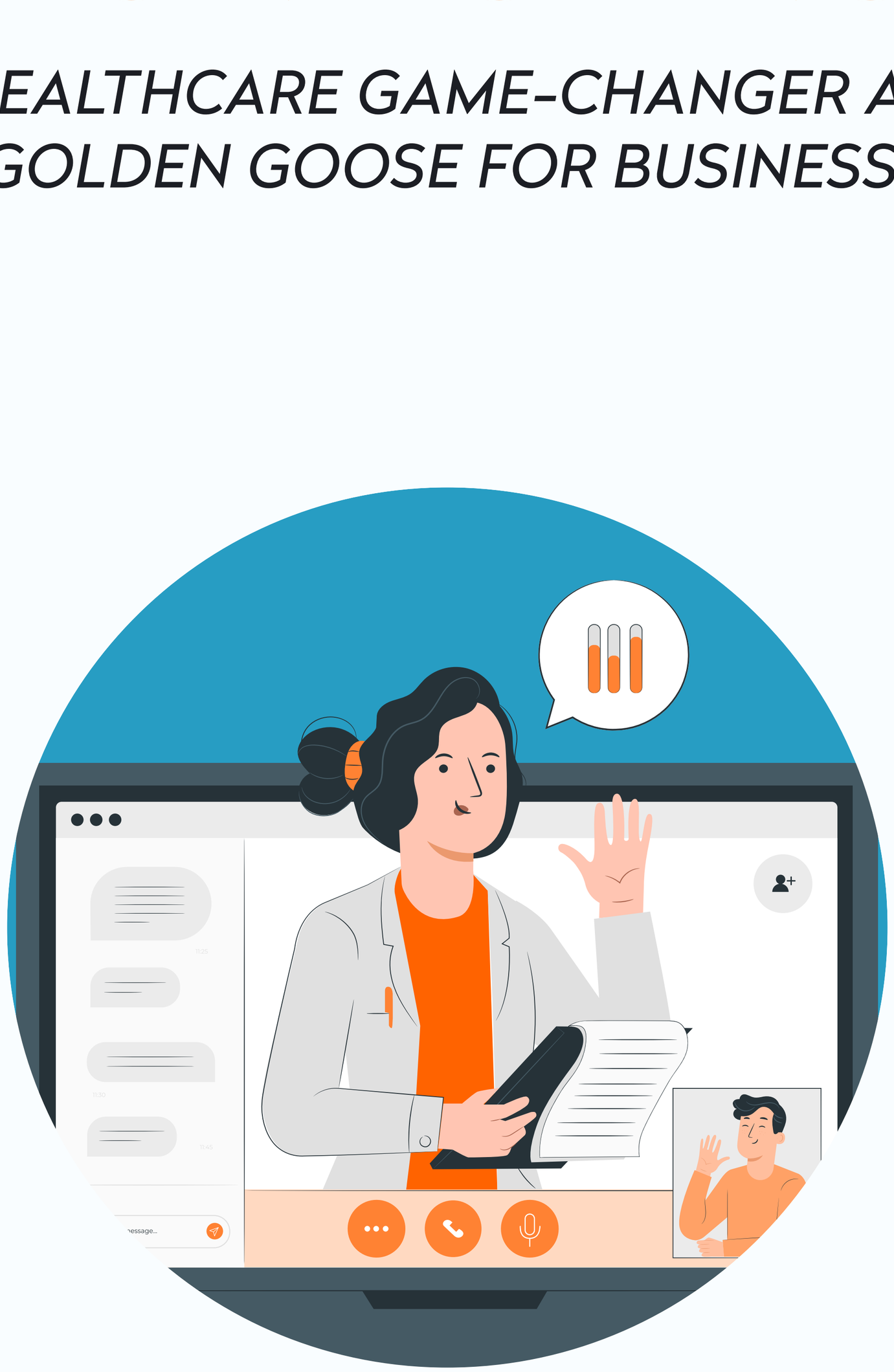
Yalantis

REMOTE PATIENT MONITORING:

A HEALTHCARE GAME-CHANGER AND A GOLDEN GOOSE FOR BUSINESSES



OBSERVING THE UNIQUE STATE OF RPM AND THE OPPORTUNITIES IT'S READY TO PROVIDE AFTER COVID-19

CONTENTS

A BRIEF LOOK INTO WHAT RPM IS:

DEFINITION, BENEFITS, AND MILESTONES

REMOTE PATIENT MONITORING (RPM) *technology allows medical professionals to track a patient's health data outside of a traditional clinical setting. This can take place in a patient's home or anywhere else with an internet connection.*

THESE ARE THE MOST POPULAR FORMS RPM TAKES:

WEARABLE DEVICES

(Smartwatches, fitness trackers, ECG monitors). These devices can track vital signs and provide real-time data to healthcare providers.

