New Zealand Remote Patient Monitoring Guide

About this guide

This telemonitoring practice guide was created with the intended audience of New Zealand healthcare providers looking to implement telemonitoring solutions for Remote Patient Monitoring (RPM). It is developed from experience and guidance from members of the Virtual Health Industry Group (VHIG) within the NZ Health IT (NZHIT) cluster, in collaboration with the New Zealand Telehealth Leadership Group.

Telemonitoring is one of the virtual healthcare delivery methods that involves the use of information technology to monitor patients at a distance. The range of telemonitoring service capability can be as simple as a falls pendant and services provided under Telecare services Association of New Zealand (TSANZ), all the way 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 family or self-monitored using apps and logs. It is noted that most devices being introduced should be Medsafe/Therapeutic Goods Administration (TGA) approved or working towards compliance.

Audience

This implementation guide is intended to assist healthcare service providers or planners in their understanding of fit-for-purpose technology required to operate a modern telemonitoring system. This guide also describes the requirements if a third-party carer who is operating a for-profit or not-for-profit telemonitoring service needs to consider the benefits and risks to establishing such a system.

Introduction

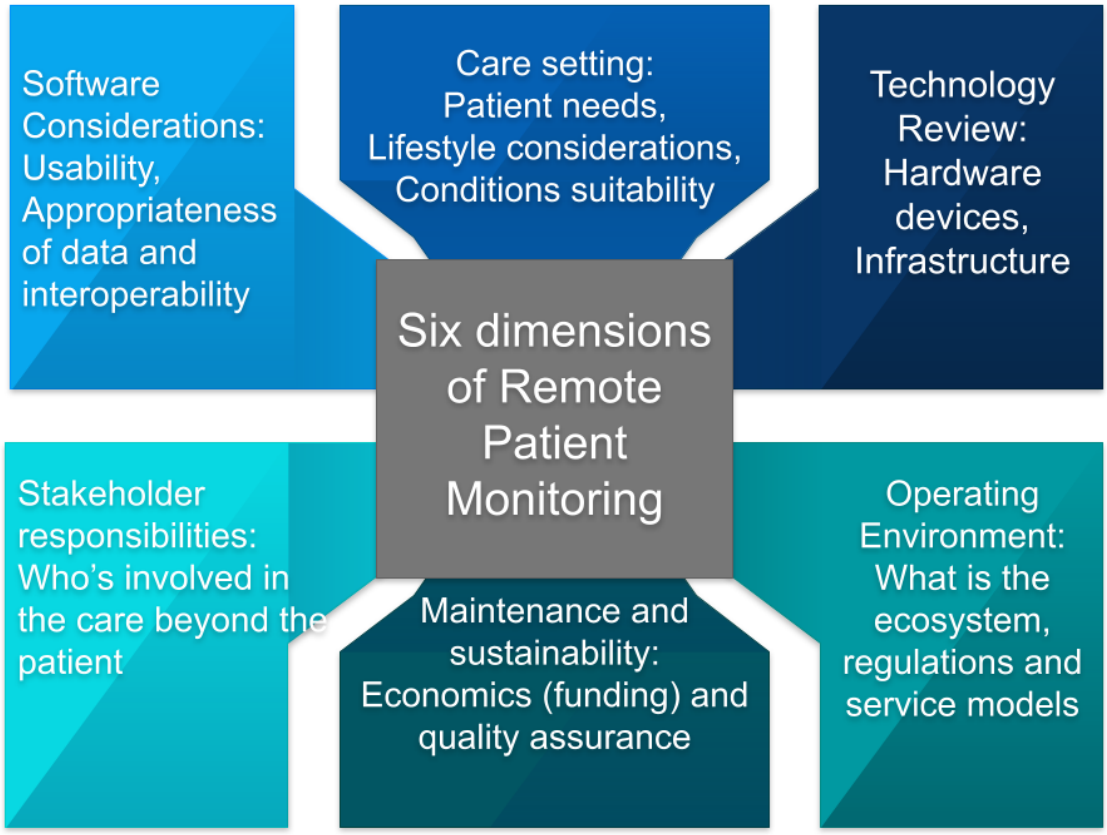
Telemonitoring is described as the use of information communication technology (ICT) to monitor patients at a distance. Telemonitoring technologies can come in one of several forms, including:

- Web-based or mobile apps for uploading information, such as blood glucose results
- 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
- 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 true telemonitoring.

