven results where it reduced the burden on medical workforce

The WHO estimates that there is a shortage of 4.3 million physicians, nurses, and other health professionals worldwide. According to a study commissioned by the Association of American Medical Colleges (AAMC) in 2017, the US will face a severe shortage of almost 46,900 to 121,900 physicians by 2032 due to overall population growth, an increase in the number of aging Americans, and the retirement of practicing doctors. The Canadian Nurses Association has predicted that Canada would experience a shortage of about 60,000 nurses by 2022. Considering the pandemic's current situation, it is anticipated that this number will only increase, leading to a widening gap between sources procured and sources contributed.

RPM offers technology for patient-provider communication and illness monitoring that reduce the risk of infection for both physicians and patients including communities. RPM can be a very safe and effective treatment method as the healthcare sector works to combat COVID-19's escalating cases across the globe. Home-based symptom escalation monitoring for patients who test positive for COVID-19 can help reduce the risk of transmission. Remote monitoring is now feasible due to the growing shortage of hospital beds, freeing up significant and crucial hospital resources intended for critical cases. Due to the pandemic, clinicians in the United States and other countries are now quickly adopting and using RPM. Additionally, many payers support the use of connected care.

Both hospitals and healthcare agencies adopt the latest technologies, including RPM, to make optimal use of resources. For instance, interactive video conferencing for physician consultation eliminates the need for patients to travel for healthcare assistance and meet physicians in person while greatly expanding the number of patients a physician could interact with.

4.Advancements in telecommunications

Advancements in telecommunications technology have enabled an uninterrupted communication flow between the patient and the healthcare provider by successfully integrating medical devices and Information and Communication Technologies (ICT) such as personal computers, cell phones, and tablets, among others for the delivery of healthcare over long distances.

Advancements in IT have provided the industry with an expanding array of options like more stable broadband networks, mobile devices with advanced cameras for defined images, HD video conferencing. and digital health records. This has generated significant opportunities for healthcare providers. For instance, the implementation of 5G technologies in the healthcare sector limits transmission time by avoiding network delays and quickly transferring data for store-and-forward services. Such technologies help expedite operations for many firms. Advancements in technology have supported improvements in remote monitoring, patient compliance, and, subsequently, their quality of life. They have greatly helped expand telehealth and telemedicine capabilities and ensured a growing demand among patients and growing providers.

5. Increasing investments in telehealth & RPM

A number of nations have demonstrated significant full support for tele-medical services, and they are starting to set up nationwide telehealth coverage, proper reimbursement guidelines, and a framework (proper regulatory framework).

For example, in April 2019, the CMS announced and finalised amendments to Medicare's policy on telehealth in order to provide RPM patients with access to most contemporary technology and improve the coordination of the healthcare procedures. This is expected to motivate more patients and physicians to practise.

In 2019, the UK NHS launched a plan to provide access to mHealth and telehealth resources by 2022 2023. It is a digital-first long-term plan that foresees mHealth access for every UK citizen to provide long and interactive face-to-face consultations with clinicians, as and when a patient requires it.

The national telemedicine approach adopted by Portugal's NHS, voluntary private insurance sectors and some special health insurance programmes which all dates back to 2000. As a result, hospitals in Portugal have adopted up to 87 percent of telemedicine services, including RPM. Additionally, the National Strategic Telehealth Plan (PENTS), which was unveiled in November 2019 by the Shared Services of the Portuguese Ministry of Health (SPMS), emphasises the regional development and sustainable growth of telehealth. All of the aforementioned government measures from various nations have helped telehealth solutions become more widely used, which is what is causing the remote patient monitoring market to grow.

RESTRAINTS

1. Regulatory variations across regions.

There are significant state-to-state and inter-country variations in laws and policies governing telehealth and telemedicine practices and a lack of specifications. For example, different US states represent a mixed scenario, with different guidelines for obtaining patient consent before telemedicine visits. This is relevant from the table below,

Table 2.1: Regulatory Outlook For Telehealth In The US State

Other factors are variations in the eligibility criteria for telemedicine services delivery, differences in requirements on disclosing provider credentials, and different reimbursement parameters. Moreover, there is a restricting scenario between different countries willing to deploy telehealth or telemedicine provisions jointly. Countries do not have a unified and defined legal framework or guidelines to implement these practices successfully. For instance, when some patient from an Asian country wishes to opt for a second opinion from a physician in the