IMPLANTABLE DEVICES

(Cardiac monitors, glucose sensors). Implanted devices can continuously monitor internal physiological conditions, such as glucose levels in diabetic patients or heart rhythm in patients with arrhythmias. These are crucial for patients requiring constant monitoring and timely intervention.

MOBILE HEALTH APPLICATIONS

These apps allow patients to log their health data, receive medication reminders, and communicate with healthcare providers.

REMOTE MONITORING KITS

(Blood pressure cuffs, pulse oximeters, weight scales). These kits include various tools that patients use at home to measure their health metrics. They are used for patients with conditions like hypertension, heart failure, and chronic obstructive pulmonary disease (COPD).

TELEHEALTH PLATFORMS

Equipped with video conferencing functionality, telehealth platforms facilitate remote consultations, diagnostics, and follow-up care. They are particularly useful for visits, mental health services, and initial consultations that do not require physical examinations.

HOW DOES PRM WORK?

STAGE 1:

RPM uses various digital tools to collect health information including:

- Vital signs (blood pressure, heart rate, oxygen saturation)
- Weight (monitored through smart scales)
- Blood sugar levels (measured with glucometers)
- Activity levels (steps taken, calories burnt, and overall activity time tracked by wearables)

STAGE 2:

This information is then securely transmitted to a healthcare provider's platform (for example, an EHR system), allowing the provider to monitor a patient's condition remotely.

It's obvious that such technology brings enormous potential to the healthcare field, enabling proactive personal health monitoring so both patients and providers can make informed treatment decisions.

THE KEY BENEFITS OF RPM INCLUDE:

INCREASED PATIENT CONVENIENCE

RPM eliminates the need for frequent in-person appointments, freeing up valuable time for both patients and providers. This is especially beneficial for patients in geographically remote areas or those with mobility limitations.

IMPROVED PATIENT–PROVIDER COMMUNICATION

RPM platforms often facilitate two-way communication between patients and providers. Patients can easily send questions or report any concerns, leading to more timely interventions and a stronger sense of connection with their healthcare team.

REDUCED RISK OF INFECTION

By minimizing unnecessary in-person visits, RPM can help to protect patients, especially those with compromised immune systems, from exposure to contagious illnesses.

ENHANCED MEDICATION ADHERENCE

Certain RPM systems can send medication reminders and track medication use, improving a patient's adherence to their treatment plan.

BETTER QUALITY OF LIFE

By allowing for closer monitoring and improved management of chronic conditions, RPM can empower patients to live fuller and more active lives.

FROM THE BUSINESS PERSPECTIVE

The size of the global RPM market *is poised to reach $207.5 billion by 2028*. You know why? Because RPM implementation already demonstrates mindblowing results:

- *A 50% reduction in 30-day hospital readmissions* for patients with heart conditions in the Cardiac Solutions practice (Phoenix, Arizona)
- *An NPS patient satisfaction score of +86 and around a 50% reduction in inpatient utilization* in Mercy Virtual Care Center (St. Louis, Missouri)
- *A 23% reduction in overall mortality across the four Health First hospitals* through collaboration with Philips (Central Florida)

All of these results also mean:

- Substantial cost savings
- Constantly increasing patient satisfaction ratings (and profits from potential clients attracted by good reviews)
- Business scaling

Considering these real-life examples, a logical question arises: How deeply has remote patient monitoring technology penetrated into our everyday lives?

Let’s take a look at how RPM adoption has been going:

DEVELOPMENT OF RPM THROUGH THE YEARS

We can break the development of RPM technology into four key stages:

STAGE #1: EARLY SEEDS (1990s)

The idea of remote patient monitoring found its roots in the 1990s with the development of basic telemonitoring technologies such as physiological monitoring systems and telemetry systems. These early systems primarily focused on monitoring vital signs in critically ill patients within hospital settings.

STAGE #2: TECHNOLOGICAL ADVANCEMENTS (2000s)

The 2000s witnessed significant advancements in communication technologies like mobile networks and wearable devices. We saw the first mobile health (mHealth) applications, while fitness trackers and smartwatches started gaining wide popularity. These innovations opened the door for the development of more sophisticated RPM systems capable of collecting a wider range of health data remotely.

