



The Aotearoa New Zealand Remote Patient Monitoring Guide 2023

A guide for healthcare service providers, planners and suppliers.

Background to this revised guide

The COVID-19 pandemic and Te Pae Tata Interim New Zealand Health Plan 2022 has put the spotlight on the use of remote technologies to support the delivery of healthcare and whānau to manage their health from home using remote patient monitoring technology. The New Zealand Telehealth Forum (NZTF) has previously been active in this work space, contributing to the development of the first New Zealand Remote Patient Monitoring Guide released in 2021 in collaboration with the Emerging Personal Health Industry Group (EPHIG) within the Digital Health Association (DHA). In 2023, the NZTF relaunched a Remote Patient Monitoring (RPM) working group to contribute leadership, network, knowledge and learnings in



this area to support best practice adoption of RPM. As part of this mahi (work), the group has reviewed the existing Guide. There was consensus that the 2021 document is generally still current and valid as a technical guide, with some minor changes made to reflect current use and technologies. Importantly, examples of learnings have been added in the boxes throughout the document. These learnings have been generously shared by members of the NZTF RPM working group involved with RPM initiatives.

About this Guide

The intended audience of this Guide is Aotearoa New Zealand healthcare providers, planners and suppliers looking to implement RPM solutions. RPM, also termed telemonitoring and remote home monitoring (RHM), is a healthcare delivery modality that involves the use of information technology to monitor patients at a distance. The range of RPM service capability can be as simple as a falls pendant through to immersive virtual reality monitoring of physiological and neurological components. The monitoring can be managed by commercial monitoring agencies, private care providers, public healthcare, GPs, the patient's whānau/family or self-monitored using Apps and logs.

This Guide is intended to:

- Help healthcare service providers, planners, or suppliers comprehend the technology that is appropriate for their needs and the planning and implementation processes required for Remote Patient Monitoring (RPM) systems.
- Describe the requirements that third-party providers (who are operating for-profit or not-for-profit RPM services) need to consider when assessing the benefits and risks of establishing RPM systems.

This Guide is laid out in the following way:

- Introduction: Definition of RPM, its potential benefits and the six foundational dimensions that need to be considered in planning.
- **Getting started:** Why an RPM might be implemented, general principles of implementation, data considerations and a key features flow chart.
- Sections 1-4: Descriptions of use case examples that highlight how a configuration around the six foundational dimensions will operate for three persona models representing the 'common' use cases of RPM.
- **General guidelines:** A list of general guidelines based on general learnings from the implementation of RPM in Aotearoa/New Zealand.
- Example of current working models: Descriptions of RPM in practice in Aotearoa/New Zealand.
- The RPM Checklist: A checklist to help ensure that all key aspects are considered when implementing RPM.
- Lessons learned: Examples of what people implementing RPM in Aotearoa New Zealand have learned appear in the boxes throughout the Guide, indicated by this icon. These lessons cover the themes of of relationships, clinician's experience, technology, patient and whanau experience, processes and support.

Introduction:

RPM is described as the use of information communication technology (ICT) to monitor patients at a distance. RPM technologies include¹:

- Web-based or mobile Apps for uploading information, such as blood glucose results or logging physical therapy prescribed exercise adherence and pain management.
- Devices that measure and wirelessly transmit information, including weight scales, blood pressure, blood glucose, oxygen saturation, or lung function.
- Wearable devices that automatically record and transmit information, especially monitoring.
- Heart rate, blood glucose, gait, posture control, tremors, physical activity, or sleep patterns.

The technologies used for RPM today extend beyond those that have been used in supporting aged and disability care or patients with long-term conditions. This Guide also touches on advancements in RPM that support maintenance of wellbeing or healthy lifestyles of at-risk groups. The Figure below illustrates the range of RPM.



Figure 1 - Examples of the range of RPM

¹ Home monitoring devices or pendants for aged care or disabilities that detect changes in normal activities such as falls. These are also known as Personal Emergency Response Systems (PERS) and are often related to but are not considered RPM in this guide.



Planning for RPM

A Harvard Business Review (2020) article² outlines four key clinical activities of RPM:

- a) Collects data on patients remotely, e.g., at home or in the community.
- b) Transmits data to health care provider (or designated support person) in a different location.
- c) Evaluates data and notifies healthcare providers as needed.
- d) Communicates data-driven insights and interventions.

For successful RPM systems, six foundational dimensions need to be planned: the care setting; technology; software; operating environment; stakeholders; and maintenance and sustainability. These dimensions are shown in Figure 3.