STATE	REGULATORY REQUIREMENTS FOR OBTAINING INFORMED CONSENT
Arizona	▪ Written or oral consent is mandatory for all patients ▪ Oral consent should be documented in the patient record ▪ Medicaid mandates written consent if a recording is involved
Connecticut	▪ Verbal disclosure by the provider to disclose information to patients regarding the limitations of treatment is compulsory ▪ The physician must obtain verbal consent during the visit
Florida	▪ No specified laws or guidelines on obtaining informed consent
Georgia	▪ Written informed consent before a telemedicine visit is required under Medicaid (Necessary for billing purposes)
Indiana	▪ Under state law, a provider is not bound to maintain separate informed consent; however, Medicaid mandates obtaining and maintaining the informed consent
Kansas	▪ Under state law, no specific guidelines on informed consent; however, Medicaid mandates consent for telehealth home services
Massachusetts	▪ Under state law, no specific guidelines on informed consent
New Jersey	▪ Informed consent needed for telepsychiatry under the Medicaid program
New York	▪ Informed consent required for telepsychiatry
Oklahoma	▪ Written informed consent is mandatory

US, the patient must have insurance despite the availability of all technical resources and the physician's willingness to conduct a medical examination.

Also, there are legal restrictions on the cloud-based transfer of medical data across international borders. These regulatory barriers restrict the market for telehealth and telemedicine, and it will remain a restraint unless unified laws are implemented to ensure smooth and streamlined operations for the same.

2. Healthcare fraud

In the context of telehealth and telemedicine activities, healthcare fraud is a crucial factor to take into account. A patient or a doctor may suffer harm in a variety of ways, such as when non-eligible or unlisted institutional providers engage in inappropriate coding and billing for false claims.

The US Department of Justice has filed charges against several telehealth providers, and companies for various telehealth schemes rolled out in 2018. As per a report published by Hendershot, Cowart & Hisey, P.C., the federal government has acted against at least five telemedicine providers for fraudulent behavior in 2018. Any such legal action on providers consequently victimizes the associated physicians and can lead to costly legal penalties or even the loss of their professional license.

3. Informal usage of social media practices

An rising concern in the RPM market is the growing use of social media. Physicians have begun to use communication platforms such as WhatsApp, Facebook Messenger, and Facetime in regions where the establishment of telehealth is in the nascent stage. These regions include Africa, Egypt, Iran, Iraq, United Arab Emirates, Brazil, and India. These platforms are used to exchange medical information informally, while physicians and healthcare professionals use, and recommend procedures without complying with medical/legal expectations or adhering to formal consultation practices and encourage informal payment options. Such practices create a high risk of violation of medical ethics and the loss of streamlined reimbursements. As a result, telehealth services are not the formal choice for routine healthcare processes.

Moreover, to deal with such informal practices, the Brazilian National Medicine Council (Federal Council of Medicine) announced that most informal practices would be covered under the expanded regulations and * recommendations (for telesurgery, teleconsultation, and some other recommendations), as applied from 2019. The new regulation will convert several informal telehealth practices to formally followed practices with the regulation of a few conditions. Implementing such regulatory changes will affect the market for formal telehealth and telemedicine practices by encouraging social media for healthcare practices, thus restricting market growth.

OPPORTUNITIES

1. HOW AI WILL REVOLUTISE THE RPM MARKET IN THE COMING YEARS

The amount of unprocessed and disorganised data available to doctors for decision-making has increased as a result of the evolution of RPM from ad hoc to continuous monitoring of several indicators. Healthcare professionals employ big data analytics and other analytics technologies to glean meaningful information from this data.

Caretakers can passively identify changes in conditions, lower hospitalizations, and boost quality metrics with an AI-powered, real-time remote monitoring solution. Utilizing cutting-edge gesture-recognition algorithms, AI-enabled RPM devices monitor users' everyday behaviours and offer insights and predictive analytics regarding things like sleep quality, fall risk, fall detection, drinking and hydration, activity patterns, and roaming. Risk of UTI and more.

A startup company Feebris (UK) is working on remote patient monitoring for respiratory conditions by using some algorithms based on signal processing and machine learning to provide clinical evaluative insights and even diagnoses. The startup Feebris (UK) was initially started in 2017, the organization raised about USD 1.4 million in a seed round. Feebris is running a pilot project in India by working with around 100,000 children in field.