STAGE #3: POLICY AND REIMBURSEMENT SUPPORT (2010s)

The 2010s saw a crucial shift with the introduction of policies and reimbursement codes from government agencies like the US Centers for Medicare & Medicaid Services (CMS). They provided financial incentives for healthcare providers to adopt RPM technologies.

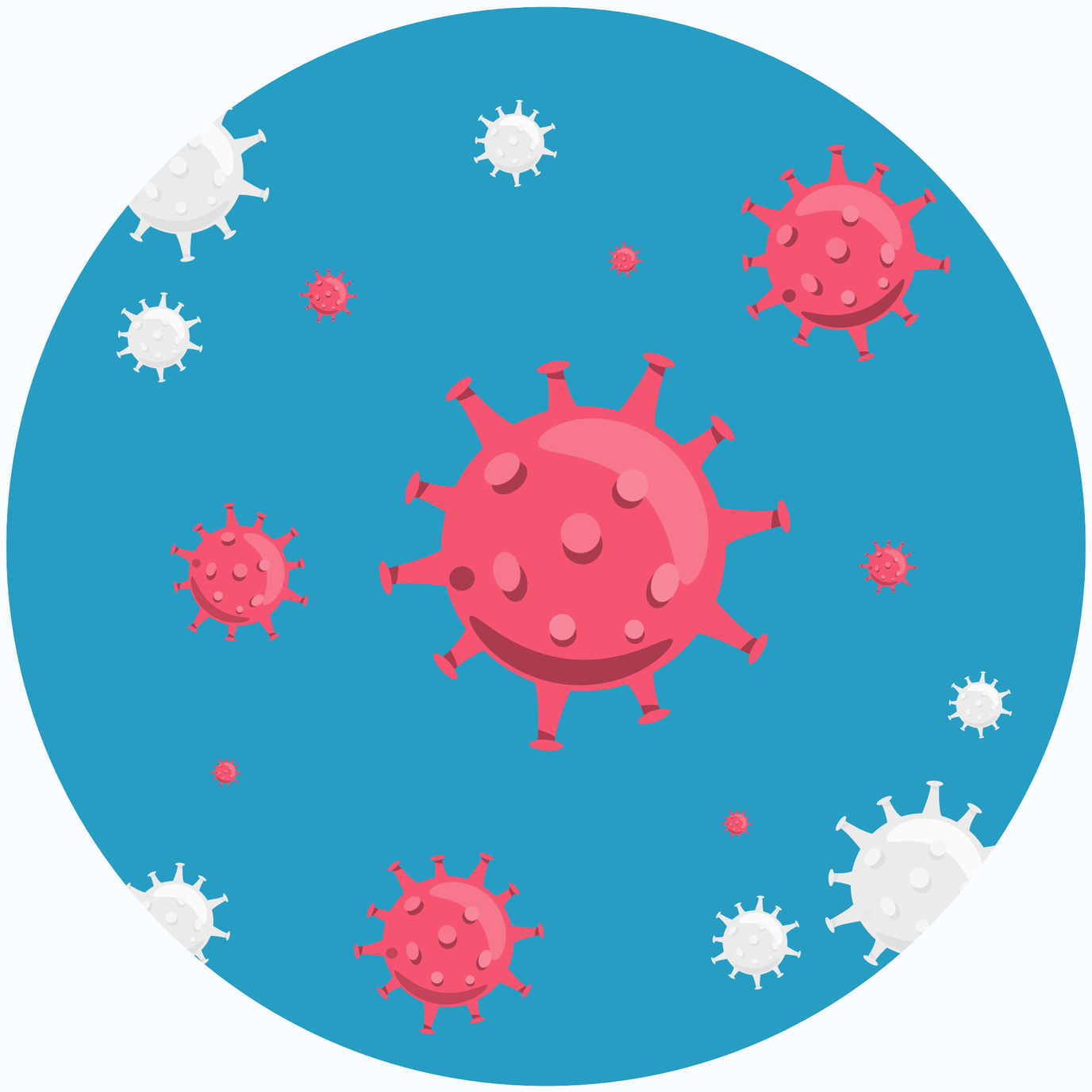
STAGE #4: REMOTE MONITORING TAKES FLIGHT (2010s AND 2020s)

With supportive policies in place and technological advancements accelerating, the use of RPM began to gain traction in the late 2010s. The COVID-19 pandemic further fueled its adoption, as RPM offered a safe and efficient way to monitor patients remotely.

How significant was the pandemic for the remote patient monitoring field?