Figure 3 - Six dimensions that require planning in RPM

²https://hbr.org/2020/07/how-to-make-remote-monitoring-tech-part-of-everyday-health-care

In this guide, we provide a description of use case examples that highlight how a configuration around these six dimensions will operate for three persona models representing the 'common' use cases of RPM.



looks at patients who currently meet the requirement for dependent living, and where their needs are met by safety devices like medical alarms.

reviews supported living arrangements where patients may be discharged from long-term condition services, or surgery and require rehabilitation support.



discusses people with technologies that enable wellbeing and regular self-monitoring.

looks at the emerging technologies available to provide advanced monitoring.

Before detailing these sections, we look at why an RPM service should be implemented and some general principles of implementation including data considerations.



Getting started

Why implement an RPM service?

The aim is to identify users of services that will benefit from being monitored, where they will have opportunities to respond to feedback and make alterations that will improve prognosis of a condition and reduce unnecessary escalation to higher levels of care. Health systems aim to reduce unnecessary hospitalisations, and patients want to live their life fully. However, providing such services requires key questions to be addressed to optimise cost effectiveness of care delivery.

Discussions and decisions around models of care need to ensure that the service is appropriate, sustainable, effective, and technology enabled. To understand the foundations of what is required in the model of care, you must first understand the desired outcomes or problem statements.

General principles of implementation

Best practice RPM implementation requires:

- 1. Specific, Measurable, Achievable, Relevant and Time-bound (SMART) programme goals.
- 2. User-centred approaches defined for patient needs.
- 3. Defined clinical outcomes.
- 4. Agreed satisfaction outcomes.
- 5. Measurable operational outcomes.
- 6. Technology platforms, including devices and infrastructure, which have been adequately tested in clinical settings for robustness and quality control validation, e.g., Federal Drug Agency (FDA)/TGA /Medsafe approved or ISO13485.
- 7. Technology platforms that are fit-for-purpose and suitable for the operating environments and care settings.
- 8. A digital health equity approach to ensure RPM is accessible can be beneficial to whānau/families most disadvantaged to benefit from RPM technology.
- 9. Surveillance of where RPM may already be implemented, evaluated, and/or where best practice has been established so that there are learnings from others.
- 10. Trackable financial outcomes.
- 11. Defined stakeholders with confirmed responsibilities.
- 12. Established change management processes.
- 13. Well-defined workflow and business operating models.
- 14. Clear minimum commitment duration from the patient and supporting parties.

Data considerations

RPM has significant data considerations and RPM implementation requires that:

- 1. Data must be obtained through adequate informed consent processes.
- 2. Data must be stored in environments that conform to the health information security framework (HISF), i.e. HISO 10029:20223.
- 3. Ethical and privacy laws must be considered for compliance including both data sovereignty and indigenous data sovereignty⁴.
- 4. Data gathering should not cause unnecessary burden on end-users.
- 5. Data must be easily accessible for clinicians and where appropriate, conveniently summarised.
- 6. Data standards should be applied with the intention of making data interoperable with other health records of the patient.
- 7. Data must be maintained for quality and assured for accuracy on a routine basis.
- 8. Data should be provided to enable healthcare decisions based on meaning, usefulness, and at a frequency that enhances patient safety.

Clinician's experience

the community."

"The RPM programme would sit well alongside the Hospital in the Home service, using the expertise of the CNS to manage patients in

³ https://www-tewhatuora-govt-nz/publications/health-information-security-framework

⁴ Consider Principles of Māori Sovereignty until the implementation of Te Aka Whai Ora Maori Sovereignty Framework

RPM key features



Figure 4 RPM system key features

Section 1 - Dependent Living: Low technology involvement

Persona:

RPM users who are generally dependent on others to help with their daily living activities. They may have:

- low health and digital literacy
- · have moderate to severe clinical conditions or impairments
- · be primarily suited within an aged care or supervised living environment
- be prone to falls and require simple dedicated devices
- require a fully supported service with escalation pathways (e.g. software enabled, by service design or clinical pathways)
- are generally too unwell to be funding their own care, technology access, connectivity
- may not have access to a health workforce who can walk alongside the patient to support their use of the RPM

Service model considerations

Telecare Services Association of New Zealand (TSANZ) Specification for Telecommunications Based Personal Emergency Response Systems (PERS):

- Part 1⁵: Alarm equipment provider technical and operational requirements
- Part 2⁶ : Alarm service provider requirements.

Care settings

Aged care or residential care facility or independent living dwelling within a village complex. The patient may have poor visual, cognitive or tactile abilities and may require simple, dedicated devices.

Technology review

- Pendant with base or standalone, 3G/4G/5G technology with or without Wi-Fi.
- Regular test-calls.
- May involve base-sets that can repeat signals and provide an audio link to the location.
- More advanced deployment may involve dedicated device and/or devices with video or voice activated devices to feedback short check-ups that may occur several times a week.