To create AI-powered RPM for asthma and related illnesses, Feebris is also collaborating with 1,000 elderly individuals in the United Kingdom. The software and hardware to deliver insights into an RPM via a wearable wristband have also been developed by Scottish startup current health. The startup has revealed raising \$11.7 million in investment. The platform may also record additional metrics

2. RPM is extremely useful in battling infectious diseases and epidemics.

The Coronavirus outbreak in 2020 has boosted the use of telehealth and telemedicine practices to provide treatment. As per an article in Business Insider published in 2020, Chinese networking equipment manufacturer ZTE and China Telecom together provided and optimised 5G network and some other communication instrumentation for Sichuan University (West China Hospital). The technology was used to support indoor video-consultations, which enabled the first remote diagnosis of coronavirus cases. Such prompt use of technology for the detection and treatment of deadly infectious diseases can enable the containment of the outbreak without physically confronting the disease's potential threats. Moreover, it can create a platform for extending professional medical help to highly sensitive and affected areas.

CHALLENGES

1. The lack of understanding, behavioural impediments, and the cost of healthcare

Although they may not be the most evident barrier, behavioural barriers nonetheless present a major obstacle to the adoption of telehealth and telemedicine. Patients and doctors frequently struggle with unfamiliarity with new procedures and are reluctant to abandon their current (traditional) procedures. Due to their lack of experience with technology, older persons may also choose not to use telehealth and telemedicine services.

The services' virtual nature may also affect perceptions of telehealth among patients long-used to in person meetings and care provision. The need for telehealth and telemedicine provisions in upper-middle, lower-middle, and low-income countries is evident, but the extent of adoption

remains juvenile. This is due to unsatisfied infrastructure requirements, communication requirements, language barriers, software requirements, and lesser technology acceptance. Moreover, women, children, and the Shysically disabled rural populations face additional social and cultural barriers to adapt to new settings.

2. Data accessibility issues

Wearables for remote patient monitoring function by sending data from the patient at home to a doctor or nurse who is located elsewhere. This data is medically accurate. Overall, medical-grade wearable technology that is dependable, efficient, and available can reduce hospital wait times, healthcare expenses, and improve the general wellbeing of individuals of all ages and circumstances.

Ensuring timely access to data is essential for RPM and its full potential. Reliable network availability is one of the major obstacles to timely data access. Although not all consumers have a home network, a sizable majority do. Given the popularity of smartphones and tablets, providing near-real-time access to the data on wearable devices is getting easier and easier, regardless of where a healthcare professional is located. The sector is making efforts to solve the connectivity issue in order to lessen this difficulty. It involves giving patients supplied phones or improving data management to reduce traffic. Other cutting-edge businesses are investigating customised network devices for controlling and sending health care data..

REMOTE PATIENT MONITORING CATEGORISATION BY PRODUCTS

Two product categories, devices and software & services, make up the remote patient monitoring market. The devices segment is further divided into devices for monitoring blood glucose, weight, foetal and neonatal health, neurological and respiratory conditions, respiratory monitoring, multiparameter monitoring, and other monitoring. In terms of products, the remote patient monitoring market for 2019 was dominated by the devices segment.

SOFTWARE AND SERVICES

1. HIGH UTILITY VALUE AND EASE OF USAGE OF RPM DRIVE THE DEMAND FOR RPM SERVICE MARKET

Also known as asynchronous services, remote patient monitoring (RPM) enables care professionals to track patient activities and vital signs from a distance or even at different time points. Connected electronic devices record patient vitals and transmit them to the caregiver. Patients are connected to an external monitoring center through a central system that feeds information from sensors and monitoring equipment. These services - remotely monitor patients' health status, thereby helping physicians diagnose, notify, and resolve health problems before they become critical by providing preventative care outside of a hospital setting.

RPM systems enable the management of several chronic conditions such as asthma, diabetes, heart diseases, and parameters such as glucose levels and vital signs through sensors. For patients suffering from chronic conditions, remote monitoring improves disease-specific knowledge, promotes earlier clinical assessment, enables better medication management, and promotes shared decision-making. One of the primary uses of remote monitoring is the home management

of chronic conditions in aged patients. This enables physicians to closely monitor aged patients and make sure they receive the required medications as scheduled at home rather than in a care center, saving time and costs, and reducing hospital admissions

In the remote patient monitoring market, glucose monitoring, and blood collection RPM devices and services have strong demand. Moreover, advancements in wearable monitoring devices and the implementation of AI have emerged as newly adopted approaches in RPM. AI-based patient management platforms such as Current (Current Health, US), Feebris (Feebris, UK), and Myia (Myia, Health, US) continuously monitor multiple parameters by generating a digital health ecosystem of connected devices. Apart from continuously monitoring chronic conditions, wearable biosensors can track and transmit data.