COVID-19:

A HUGE SHIFT IN THE RPM PARADIGM



Before the COVID-19 pandemic, remote patient monitoring was a growing trend in healthcare, but its adoption was gradual. The unique challenges posed by the pandemic significantly accelerated the use of RPM technologies. Let's explore how COVID-19 propelled RPM into the spotlight.

HOW THE PANDEMIC CHANGED EVERYTHING

Due to the COVID-19 crisis, remote patient monitoring technologies came to the fore. Creating distance between the patient and the doctor was extremely critical during the pandemic because it provided both safety and the possibility for medical professionals to monitor and help more people.

RPM successfully addressed pandemic challenges, enabling the following changes and improvements in the healthcare realm:

SAFETY FIRST

RPM allows healthcare providers to track critical health data remotely, minimizing unnecessary in-person visits.

HOSPITAL CAPACITY

The surge in COVID-19 cases overwhelmed healthcare systems, straining hospital capacity. RPM enabled the safe discharge of patients recovering at home, freeing up beds for critical cases. Additionally, RPM could monitor recovering patients, allowing for early intervention if their condition worsened.

REMOTE TREATMENT REDEFINED

The pandemic forced a rapid shift towards remote healthcare delivery. RPM, coupled with telemedicine consultations, became a powerful tool for doctors to diagnose, monitor, and even adjust treatment plans for patients remotely. Conditions previously requiring frequent in-person visits could now be managed effectively at home.

ACCEPTANCE BOOST

Both patients and healthcare providers became more comfortable with remote care due to the pandemic. Patients appreciated the convenience and safety of RPM, while healthcare providers saw its effectiveness in managing various conditions.

In circumstances when the number of medical specialists was limited (as was the number of hospital beds), the ability for a patient to send a distress signal and receive emergency aid was vital.

Considering all this, it's no wonder that the remote patient monitoring device industry has been booming since the pandemic.

However, the peak is over. ***What can we observe now after the COVID-19 climax?***

POST-COVID REMOTE PATIENT MONITORING: HOW FAR HAVE WE COME?

The COVID-19 pandemic wasn't just a global health crisis — it also served as an unexpected accelerator for advancements in telemedicine. Initially used to manage COVID-positive patients remotely, reducing hospital strain and the risk of hospital-acquired infections, RPM has demonstrably improved healthcare delivery.

But the story doesn't end there. As we move into the post-COVID era, RPM is solidifying its place as a powerful tool, transforming healthcare in exciting new ways. Check them out:

CHRONIC DISEASE MANAGEMENT

RPM is proving invaluable in managing chronic conditions like diabetes, heart failure, and chronic obstructive pulmonary disease (COPD). Patients can transmit vital signs and health data remotely, enabling proactive interventions and preventing complications.

POST-SURGICAL CARE

Remote monitoring allows for closer observation of patients recovering at home after surgery, reducing hospital readmission rates and improving recovery outcomes.

MENTAL HEALTH MONITORING

RPM offers tools for tracking mental health metrics like sleep patterns and mood swings. This data can be crucial for therapists and patients to monitor progress and adjust treatment plans accordingly.

SPECIAL POPULATIONS AND INCLUSIVITY

RPM proves particularly beneficial for geographically isolated populations or those with limited mobility. It empowers them to receive quality care without frequent in-person visits.

ADVANCED ANALYTICS AND AI

Integration of machine learning (ML) with RPM systems enables real-time analysis of patient data. This allows for identifying subtle changes that might indicate potential health issues, facilitating early intervention.

FOCUS ON PATIENT ENGAGEMENT

The post-COVID phase emphasizes patient education and self-management. RPM platforms incorporate educational tools and interactive features to empower patients to actively participate in their healthcare journey.