Software considerations

- Guaranteed delivery of messages, audit, monitoring of calls, clinical safety alerts and patient non-response alerts.
- Retain information required for escalations to appropriate users.
- Software enabling daily and hourly level trends, with escalation pathways (which may include in-person attendance) and agreed plans with clinicians, caregivers and patients.

The New Zealand Remote Patient Monitoring Guide 2023

Relationships

"Engagement is best supported by relationships."

Clinician's experience

"Ensure patient group meet the RPM inclusion criteria, numerous patients were older adults with comorbid conditions hence difficult to manage."

Technology

"With the increasing heterogeneity of mobile devices, supplied RPM devices are often a preferable solution because it standardises the patient experience."

 ⁵ https://www.tsanz.org.nz/_files/ugd/fed9d3_c395edd4ccd045cdb0b77aa50ba09ed1.pdf
 https://www.tsanz.org.nz/_files/ugd/fed9d3_227b35ad16d449f8bfd3054219e0641c.pdf

Operating environment

Platforms of this nature may be classed under safety monitoring technologies, where emergency call and personal emergency response systems (requiring a dedicated monitoring provider service that may operate 24/7), and could involve capabilities to detect and prevent falls, environmental monitoring, access controls, and wander management.

Stakeholder responsibilities

There are usually five parties in this arrangement service:

- Funders which may be family or social agencies
- RPM service provider which meets TSANZ audit and compliance
- Monitored user
- Designated escalation person (e.g., whānau/family, friend or neighbour who has immediate check in)
- Clinical support/caregiver provider (e.g., GP, or nurse team in an aged care facility)

Maintenance and sustainability

- These patients would usually require long term monitoring and may be on programmes for long periods. Therefore, logging of history, trends, and interactions must be completed on a robust software package that allows for relationship management and reporting.
- Hardware technologies need to be serviced or maintained in regular intervals to keep accurate information. It is recommended that base sets are tested for connectivity at least once every quarter, and physical service maintenance or replacement within two years.

Clinician's experience

"It's been a great pleasure to have been part of this program in nurse capacity, this has created awareness of the current/ongoing shift of health services to primary care rather than secondary care."

Technology

"BYOD device use needs to consider ongoing management of the device, such as connectivity, updates, data management, offline storage capability and linking and unlinking identities."

Clinician's experience

"New technology promoting health in communities - reduces hospitalisation, and time of inpatient admissions."



Section 2 - Supported Living: Technology enabled – but well supported

Persona

Users of this type:

- Would be primarily managing at-risk patients, who are clinically supported for management of chronic conditions, or post-acute patient stabilisation and rehabilitation.
- Might have a range of health and digital literacy but need to be actively monitored for their condition to help recovery and promote self-management.
- The RPM may conclude once the patients are able to self-manage.

Service model considerations

In New Zealand, there is no centrally funded mechanism. Current service providers are reliant on patient-self subscription, value-adding initiatives at residential or aged care facilities, or hospital telehealth initiatives.

Care settings

- Patients of this type require personalised care plans with education self-management advice linked with measurable goals, to successfully manage this type of service intervention.
- Each patient may be different in condition, with common uses for respiratory (Chronic Obstructive Pulmonary Disorder (COPD)), cardiovascular (Heart Failure), or blood pressure (BP) monitoring.
- Routine physiological parameters may involve weight, blood pressure, temperature, pulse oximetry, heart rates and rhythm.
- Patients could also have behavioural questionnaires as well as patient experience and/or outcome measures.

Technology review

- Technologies of this nature may be based on mobile devices using Apps or a dedicated RPM device.
- It may involve GPS, Bluetooth, WiFi, 4G/5G based services connectivity, and may or may not involve a base-set.
- It may involve a store-and-forward function or a live feed.
- It will likely use video capabilities to check-in and complete surveys on the device.
- RPM devices need to be compliant with current privacy and data protection requirements⁷, the Therapeutic Products Act 2023 (software as a medical device)⁸ and Radio Spectrum Management if using Bluetooth⁹.

Patient and whānau experiences

"Whānau were able to choose when and where they accessed information and advice from a kaupapa Māori perspective alongside the knowledge and information of a clinical kaimahi."

Technology

"Our experience is that the people like knowing the system has been created and designed for people just like them. For the vendor that means that some flexibility in the configuration of the consumer-facing software for different patient cohorts is greatly beneficial."