Moreover, in 2018, the CMS in the US expanded reimbursements for RPM, virtual visits, and other telehealth services. This development is expected to encourage more physicians to use remote monitoring services. However, concerns such as the fear of losing interpersonal contact, the additional personal responsibility for the patient to maintain hygiene and functionality of monitoring devices, and challenges for the elderly in adjusting to complex technology might restrain software and services' growth of the market

Though, in the current wake of the pandemic, most patients increasingly prefer home healthcare & rehabilitation due to its convenience and safety, which is a key factor driving the growth of the market of RPM. The rising inclination towards preventative care adoption outside of a hospital setting among patients & end users is further boosting the growth of the remote patient monitoring software & services market.

Some companies offering remote monitoring software and services are Remote Monitoring Platforms and Applications (Medtronic). FetaLink+ (Cerner), Teamplay myCare Companion (Siemens Healthineers), and Remote Patient Monitoring Software (Koninklijke Philips).

Table 8.3: RPM Players And The Market Categorisation

S.NO	SERVICES	KEY PLAYERS
1	Platform, Service and Monitoring Device Providers	Koninklijke Philips
		Vivify Health
		iRhythm
		Abott
		Boston Scientific
		Cerner
		GE healthcare
2	Emerging Players	Tealdoc
		KevaHealth
		Vivalink
		Datos
		Vitls

3		Healthsnap
		MedM
		Prevounce
	Network Connectivity and Hardware Providers	AT & T
		Verizon
		Telefinica
		NTT communications
	Hospitals/Health Systems	University of South California
		Mayo Clinic
		Ascension
		Cleveland Clinic
		Lifepoint Health
		Encompass Health Group
		United Health Services Group

DEVICES

MULTIPARAMETER MONITORING DEVICES

A significant market driver for this sector is the rising incidence of chronic disorders.

Multiparameter trackers provide continuous monitoring of patients' multi-physiological and biochemical parameters in real-time, including the electrocardiogram (ECG), respiratory activity, blood pressure, heart rate, SpO2 (oxygen saturation), blood sugar, and body temperature. These parameters indicate health status and facilitate the diagnosis of various clinical conditions. Wearable sensors and systems monitor patients and older adults with chronic conditions in home and community settings. Apart from physiological and biochemical sensing, these devices also provide motion sensing. These devices provide sensing of one or multiple vital parameters and transmit data to a centralized system or a mobile app in RPM.

An expanding increase in the aging population increases the prevalence of serious chronic diseases like COPD, diabetes, asthma, and stroke, and increasing awareness of self-diagnostics are major market drivers for this segment.

Some of the companies providing multiparameter devices are VitalConnect Patch (VitalConnect). Qardiosore (Dardio, Inc.), and Actiheart (CamNtech).

RESPIRATORY MONITORING DEVICES

The respiratory monitoring devices market in this report includes pulse oximeters. Pulse oximeters are used to monitor a patient's blood oxygen saturation levels and heart rate. Continuous monitoring of oxygenation levels is critical in hospitals and other critical care settings, as any fall in the patient's oxygenation levels may lead to unconsciousness, brain damage, or respiratory failure. These devices also help in preoperative monitoring to indicate the patient's cardiorespiratory status. The data can be captured, stored, and then transmitted to

specialists for evaluation. Fingertip pulse oximeters, which can be connected with smartphones, are user-friendly devices for hospitals or the home care environment. Some pulse oximeters can send notifications or alarms if values deviate from the routine threshold of the patient. Rising awareness of these devices and its convenience in self-monitoring are factors driving the adoption of pulse oximeters and overall market growth of respiratory monitoring devices. Other drivers include the availability of low-cost oximeters and technological advancements.

Also, pulse oximeters are used in the detection of COVID-19. The demand for pulse oximeters has significantly risen ever since the pandemic began. For instance, if a person is suffering from COVID-19 symptoms such as weakness, muscle pain, or fever, they can use the pulse oximeter as a primary screening device to measure blood oxygen levels. If the value is 92% (or lower), then the patient needs to go for further screening to a hospital or otherwise. The oximeter is a small, affordable, and powerful device that has proven to be a significantly important tool to monitor health from a home's comfort. Technological advancements and growing competitiveness in this market have resulted in the availability of low-cost connected pulse oximeters. This is another key factor driving the adoption of these devices among physicians and patients

Some of the companies providing pulse oximeters and major keys players in respiratory monitoring (devices) market include the Wireless Pulse Oximeters (Delta Mobile Systems, Inc), CMS50FW Pulse Oximeters (Contec Medical Systems Co. Ltd), and Radius-7 (Masimo).