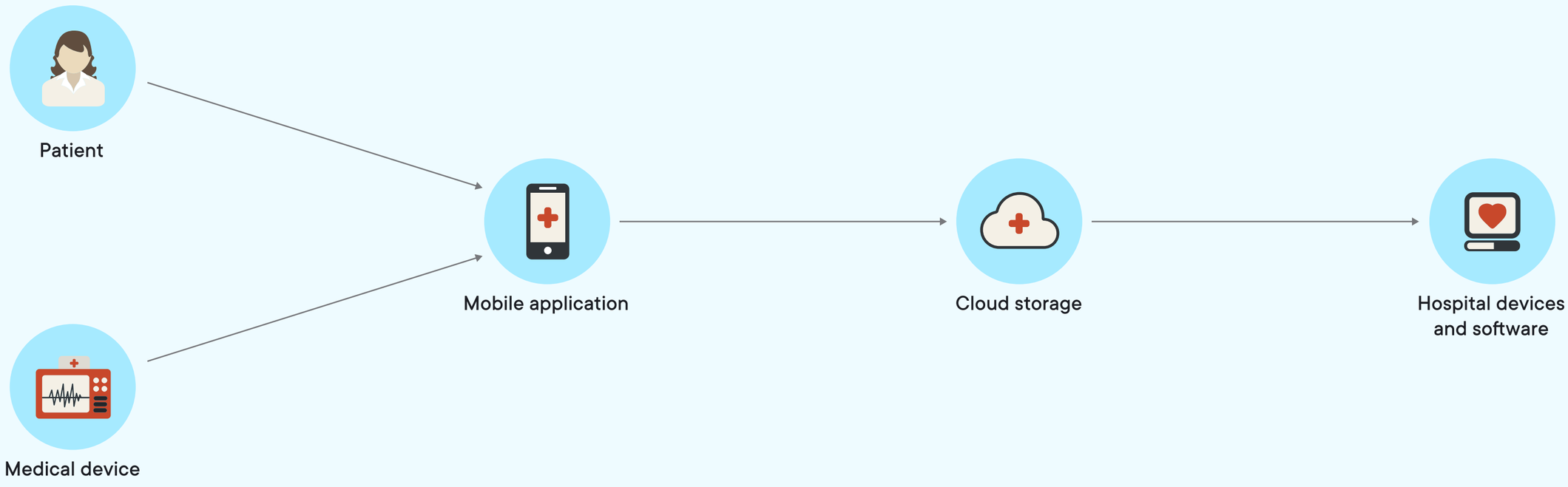
Despite the growing global acceptance of remote patient monitoring technologies, some health providers are still reluctant to implement them. This is mostly because of the hardships associated with implementation — namely, problems with authorization and unclear benefits of RPM.

Let’s talk about how to ensure RPM implementation.

KEY COMPONENTS OF A REMOTE PATIENT MONITORING SYSTEM

RPM systems are mostly considered a kind of IoT network. However, remote patient monitoring is wider than IoT and includes some cases with direct human-to-device interaction.

Here are some key components of an RPM system:



[Key components of an RPM system]

Let’s talk about RPM system components in detail and find out problems they help to solve in order to obtain the most accurate picture of a patient’s health condition.

#1: MEDICAL DEVICES COLLECTING DATA ABOUT PATIENT CONDITIONS

All medical tools and *IoT medical devices* require careful scrutiny and thorough control.

The US Food and Drug Administration (FDA) authorizes medical devices and decides whether they can be used as a source of data sufficient for clinical decision-making.

✓Gaseous-phase CO2 gas analyzers,
✓Diagnostic spirometers,
✓Monitoring spirometers,
✓Peak-flow meters for spirometry,
✓Breathing frequency monitors,
✓Apnea monitors

✓Blood pressure measurement systems,
✓Cardiac monitors,
✓Electrocardiographs,
✓Oximeters,
✓Radiofrequency signal transmitters and receivers

✓Audiometers,
✓Otoscopes,
✓ Electronic thermometers,
✓Electrocardiographs,
✓Biofeedback and sleep assessment devices,
✓Vestibular analysis apparatuses

[FDA authorized medical devices]

YALANTIS HELPED ONE OF OUR CLIENTS OBTAIN FDA CLEARANCE FOR THEIR MEDICAL DEVICE

Learn how

How does it work?

All patient-side RPM devices gather data and send it further — to a mobile device, such as a tablet or phone, and to a mobile application for patients. Several wireless technologies can be used to transmit data from an RPM medical device to a mobile application, but Bluetooth Low Energy is the most commonly used.

Although only data from authorized medical devices can be used for clinical decisions, medical specialists can also find data from common wearables (such as fitness trackers and smartwatches) useful. Yalantis even helped one of our clients *integrate their patient-facing ap plication with smartwatches for broader context*. The healthcare community is still discussing this matter, but the overall opinion towards common wearable devices is becoming increasingly positive.

Another way health data can be gathered is manually by the patient.

#2: PATIENT AS A CORE INFORMATION SUPPLIER

IoT is great, but devices cannot measure everything, at least for now. No sensor can detect a patient's overall mood and how it changes over time, or detect a patient's subjective level of depression. Still, these factors are really important in creating a broad picture of illness, especially when it comes to long-term diseases such as cancer.

How to solve this problem?

Such information can be obtained via a questionnaire or a feedback form filled out manually by the patient. After data is filled in, it is processed by a mobile application and sent to the cloud, where it can be analyzed by medical professionals.