⁷ https://www.legislation.govt.nz/act/public/2020/0031/latest/LMS23223.html?search=ts_act%40bill%40regulation%40deemedreg_privacy_resel_25_a&p=1#LMS23417
⁸ https://www.legislation.govt.nz/act/public/2023/0037/latest/whole.html?search=sw_096be8ed81d97df2_software_25_se&p=1#contents

⁹https://www.rsm.govt.nz/assets/Uploads/documents/compliance-guide.pdf and https://iotalliance.org.nz/wp-content/uploads/sites/4/2019/05/IoT-Spectrum-in-NZ-Briefing-Paper.pdf

Software considerations

- May be an App or dedicated device arrangement for the user which should be easy to setup or can be provisioned from back end by the service provider.
- The App device is connected to a back-end clinical management software which can send reminders to the patient to provide periodic information (such as response to questionnaires, symptoms and record medical measurements (such as temperature, blood pressures, etc.) back to clinicians.
- This software can be supported with decision support operated by the RPM service provider and/or caregiver team.
- Ideally, this is provided with access to medical records and telehealth functionality.
- An associated web App may be provided to the escalation person or GP to review trends and performance towards goals.
- Alert systems are designed to trigger second tier assessments alongside support teams.
- Often a virtual ward functionality and a dashboard is required to monitor and manage many patients in the community.

Operating environment

- The technology involved in this requires monitoring processes for timed check-ins. Some technologies allow for hourly measures with video check-ups on a daily or business hours basis. May be operated under a shared provider arrangement where GPs/healthcare teams operate during business hours, while RPM service providers manage after-hour services.
- Exception based alerts and manual intervention are essential and may be supported using Artificial Intelligence (AI) learning services to analyse data, and send alerts based on rules. As higher data points increase workload, the use of AI may need to review anomalies, alerts for escalation and medico-legal review.
- Services may need to consider a surge-based support approach which could be scaled back to timed check-ins at agreed intervals when independent living behaviours are established.
- The cost to the user should be optimised to increase ready uptake of the service as costs are usually borne by the patient.

Stakeholder responsibilities

There are usually six parties in this arrangement service:

- Funder (e.g. an organisation, health agency, individual or family)
- RPM service provider
- Monitored user
- Designated escalation person (e.g., family, friend, or neighbour who has immediate check-in)
- Caregiver (e.g., their local nurse team in aged-care facility)
- Specialist, GP, Nurse Practitioner or Nurse responsible for clinical management.

Support

"Language between the technology providers and tech support and patients is often different – a skilled and trained support provider offers 'translation' and trouble-shooting support."

Patient and whānau experiences

"Respondents believed digitally enabled health care increased equity and ease of access where travel time and cost had previously been a barrier."

Clinician's experience

"Patients taking charge of recording observations and new symptoms enabled them to note changes in condition early."

The New Zealand Remote Patient Monitoring Guide 2023

Maintenance and sustainability

- Most service provider goals for this type of programme will aim to improve clinical oversight and make timelier interventions so risk factors can be better managed, and hospital admissions/in-person clinical contact is minimised. Therefore, routine management of physiological and social measures is required to spot any potential deterioration prior to requiring hospital level care.
- Users of this programme need to have ownership and empowerment over their health goals to maintain their devices and note when there is uncertainty.
- Technology must be routinely checked and maintained for accuracy, quality and security purposes. Technical and operation support must be easily accessible within a reasonable business day to review, maintain, or replace a device/change batteries that would create data which would be relied upon for provision of clinical care.

Lessons learned

- Physiological parameters in isolation without context are not useful to patients or providers of care. Each physiological parameter is only a measure at a point in time of a specific trait, and needs to be combined with location, environment, social, and clinical situation to gather the correct context for safety and clinical purposes. For example, blood pressures, heart rates, and ECG's have high variability or may create false-positive trends when the influence of social events or medicines have not been considered. Therefore, it is important that the way the RPM information is captured is reflected to the patients and/or providers of care in a way that is relevant, consumable, and is integrated to support a holistic view of health.
- Only exception events must be presented to enable the service team to focus on those who need help.
- When presenting data to clinical teams, consideration should be given to the fact that they only have limited time to discuss the patient's case and data must be useful and relevant for clinical decision support. Data may be presented in 'number of abnormal events in the last week/month/last review,' or 'trends in the last month of non-adherence to goals. Just providing a log of data may not be useful to service providers, patients, or clinicians.
- Service providers should have clinical context, and consent to access a patient's up-to-date relevant health records to make the best judgement towards appropriateness of their RPM implementations.
- New generation of RPM services can be implemented using 'Fully Managed Device Kits' with integrated Mobile Device Management solutions. This means simply identifying a device (through a QR code or Radio Frequency Identification (RFID)), synchronisation to network, assigning to the user and issuing the device without further setup needed by the patient and no connectivity concerns: "It just works!"

Clinician's experience

"There appeared to be no age barrier to using digital services and, in some cases, the whole way consumers experience and manage their own health has changed. There were significant positive shifts from those who hadn't experienced telehealth before to now seeing the benefits."