SOME OTHER PROMINENT MONITORING EQUIPMENTS

Other monitoring devices include monitoring devices for sleep, coagulation monitors, temperature monitoring devices and hemodynamic monitoring devices. Habitual snoring is a widely prevalent condition which affects around 22-44% of males which are middle aged and 13-28% of females (middle aged). It is one of a key symptom which gives possibility of OSA (Obstructive sleep apnea). According to the WHO, -100 million people worldwide have OSA In the US, 50-70 million people suffer from OSA, of which 1 in 4 men and 1 in 9 women are affected. This condition is linked to a higher risk of sleep-disordered breathing

In many countries, telemedicine is used to monitor sleep apnea. These devices measure breathing and blood oxygen levels. The increasing prevalence of sleep apnea disorders and the availability of low-cost sleep monitoring devices are thus expected to drive these devices' adoption in the coming years

Coagulation monitoring devices support anti-coagulation disease management for patients at risk for stroke and other clotting disorders.

Hemodynamic monitoring systems assess several physiological parameters related to the circulatory system. These monitors also help measure blood pressure inside the veins, heart, and arteries.

5.DISCUSSION/CONCLUSION

COVID-19'S EFFECT ON THE MARKET FOR RPM

The pandemic passively affected the population health throughout the world and has had a significant economic impact on most nations. 31.6 million cases have been documented globally as of September 22, 2020, and 971,881 people have died as a result (Worldometer). Given that social distance is now the only developed technique that can minimise exposure, the pandemic is presenting enormous prospects for RPM technologies. In line with this, remote patient monitoring is a desirable, practical, and economical choice. Additionally, this technology is crucial for keeping healthcare professionals secure..

Remote patient monitoring services are becoming into a valuable resource with significant implications for the full continuum of healthcare delivery. The use of remote patient monitoring has a number of benefits, particularly in non-urgent/routine care settings and circumstances when services don't necessitate direct provider-patient engagement. This lessens the need for resources, increases access to care, and lowers the possibility of an infectious agent spreading from person to person. When viewed at a national, continental, or global level, the accompanying decrease in resource consumption brought on by the requirement for less personal protective equipment can result in considerable financial savings.

Earlier, RPM companies' biggest constraint was the reluctance of patients and providers to switch from conventional in-person care to virtual care. However, RPM is becoming the only option available to consumers already dealing with the consequences of social isolation and highly infectious disease.. Telehealth and remote patient monitoring will likely witness far greater acceptance in this scenario, this market's opportunities are expected to remain in play even past the pandemic. This has provided a huge opportunity for the RPM vendors to connect with traditional provider organizations to provide the technology needed for efficient remote healthcare. Moreover, according to industry experts, the consumers who have used telehealth have rated it highly and are considerably satisfied. Hence this is a lucrative opportunity for RPM companies to convince patients and providers to switch to remote care from traditional care, engage customers, provide their product and prove the benefits of their product, allowing them to maintain the customer base post-COVID-19. However, with the large immediate increase in the usage, RPM companies could face challenge sin handling load and may face technical problems, IT crashes, which would require sophisticated mobility solutions. To mitigate these shortages, in March 2020, the FDA provided updated guidelines that allows for faster entry into RPM market equipment Hence, this is also a good opportunity for RPM companies to understand and evaluate these challenges and be prepared to tackle such situations in the future.

Additionally, government bodies and private organizations are taking initiatives to promote RPM solutions for COVID-19.

In March 2020, the USFDA released guidelines recognizing the role of digital health technologies in the management of COVID-19. Additionally, in April 2020, the US FCC approved & developed a USD 200Mn program to provide necessary funds to ensure proper telehealth services and medical providers' devices in the country.