Here are some of the parameters that patient-managed remote control applications can gather:

- Overall mood and feeling of wellness
- Sleep quality
- Whether a patient feels well-informed about the illness and possible treatment
- Level of accomplishment in daily activity

- Feelings of nausea
- Weight loss or gain
- Social activity

This list can be long and must be specific for each particular illness.

Analog data undergoes digital transformation and is sent to the next component: the patient-side mobile application.

#3: MOBILE APPLICATION AS AN INTERMEDIARY BETWEEN PATIENT AND MEDICAL DEVICE

Mobile applications act as a bridge between patients, their medical devices, and the healthcare providers receiving the collected health data. However, these apps must navigate a tricky path. On the one hand, they need to comply with a variety of regulations to ensure patient privacy and data security. On the other hand, they must be user-friendly to encourage patient engagement and maximize the amount of valuable health information collected.

ACHIEVING THIS BALANCE IS KEY

The app's security features should be robust without becoming overly complex and frustrating for patients. Transparency is also crucial: patients need to understand exactly what data is being collected and how it's used. A well-designed user interface that is easy to navigate and accessible for users with disabilities is essential for maximizing patient adoption.

#4: CLOUD DATA STORAGE

In remote patient monitoring, cloud storage acts as a central hub for collected health data. This data can arrive in two ways:

1. MOBILE APP GATEWAY

Most commonly, information is transmitted from the patient's mobile application, which acts as an intermediary between the medical device and the cloud storage.

2. DIRECT DEVICE CONNECTION (LESS COMMON)

In some rare cases, if the medical device itself has strong enough connectivity features, it might transmit data directly to cloud storage, bypassing the mobile app.

Once the data reaches the cloud, it's then securely transferred to the healthcare provider's systems for analysis and monitoring. This centralized storage allows healthcare professionals to access patient information from various devices and locations, facilitating comprehensive care management.

#5: HOSPITAL DEVICES AND SOFTWARE THAT ANALYZE INFORMATION ABOUT PATIENT HEALTH

This is another part of the RPM flow where an application is needed, often being integrated with a general EHR system.

YALANTIS HAS EXPERIENCE INTEGRATING EHRS WITH PATIENT MANAGEMENT SYSTEMS

Go through the whole process of integration

On the hospital side, the application should consist of several main centers, each with its own function:

THE CENTER OF ANALYSIS

Provides medical personnel with complete and processed patient data along with visualization tools and business intelligence. It is the main part of the application that allows doctors to make informed clinical decisions.

THE ASSISTANCE CENTER

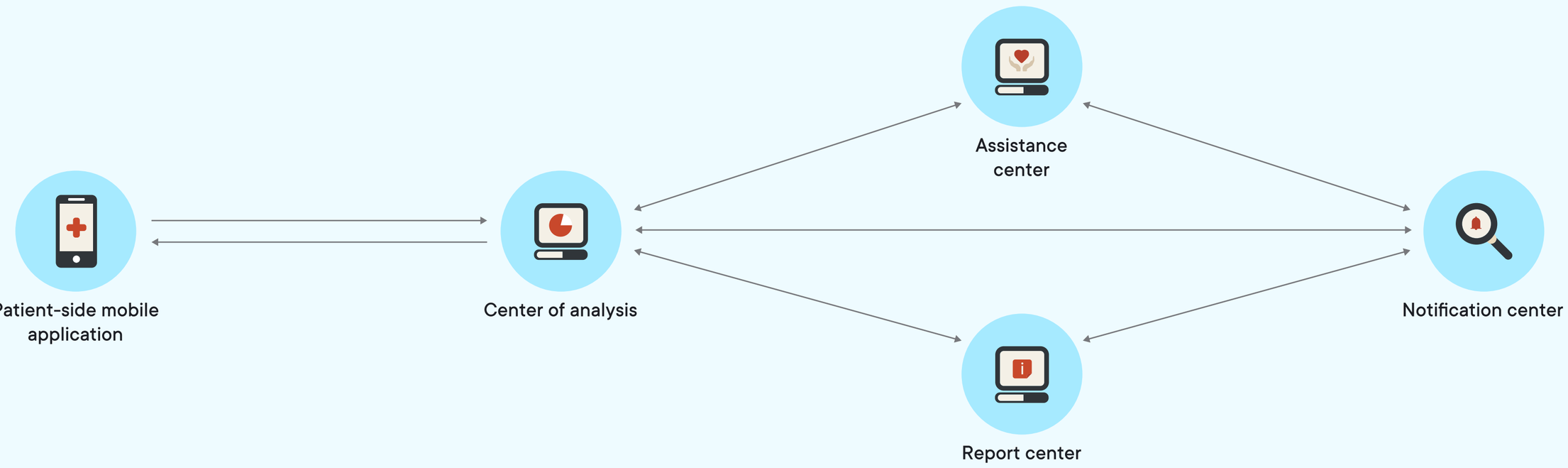
Automatically compares data received from the patient to limits set by the doctor. If the limits are surpassed, this information is transmitted to the notifications center.