Processes

"When on-boarding to an RPM system, demonstrate exactly how to use it and then watch patients using the system to help them learn, this also has a material impact on early engagement."

Clinician's experience

"RPM Initiative has a population focus rather than individual focus. The whole family unit becomes aware of healthy diets and begin to understand a long-term condition."

(Ç)

Section 3 – Wellbeing: Patient Self-Monitoring

Persona

Users of this type are:

- Subscription based services e.g., with a fitness or dedicated smartwatch device.
- Using wearable devices with GPS, 3G/4G/5G connectivity, and continuous physiological measurement that logs routinely in the background.
- In an at-risk group with pre-dispositions
- Wants to maintain independence
- Technology literate
- Have a social support system that enables family/ whānau -based monitoring and response management

Service model considerations

• Most programmes offering this service have an upfront device cost, in addition to subscription service arrangements for value-adding monitoring. The service may support approved mobile platform (iOS/Android) compatible medical devices.

- Some prevention programmes for patients with pre-dispositioned chronic diseases such as early stage renal, diabetes, COPD etc., may be subsidised by healthcare services using RPM technologies.
- Providing useful patient-specific content for self-management will improve the quality of service.

Care settings

Consumers of this service are self-selected and generally living in independent situations and have high cognitive and tactile capability.

Technology review

Wearable devices with self-managed dashboards on Apps or web portals, which also have sharing consent capabilities.

Software considerations

Web based App synced with devices that may be embedded or attached to a person (wearable).

Operating environment

Users will be across a spectrum of environments, and alerts are provided to a carer who might help self-monitoring or assist education of wellbeing considerations.

Relationships

"We had the patient and whānau voice, and together with the health professionals, created a crossspectrum view, which supported shifting the model of care towards a much bigger community focus."

Clinician's experience

"Eliminating the use of passwords is beneficial so that patients don't forget them and then need to reset them several times."

Clinician's experience

"Helped the patients develop routines for vitals and medications. Patients became more connected with GP practices and began to question why medications were prescribed."

Stakeholder responsibilities

There are usually three parties in this arrangement service:

- Monitored user
- Escalation person (family or friend)
- Clinical provider (e.g., their GP, or usual health care provider) who would be consulted if consumer or escalation person is concerned

An RPM service provider may be involved and funded if a service is offered.

Maintenance and sustainability

- Most devices should be self-sustaining for at least 3 days with longer term expectations if the device is required to be on higher risk or frail patients.
- Charging must be simplified for users who will need to plug in frequently, so alternative solutions to port-style plugs must be considered if there is the need for higher frequency charging requirement.

Clinician's experience

"Recent feedback for an RPM trial showed that **eight out of the nine clinicians** involved felt that RPM improved patient medication optimisation, increased patient engagement with healthcare services and improved health outcomes (e.g., BP management, weight). **Two thirds of the clinicians** thought that the programme reduced admissions, and all felt it had reduced in-person appointments. **78%** (n=7) felt that it reduced length of readmission and improved patients' quality of life."

PATIENT STORY:

Mary King^{*} is 67 years old and is 12 months post renal transplant. She has frequent arrythmia episodes and was enrolled into RPM as part of a pilot programme. Before she started RPM, Mary would record her results in a diary and take it to her 3-monthly clinic for review. After any hospital admissions her SVT was not visible to the renal team, and they relied on Mary to update them.

With RPM, Mary reports she takes her BP a lot more regularly than before, and it has identified that she has high BP which she did not know about. The clinical team now have access to Mrs King's RPM data, including her SVT, so she no longer has to provide this information and she feels this really helps reduce her effort and worry. It also means that when Mary contacts the clinical team with any concerns or symptoms, the data is there to support joint decision making.

Mary uses the message function to raise concerns and ask questions and she says, "I love getting answers straight away without having to wait or keep calling the nurses." She was previously reluctant to 'bother' the nurses and interrupt them. On one occasion, Mary used the message function to raise a concern about a new anti-coagulation medication. This prompted an in-person appointment with her physician, something that would not have happened in her previous care process.

*Not her real name

Section 4 – Over the Horizon: The use of AI/ML/AR/VR systems and other emerging technologies

Some emerging technologies that may be of interest for future considerations in models of care.

Care settings

Augmented reality (AV) or virtual reality (VR) based assessments conducted by both parties with VR/AR devices in RPM environments such as a home, car, marae, recreational vehicles/buses, or community hall environment.