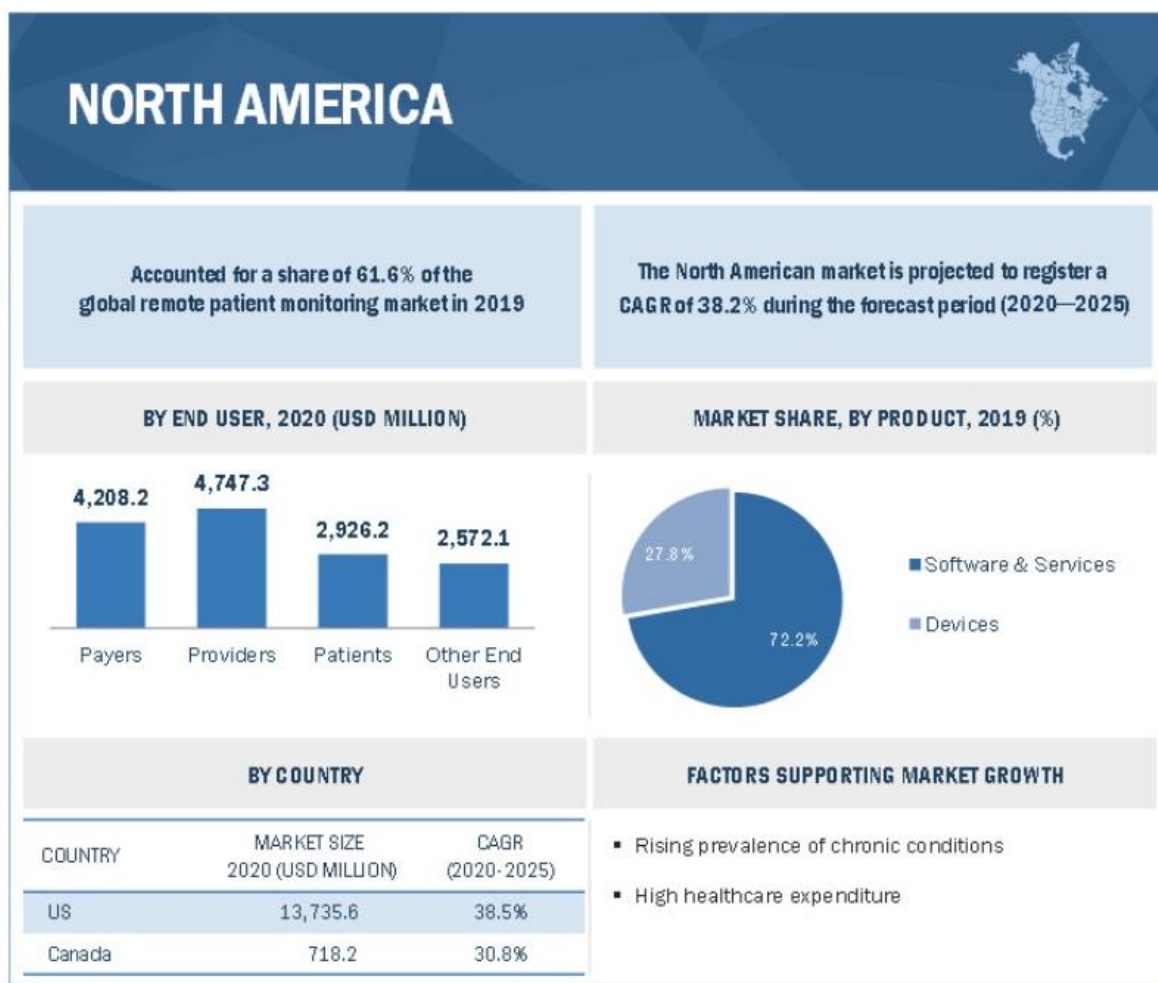
VALUE CHAIN ANALYSIS

The value chain of the RPM market comprises entities including the telecommunications companies, i.e., network, connectivity and hardware providers; CT tools and electronics manufacturers, i.e., the infrastructure service providers; The platform; service and medical device providers; and consulting firms and system integrators, data collection and storage, health-care analytics, and medical intervention.

REGION WISE ANALYSIS : US

In 2019, the remote patient monitoring market was dominated by North America, which includes the US and Canada. The market in North America is anticipated to grow at a Compounded Annual Growth Rate of 38 percent from 2020-2025, from USD 14,453.8 million to USD 72,819.7 million. The high cost of healthcare, the growing elderly and overall populations, and the increased funding for telehealth are all factors in North America's significant market share in the world.