THE NOTIFICATIONS CENTER

Is designed to generate warning messages once the assistance center discovers that limits have been surpassed. If they are, a notification is immediately sent to the medical specialist responsible for monitoring.

THE REPORT CENTER

Gathers all information generated by measurements and their processing, arranges them into reports, and sends them to the person responsible.



[Hospital-side application structure]

What’s next?

After data has been received and processed on the hospital side, the next step is for hospital staff to react. The responsible healthcare professional either makes a clinical decision on changes in the treatment process or, if the information was obtained by unauthorized devices such as fitness trackers, gives general recommendations to the patient.

RPM systems are generally very useful, but they excel in telehealth solutions. A large portion of healthcare institutions have already implemented telehealth solutions into their workflow, and they can be improved by adding RPM functionality.

REMOTE PATIENT MONITORING APPLICATION DEVELOPMENT:

HOW TO PUT TOGETHER THE ESSENTIA COMPONENTS

Custom software development for an RPM system can be divided into two main parts:

1. *Building the patient-side application*
2. *Building the hospital-side application*

Patient-side application

First of all, a patient's interactions with the RPM solution have to be as clear as possible: the effectiveness of data gathering depends on it, as does the overall quality of treatment by extension. It is also important to consider that the application's UI/UX must be accessible for various user groups, including elderly people and people with motion and/or vision limitations.

Besides, an application intended for a patient's mobile device has to meet a certain set of criteria:

Support the correct protocol for interaction with IoT medical devices gathering vital patient data. Most likely, these devices will use the Bluetooth Low Energy (BLE) protocol, but they may also use LoRaWAN or other standards.

Maintain a high level of security for protected health information and comply with HIPAA requirements.

Be able to integrate into a system of interconnected medical software products by establishing a connection with the hospital-side system through a secure API that supports HL7 FHIR standards.

Possess caching mechanisms to prevent connectivity issues in case of network failures.

In addition to meeting these criteria, you could implement a great number of upgrades and improvements according to your particular requirements.

AN EXAMPLE PROJECT FROM OUR EXPERIENCE:
HOW WE REDEFINED AN EXISTING TELEHEALTH SOLUTION

The Yalantis team needed to enhance the functionality of both patient-side and hospital-side applications and implement a telehealth module. The client's focus was on integrating IoT elements into their solution to increase the effectiveness of overall patient treatment. Here are the improvements we introduced to the patient-side application:

IMPROVEMENTS AIMED AT THE PATIENT EXPERIENCE

The user interface was lacking in terms of user-friendliness. We created a new UI, making it easy for patients to navigate, send information, follow guidelines from medical professionals, track overall treatment progress, and give feedback. We also made sure that the UI was clear and understandable for all age groups and patients in any physical condition.

LIVE VISIT MODE WITH VITALS TRACKING

We added a feature that allows the application to automatically detect when an online doctor visit is live and switch to a mode that allows the doctor and patient to seamlessly interact with each other and share real-time medical data.

COMPREHENSIVE PATIENT DASHBOARD

A patient's understanding of the treatment flow and their state is crucial for overall treatment success. Therefore, we implemented an overview with all data accumulated over a certain period presented in a clear and easy-to-read form.

DOCTOR-CONTROLLED SCHEDULES

Another effective tool for maintaining the treatment flow is a scheduling system. It's a great way for doctors to assign times when patients should do any kind of routine activity: take medication, check vital signs, or perform physical exercises. The system sends automated notifications to patients.

HOSPITAL-SIDE APPLICATION

The hospital-side application has its own set of requirements to comply with, including:

- **HIPAA requirements.** JJust as with the patient-side application, *HIPAA compliance must be maintained at all times*.
- **Healthcare interoperability standards.** The application must be able to successfully become part of a complex device and software system, which most of the time means adopting HL7 FHIR and US Core Data for Interoperability (USCDI) standards.