Technology review

Wearables	Implantables	Ingestibles	VR/AR Headsets with eye-ball tracking		
Fitbit smartwatch range Apple Watch range Other wrist, clothing or head mounted wearables	Insulin pumps Implantable cardioverter- defibrillators	Medications with inert tags which transmit to an external device when ingested Targeted drug delivery	Microsoft Hololens series Oculus Quest 2 Google Glass		
Environmental sensors and Internet of Things (IoT)					
Humidity e.g., comfortable range, not too damp Temperature e.g., maintaining 17–24-degree comfort range Environmental pollution from air, surface, or soil quality Water e.g., quality, taste Sound e.g., near busy road, flight path resulting in disturbances in sleep/attention Light and impact on sleep Ultraviolet exposure and impact on vitamin D production from UV-B) Radiation from other sources such as radioactive or microwave sources Geofence GPS to prevent dementia patients from wandering off Atmospheric or exhalation 02/C02 levels Sudden movement/falls Proximity using Passive Infra-Red (PIR) Environmental toxicity based on exposure to heavy metals and plastics PIR triggers for expected behaviours such as toilet use					

Software considerations

- Artificial intelligence/ machine learning supported decision support suites
- Integration with Hira (National Health Information Platform) or equivalent patient records

Operating environment:

Provided as a service in-person, in vehicle, or in a mobile location

Stakeholder responsibilities

- Patients' literacy
- Provider competency in operating devices

Maintenance and sustainability

- Calibration of the device sensors
- Battery maintenance
- Software updates
- Security patches
- Privacy considerations

Point of care testing (bodily fluids/secretions)

Pregnancy testing	Uric Acid	Full-blood count
Viral load (HIV, HepC)	HPV testing	D-Dimer
INR	Lipids/Cholesterol	Electrolytes (Na/P/K/Ca)
BGL	Drug testing	Troponin
HbA1c	Alcohol testing	Creatinine
Bilirubin		

Clinician's experience

"Persistent IT issues are time consuming for both patients and staff and are exhausting for patients. Most gave up in the end or were not willing to continue trying."

Technology

"We learnt quite early on the importance of getting the blood pressure cuff size right. The onboarding process should make multiple size blood pressure cuffs available based on the circumference of a patients' upper arm. Home BP monitoring enables more readings and better patient engagement but if the BP machine isn't used correctly it can result in errors and frustration."

General guidelines

The following guidelines are based on general learnings that have been gained from the implementation of RPM in Aotearoa New Zealand and the literature. They have been divided into technical and people-related aspects.

Technical

- Smartphone and tablet software needs to ensure hardware controls for connectivity such as ensuring Bluetooth/Wi-Fi is on and has not accidentally activated flight mode. There is also a need to reduce the chance of switching the App off accidentally.
- Wi-Fi can be problematic for service provider if client changes broadband supplier and router. Use of Mobile Device Management (MDM) to overcome the cost-of-support and the automatic upgrade of App software may be necessary.
- Battery endurance needs to be considered fit-for-purpose for the client's needs. Daily charging does not necessarily work to maintain ease of use.
- Apps have often shown to be inappropriate as users often do not know how to maintain connectivity on Bluetooth, flight
 mode or other setting variables that may impede smooth functioning. As Apps provide a lower cost option, autodetection of lack of connection and auto-re-enablement of communication channels may be necessary to ensure quality
 service delivery.
- Devices and platforms should adhere to interoperability standards defined by ISO/TC 215 Health informatics technical committee for telehealth¹⁰.
- Devices need review by appropriate experts to ensure that they adhere to New Zealand standards and that the research supporting their use is scrutinised.
- Security guidelines should follow best practices defined by Securing Telehealth Remote Patient Monitoring Ecosystem: NIST 1800-30¹¹ and HISO 10029:2015 Health Information Security Framework¹² (and future versions).
- Device and software platforms should maintain confidentiality, integrity of data, non-repudiation and availability of services at an appropriate level to build trust and meaningfulness to support behaviour change.
- Be aware that location-based services may not be accurate when inside and especially inside multi-story buildings.

¹⁰ https://www.iso.org/committee/54960.html

¹¹ https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1800-30.pdf

¹² https://www.tewhatuora.govt.nz/publications/health-information-security-framework

People:

- The use of RPM should be part of a clinically led model of care.
- For patients who would benefit from RPM but may struggle with the technology or have digital or health literacy barriers, it is imperative that there is a holistic view of the whānau/family and a supportive health service provider who can 'walk alongside' that patient. This is also consistent with ensuring RPM technologies are actively working to drive benefits equitably.
- The use of design-led, co-designed, or co-produced services will significantly help improve engagement, compliance and appropriateness of long-term use. It helps build trust and comfort in using the devices and platforms if patient suggestions are adapted.
- Selection and assessment criteria are required so that the cohort of patients are appropriate and most likely to benefit from RPM.
- Needs assessments of people's skills and opinions are required for successful implementation. These include comfort and skill with technology¹³; enthusiasm to participate; trust and comfort in the use of digital services and in the people, processes, and systems operating the RPM.
- Health providers, patients and whānau/families/caregivers should be trained in the use of the RPM device to ensure they feel confident to operate the equipment¹³.
- When patients struggle to operate equipment or software this imposes a technical support burden on clinicians which can undermine the effectiveness and efficiency of RPM.
- Usability evaluations should take place at regular points along the patient's RPM journey¹⁴.
- Patients and whānau/families/caregivers should be able to reach out to a health provider for support where needed and expect regular contact with providers. Relationships with one or two providers is important for consistency and the development of trust. When patients struggle to operate equipment or software this imposes a technical support burden on clinicians which can undermine the effectiveness and efficiency of RPM.
- Any RPM service needs to consider the impact of dependency following the intervention. Technology that drives social or clinical dependence without managing expectations will create anxiety and potential harm to the patient when the service is withdrawn.
- It is beneficial to have a process that allows patients to give and withdraw consent for others (e.g. whānau, family, friends) to access their RPM device and data.
- It is beneficial to have a process for the patient to notify the RPM provider if they wish to pause the RPM for any reason (e.g. to go on holiday) and an ability for the provider to pause the RPM.
- Developing connected communities using RPM helps to build social networks and provides an opportunity for social interactions at a distance.
- Providing functionality in the RPM device to inform whānau/families/caregivers that they are ok (e.g. up and well) can alleviate worry for loved ones, reduce burden on patients by removing the need to respond to routine well-being questions and thus enrich the interactions between patients and their support networks.

Support

"Our findings are that we get better compliance and outcomes when there is literally a person in the loop – videoconference sessions and messaging with a real person via encapsulated functionality in the RPM device on the customer side. This takes the conversation beyond devices and inputs, it adds the human element, and may lead to other advice or referrals."

¹³ Pienaar, F. (2022) Literature Review Assessing the usability of Remote Home Monitoring (RHM) device, Report for Whakarongorau Aotearoa / New Zealand Telehealth Services ¹⁴ For example, the System Usability Scale (SUS) is a free, short, validated measurement tool. https://xd.adobe.com/ideas/process/user-testing/sus-system-usability-scale-ux/

Examples of Current Working Models

Diabetes kaitautoko

The diabetes kaitautoko (health coach/cultural support worker) will be part of a team supporting whānau Māori¹⁵ with uncontrolled or out of control HbA1c levels. The diabetes integrated team includes RPM: Glucose monitoring devices; point of care testers for uric acid to identify gout; foot protection smart mat to identify diabetic foot ulcer; diabetes reality software that connects the devices and data and send to the diabetes integrated team.

Renal RPM Waitemata

The renal team at Waitemata are piloting RPM¹⁶ for patients who are 12–18 months post renal transplant. The goal of the pilot is to empower patients with the knowledge of their condition, provide clinical oversight for timely intervention and medication titration. It aims to foster partnership and connection with clinical teams, so patients feel supported and heard when any questions or issues arise.

Symptom-collecting App

A symptom-collecting App has been used to help rural populations access health care. The App that has been configured and trialled by a Hawke's Bay GP,¹⁵ enables patients to share their symptoms before they have an in-person or online consultation. The App ¹⁷ has three interfaces: a patient interface for the patient to report symptoms and book appointments; a HealthRADAR system for monitoring long-term conditions; and a clinician interface for reviewing of notes, checking of parameters, labs, medications and giving feedback to patients.



RPM of COVID-19 patients in the community: Proof of concept study

The Hospital in the Home team at Counties Manukau, partnered with the Whānau Ora Community Clinic to use a small medical-grade monitoring device to continuously monitor COVID-19 patients in the community¹⁸. Eligible patients consented to wear the device on their upper left chest wall, to continuously collect physiological readings and biometrics relating to gait and body position. Patient data was wirelessly transferred via an App on a provided mobile phone to a reporting platform for analysis and monitoring by an RPM team. Patients were monitored 24/7 by Registered Nurses as part of an established Hospital in the Home model of care, while they recovered from their COVID-19 infection. The experiences of patients, whānau and the clinical staff involved in the study were explored. Positive feedback was received from patients and whānau (n=121; 40% Māori, 27% European, 17% Pacific, 8% Asian and 7% Indian) regarding device comfort, the reassurance provided by the monitoring and the ability to recover at home. Most providers preferred to work with the RPM model of care compared to traditional methods of care but highlighted the need for the collection of additional physiological markers if RPM was to extend to the more complex cases cared for under the Hospital in the Home model of care. During the study it became apparent that alongside the alerting platform signalling patient deterioration, it would also be beneficial for the RPM nursing team to access two-way clinician/patient communication e.g., via text/phone/videoconferencing and to supply patient information directly 'into the hands' of patients. The study also highlighted the collaboration between the hospital and Whānau Ora Community Clinic in the provision of care.