Figure 9.1: North America and US: Remote Patient Monitoring Snapshot



Due to the rising prevalence of chronic conditions, rising reimbursement for RPM services, the need to cut healthcare costs, growing population, favourable regulatory indications, and proper funds and support for telehealth, the US is currently the largest regional market for remote patient monitoring. By 2032, the US population is expected to expand by more than 10%, with the senior population (those over 65) growing by 48%, according to the US Census. This is anticipated to greatly increase the prevalence of diseases overall.

Six out of ten persons in the US have at least one chronic disease, and four out of ten have two or more, according to CDC. The CDC further added that over 1.6 million people are diagnosed with cancer each year, and almost 600,000 die from it. Heart disease, stroke, diabetes, and obesity are other major chronic conditions. Moreover, the American Medical Colleges Association predicted

that the US would face a shortage of up to nearly 122,000 physicians by 2032. All these factors project a highly favorable environment for the greater use of RPM.

The US also accounts for the highest healthcare spending in the world. According to the National Health Expenditure Accounts (NHEA), healthcare spending in the US grew 46% in 2018, reaching USD 3.6 trillion or USD 11,172 per person. For instance, Sentara Home Care Services (US) witnessed a 9.09% 30-day all-cause readmission rate for its telehealth patients in just over seven months, compared to the 39% readmission rate of Virginia Hospital in the US.

The CMS provided a formal definition of proper billing code for RPM in 2018. The "collection and interpretation of physiological data (such as ECG, blood pressure, and glucose monitoring) digitally stored and transmitted by the patient and caregiver to the doctor or other healthcare professionals, qualified by education, training, licensure/regulation (when applicable), and requiring a minimum of 30 minutes" is covered by CPT code 99091. For codes 99453, 99454, and 99457, the typical Medicare reimbursement rate is USD 21, USD 69, and USD 54. By adding CPT code 99458, which pays for an extra 20 minutes per patient each month in 2020, CMS increased the options for physician reimbursement once more.

Additionally, CMS encourages innovation and modernization of home health care by allowing home health companies to include the price of remote patient monitoring as acceptable charges on the Medicare cost report form. This is anticipated to encourage home health agencies to employ cutting-edge technology and lead to better care planning. Patients, their carers, and their clinicians all have access to RPM data. RPM technology can empower and enable patients' independence. The MyHealthEData programme will advance if people are assisted in providing their data.

Table 9.2: CAGR Of Remote Patient Monitoring in US

Product	2018	2019	2020	2025	CAGR (2020–2025)
Software and Services	4,697.1	5,344.6	10,079.8	55,398.4	40.6%
Devices	1,897.0	2,047.7	3,655.8	14,676.5	32.0%
Total	6,594.1	7,392.3	13,735.6	70,075.0	38.5%

COMPETITIVE LANDSCAPE

The competitive landscape includes analyzing the key strategies adopted by top players to expand their global presence. The top companies' key growth strategies (profiled in the report) include collaborations, partnerships & agreements, product launches & approvals, expansions, and acquisitions.

The remote patient monitoring market is a fragmented market with many prominent players. The key players operating in this market are Koninklijke Philips N.V. (Netherlands), Cerner Corporation (US), BioTelemetry Inc. (US), Boston Scientific Corporation (US), Medtronic (Ireland), Tealdoc Health Inc (US), GE Healthcare (US), Siemens Healthineers AG (Germany), OMRON Healthcare (Japan), Abbott Laboratories (US), Resideo Life Care Solutions (US), Vivify Health, Inc. (US), ALTEN Calsoft Labs (France), Preventice Solutions (US), Bio-Beat Technologies (Israel), VitalConnect (US), Welch Allyn (US), Teladoc Health Inc. (US), Dexcom Inc. (US). iBhythm Technologies, Inc. (US). VivaLNK Inc. (US). BIOTRONIK (US), Bardy Diagnostics, Inc. (US), Biofourmis (US), Biotricity (US), and Blue Spark Technologies (US).

MAJOR PLAYERS AND THEIR KEY STRENGTH

Koninklijke The market leader in remote patient monitoring is Philips N.V. (Netherlands). The organisation may continue to hold the top spot in the market thanks to its knowledge, experience, and extensive capabilities in a variety of industries and business operations. By expanding its operating base and introducing competitive technology, the company focuses on attaining sustainable growth.