BECAUSE RPM INVOLVES SENSITIVE PATIENT HEALTH DATA, ADHERING TO COMPLIANCE REQUIREMENTS IS PARAMOUNT BECAUSE:

- compliance ensures only authorized personnel can access patient data and that such data is transmitted and stored securely
- compliance requirements ensure that data collected through RPM systems is reliable and trustworthy, helping healthcare providers make informed decisions based on accurate patient information
- compliance requirements establish safeguards to minimize the risk of data breaches and unauthorized access, protecting patients from potential harm

PART 2 OF AN EXAMPLE PROJECT FROM OUR EXPERIENCE:
WHAT WE DID FOR THE HOSPITAL-SIDE APPLICATION

Getting back to the Yalantis IoT integration case we described above, we also made some major improvements to the existing hospital-side application. Here are some of the most important enhancements:

NOTIFICATION SYSTEM

The system constantly receives data from vital sign sensors and sends notifications as soon as changes reach an established threshold indicating a serious deterioration in the patient's state. Medical professionals monitoring the system can then react accordingly, administering urgent measures.

SYNCHRONIZATION OF ONLINE SESSIONS WITH TRACKING PROCESS

The second half of the synchronization system is built into the hospital-side application. The doctor can review measurements taken during the online visit and analyze them without interrupting the visit.

ENHANCED MONITORING AND CONTROL OF VITALS DATA

We made it easier to visualize data on vitals gathered from sensors. A plethora of data visualization tools are now available to the user, such as graphs and tables, so that even large amounts of information can be processed by doctors.

ROUTINE CREATION TOOL

Now, doctors can create customized routines for patients, setting times for medication intake, physical exercises, vital sign checks, and online visits. Notifications are sent to patients, ensuring their awareness and improving the treatment flow.

LEARN MORE ABOUT OUR EXPERIENCE REDEFINING A HEALTHCARE SOLUTION

Read case study

Setting up your IoT remote patient monitoring system is a great way to ensure a constant increase in healthcare service quality, but it’s not the limit. Yalantis specialists can assist you in building another kind of RPM: a patient-reported online measures (PROM) system.

BEYOND IOT:

PROM REMOTE PATIENT MONITORING APPS

Some medically significant metrics cannot be measured via IoT devices alone. Especially in the case of chronic and long-term diseases such as cancer or diabetes, many things crucial for the treatment process can only be measured or assessed by patients themselves.

Therefore, patient-reported outcome measures, or PROMs, keep gaining importance in the field of medical data assessment. Of course, the subjective experience of the patient cannot (for the most part) be a reason for a clinical decision. However, it can be used for creating a general picture of treatment progress and as a basis for recommendations aimed at improving a patient's quality of life. PROM-based applications can also include access to online patient portals, creating self-help groups and providing a sense of unity.

Here are some important points on the importance of PROM applications:

Patient reported information helps medical professionals establish the most effective treatment practices by presenting large amounts of data on the pain levels, physical function, and mental state of patients, simultaneously aiding in making clinical decisions.

PROM questionnaires can use both generally accepted standards — such as SF-36, VAS, or EQ-5D — and implement more specific sequences developed for a particular ailment.

PROM questionnaires should be created with user-friendliness and compactness in mind; an abundance of information can lead to patients getting bored and annoyed and can therefore reduce patient compliance.

FOR EXAMPLE,

Yalantis designed PROM functionality for a telehealth-based home rehabilitation solution. Questionnaires we created help providers gather critical information about a patient's lifestyle, routines, and habits and design a unique and perfectly suitable rehabilitation program for them.

- PROM systems are also useful for creating predictive models. Establishing patterns in patients' states and treatment flows makes it easier for doctors to make clinical decisions and leads to more cost-effective services.

Our specialists believe that the trend toward PROM systems and applications will continue to grow, especially as more and more healthcare providers switch to value-based services.

CONCLUSION

The COVID-19 pandemic has changed the rules in the healthcare industry forever.

People will rely more and more on remote healthcare, be wary of face-to-face interactions, and expect the industry to be ready for the next global pandemic. The best way for healthcare providers to demonstrate such readiness is to employ reliable remote healthcare technologies now.

RPM systems, however, are more than an alternative to on-site healthcare. They intertwine with it and expand its limits. They can allow patients to register a lot more data on their health and general state of body and mind, leading to an increase in the effectiveness of in-person visits to the doctor.

RPM systems are gathering data in much larger volumes than traditional medical methods, and they are also teaching patients to be more attentive towards their health.

YALANTIS HAS SPECIALISTS WITH IMMENSE EXPERTISE IN REMOTE PATIENT MONITORING

If you want a reliable partner or an expert consultation on RPM matters, contact us — we would be happy to help!

Talk to our representative

Yalantis

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