¹⁵ Team of 19 Digital Enablement Project https://www.tewhatuora.govt.nz/our-health-system/digital-health/hira-connecting-health-information/#digital-enablement ¹⁶ https://www.spritely.co.nz/

¹⁷ https://evolko.com

¹⁸ Ogilvie, C. et al. (2022) Proof of Concept Remote Monitoring of Patients with COVID-19 Using a Wearable Device, Counties Manukau, Te Whatu Ora: Health New Zealand

Hauora Tūhono

In 2020, Nurse Maude trialled a RPM service that aimed to reduce isolation for older people living in Canterbury¹⁵. Hauora Tühono was based around a simple tablet that connected türoro to a range of health support and monitoring using Bluetooth devices for measuring their vital signs, this was rolled out in partnership with their whānau. As this method was found to be acceptable by all users, Nurse Maude has incorporated this method of working into their District Nursing services. Tūroro now use their own digital technology e.g., smart phones to monitor their health conditions and their District Nurse maintains regular contact with them to ensure their wellbeing and answer any queries.

Manaaki Mamao

Manaaki Mamao is a preventative care programme delivered by Hato Hone St John focused on reducing incidence of heart attack and stroke for at risk Māori and Pasifika¹⁹. The service uses RPM technology¹⁶ to help manage care of patients with uncontrolled hypertension who have been referred to the service by their GP. The service includes provision of equipment, health literacy content, collection of data, regular video consultations and patient advocacy. Patient notes and progress are provided back to GPs if consented by patients.

Primary care cardio-respiratory monitoring

A Taranaki-based primary care diagnostic service is providing cardio-respiratory diagnostic monitors to primary care¹⁵. The initiative aims to provide equal and equitable access to ambulatory blood pressure, sleep/oximetry, holter and event recorder testing regardless of where someone lives, their location, ethnicity or socio-economic status. The monitor is given to a patient by the GP/primary provider or couriered directly to them. After testing has taken place, the data is uploaded to a secure server system.



¹⁹ https://www.stjohn.org.nz/medical-alarms/manaaki-mamao/

Stakeholders		Technology review			
Task Functions	Validity (tick or x)	Description	Task Functions	Validity (tick or x)	Description
Identified patient type			Monitoring devices		
Supporting person			Telecommunications plans		
Clinical lead			Device lifecycle plans		
Clinical Support team			Transmission base stations or devices		
Escalation processes			Online portal for consumer and health providers		
Care setting			Software		
Task Functions	Validity	Description	Task Functions	Validity	Description
Shared care arrangements			Consumer monitoring software		
Environment suitable			Hardware assigned to consumer		
Frequency of monitoring			Analytics package		
Clinical variables agreed			Clinical alert settings		
Non-clinical variables			Reporting/review systems		
Operating environment			Maintenance and sustainability		
Task Functions	Validity	Description	Task Functions	Validity	Description
Meets security standards e.g. HISO 10029:2022			Technical support and service-level agreement (SLA)		
Approved for use in New Zealand e.g. MedSafe			Training for providers		
Interoperability standards e.g. ISO/TC 215			Patient support education		
Privacy law adherence			Schedule for testing devices		
Data sovereignty			Funding model		

Consumer Deployment Considerations Checklist			
Needs assessment		Implementation	
Identify list of eligibility criteria and benefits to prospective user		Ensure set up is legally compliant to requirements (e.g., privacy, risks)	
Assessment that the technology is appropriate for prospective user		Patient scheduled check-ins and feedback mechanisms agreed	
Education material that is suitable for patients/users		Funding stream sustainable and manageable	
Consent obtained from patient and carers		Patient access to data and guidance education	
Identify 3-5 goals for the patient		Conduct calibration and service testing mechanisms	
Define metrics that are appropriate to goals		Technical and clinical support mechanisms agreed	
Assess barriers and risks such as language, disabilities, or cultural concerns		Agree ongoing engagement plan against care protocol including duration	
		Onboard primary healthcare providers for monitoring outcomes	

Contributors

We extend our thanks to Dr Ruth Large for her leadership of the 2023 Guide and members of the NZTF RPM working group and the Emerging Personal Health Industry Group (EPHIG) within the Digital Health Association (DHA) for their contributions. In particular:

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Ben Duffus	Te Whatu Ora Hawkes Bay
Ruth Kibble	Primary, Community and Rural Early Actions, Te Whatu Ora
Jenny Pooley	Te Whatu Ora Northern
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Acknowledgements

We gratefully acknowledge the authors of the New Zealand Remote Patient Monitoring Guide (2021)



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