In 2019, the market for remote patient monitoring has Medtronic (Ireland) in second place overall. The company works in more than 350 sites throughout more than 150 nations

Table 9.3: Agreements, Partnerships And Collaborations

MONTH & YEAR	APPROACH	COMPANY 1	COMPANY 2	DESCRIPTION
2020	Collaboration	Koninklijke Philips	American Telemedicine Association (ATA) (US)	This collaboration helped increase the adoption of telehealth across acute, post-acute, and home care settings.
2020	Collaboration	Koninklijke Philips	BioIntelliSense	This collaboration with BioIntelliSense integrates its BioSticker medical device into Philips' remote patient monitoring (RPM) offering to help monitor at-risk patients from the hospital to the house.
2019	Collaboration	Medtronic	Novo Nordisk	This collaboration helped provide integrated solutions and combined clinical data for diabetes patients.
2019	Agreement	Medtronic	Capital District Physicians' Health Plan, Inc. (US)	This agreement allowed CDPHP members to access a patient engagement program, known as Medtronic Inner CircleSM.
2019	Joint venture	OMRON Healthcare	iAPPS Pte. Ltd. (Singapore)	Both companies announced the establishment of HeartVoice Pte. Ltd., a joint venture that provides health management services to businesses.

Figure 9.1: Product Launches

MONTH & YEAR	COMPANY	SEGMENT	DESCRIPTION
2020	Koninklijke Philips	Devices/Hardware	Launched the Avalon CL Fetal and Maternal Pod and Patch for remote monitoring in the US, Europe, Australia, New Zealand, and Singapore to support fetal and maternal monitoring
2020	Koninklijke Philips	Digital Health Solutions	Launched the Sonicare oral healthcare ecosystem, Philips Avent mother and childcare ecosystem, and Philips' SmartSleep ecosystem
2020	Medtronic	Devices	US FDA approval for the Minimed 770G Insulin Pump System
2020	Medtronic	Diabetes Management	US FDA approval for the Android version of its Guardian Connect Continuous Glucose Monitoring (CGM) System
2020	BioTelemetry	Heart Monitoring	The company expanded its Mobile Cardiac Outpatient Telemetry (MCOT) service to monitor life-threatening QT prolongation in COVID-19 patients.

Figure 9.2: Expansions

MONTH & YEAR	COMPANY	COUNTRY	DESCRIPTION
2019	Siemens Healthineers	Forchheim (Germany)	The company invested USD 395 million to expand the Forchheim location with a medical components factory and a new R&D & logistics center.

Figure 9.3: Acquisitions

MONTH & YEAR	COMPANY 1	COMPANY 2	DESCRIPTION
2020	BioTelemetry	On Demand Remote Patient Monitoring (RPM)	BioTelemetry acquired the On Demand remote patient monitoring (RPM) and coaching platform, operated by Envolv People Care, Inc., which is a Centene Corporation subsidiary. This acquisition expands chronic RPM and coaching solutions to BioTelemetry's current suite of acute care connected health products and services, focusing specifically on diabetes, hypertension, and chronic heart failure.
2019	Koninklijke Philips	Medumo (Boston)	This acquisition helped combine Medumo's direct patient interaction services with its diagnostic imaging systems and enterprise diagnostic informatics. This development complements Philips' VitalHealth population health management platform.
2019	Medtronic plc	Klue, Inc. (California)	This acquisition helped incorporate Klue's technology in the Medtronic Personalized Closed Loop (PCL) insulin pump system.
2018	OMRON Healthcare	3A Health Care s.r.l (Italy)	This acquisition helped OMRON Healthcare provide a broader portfolio of respiratory solutions to a wider range of customers.

REFERENCES

1. Ivanov, A, Hrisafov, K., Chivarov, N., Chivarav S., & Budinska, I. (2021) Tele-Medical System For Remote Monitoring Of Patients With Covid 19 And Other Infectious Diseases. IFAC-Papersonline, 54(13), 327-332. doi: 10.1016/j.ifacol.2021.10468
2. Sharma, N., Mangla, M., Mohanty, S., Gupta, D., Tiwari, P., Shorfuzzaman, M., & Rawashdeh, M. (2021). A smart ontology-based IoT framework for remote patient monitoring. Biomedical Signal Processing and Control, 68, 102717. doi: 10.1016/j.bspc.2021.102717
3. Kim, Y., Lim, I., Lee, J., & Lee, J. (2012). Sensor Based Real-Time Remote Patient Monitoring System: A Study on Mobile DB Construction of Minimum Network Traffic in Use of HTML5 WebSQL Procedia Engineering, 29, 2382-2387. doi: 10.1016/j.proeng. 2012.01.319