Fundamentally, the technologies today used for remote patient monitoring extends beyond those that were traditionally used in supporting aged and disability care, or patients with long-term conditions. This guide also touches on advancements in RPM that supports maintenance of wellbeing or healthy lifestyles of at-risk groups.
Harvard Business Review recently described that there are four key clinical activities that constitutes RPM[1]:

a. Collect 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. Evaluate data and notify healthcare providers as needed
d. Communicate data-driven insights and interventions

Beyond the clinical activities in the delivery of any telemonitoring solutions, there are six dimensions that provide the foundations for successful telemonitoring systems that need to be planned:



In this guide, we will be providing a description of use case examples that highlight how a configuration around these six dimensions will be operating for three persona models representing the 'common' use cases of remote patient monitoring. Section one looks at patients who currently meet the requirement for dependent living, and where their needs are met by telecare safety devices like medical alarms. Section two reviews the supported living arrangements where patients may recently be discharged from long-term condition services and require rehabilitation support. Section three discusses those with technologies that enable wellbeing and regular self-monitoring. A fourth section looks at the emerging technologies available to provide advanced monitoring.

Getting started

Why do you want to implement a remote patient monitoring service? to the aim is to identify users of services that will benefit from a monitored state where they will have opportunities to respond to feedback and mark alterations which will improve prognosis of a condition reducing 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 in order to optimise cost effectiveness of care delivery.

Remote patient monitoring service delivery is focused on a technology platform, but it is important not to neglect discussions and decisions around models of care where the focus should be 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

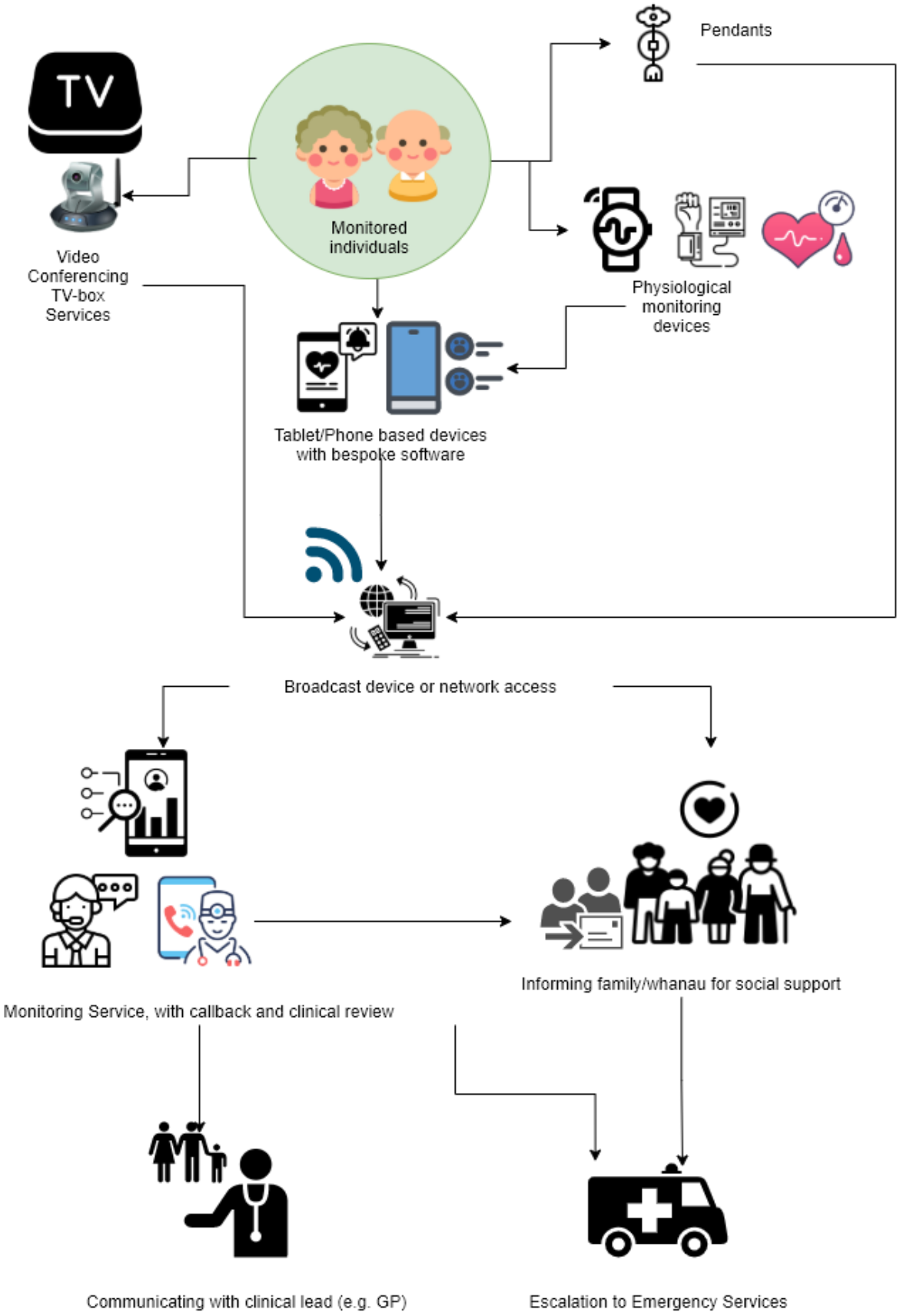
A telemonitoring service that best practice remote patient monitoring requires:

1. SMART goals of the programme
2. Clinical outcomes defined
3. Satisfaction outcomes agreed
4. Operational outcomes measurable
5. Financial outcomes trackable
6. Stakeholders and their responsibilities defined and affirmed
7. Change management processes implemented
8. Workflow and business operating model is well defined
9. Technology platform that is fit for purpose and selected for use in the suitable operating environment and care setting.
10. User centred approaches defined for what the patient needs
11. A decision for minimum commitment duration from the patient and supporting parties
12. Technology platforms including device and infrastructure have been adequately tested in clinical settings for robustness and quality control validation, e.g., Federal Drug Agency (FDA)/TGA /Medsafe approved or ISO13485.

In addition, remote patient monitoring has significant data considerations:

1. Data generated does not cause unnecessary burden on end users
2. Data must be stored in environments that conform to the health information security framework standards
3. Data must be obtained through adequate informed consent processes
4. Ethical and privacy laws must be considered for compliance including both data sovereignty and indigenous data sovereignty
5. Data standards should be applied with the intention of making data interoperable with other health records of the patient.
6. Data must be maintained for quality and assured for accuracy on a routine basis.
7. Data should be provided to enable healthcare decisions based on meaning, usefulness, and frequency that enhances patient safety.

Remote Patient Monitoring Key Features



Section 1 - Dependent Living: Low technology involvement

Persona

Telemonitoring 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
- are generally too unwell to be funding their own care

Service model considerations

In New Zealand, most providers of this type of service require to be accredited by Ministry of Social Development (MSD) for funding using the TSANZ Specification for Telecommunications Based Personal Emergency Response System Part 1 and Part 2, based on Telecare standards ISO/TS 13131:2014 or 2021 standard.

Care settings

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

Technology Review

- Pendant with base or standalone, 3G/4G/5G technology advised without Wi-Fi.
- Regular monthly test-calls or TSANZ specified.
- May involve base-sets that can repeat signals and provide an audio link to the location.
- More advanced deployment may involve dedicate tablet or dedicate TV set top-box devices with video or voice activated devices to feedback short (up to 10 mins long) check-ups that may occur several times a week.

Software considerations

- Requires guaranteed delivery of messages, audit, monitoring of calls, clinical safety alerts, and patient non-response alerts.
- Needs to retain information required for escalations to appropriate users.
- Software requires daily and hourly level trends, with escalation pathways and agreed plans with clinicians, caregivers and patients.

Operating Environment

Platforms of this nature would 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 will 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:

- Funder (which may be family or social agencies, but often MSD/WINZ)
- Telemonitoring service provider which meets TSANZ audit and compliance
- Monitored user
- Designated escalation person (e.g., family, friend or neighbour who has immediate check in)
- Clinical Support/caregiver provider (e.g., their 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 years. 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 in order to keep accuracy of the 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. TSANZ test periodic reports every 24 hours.

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 pre- or post- acute management of chronic conditions, or post-acute patient stabilisation and rehabilitation.
- Are generally health and digital literate but need to be actively monitored for their condition to help recovery and promote self-management.
- May be on the telemonitoring programme for up to two years but generally conclude once they are able to self-manage (often within a year).

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 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 (COPD), cardiovascular (Heart Failure), or chronic pain management. Routine physiological parameters may involve weight, blood pressure, temperature, pulse oximetry, heart rates. Some parameters will involve ECGs on more modern devices. Patients will also have behavioural questions as well as patient experience and/or outcome measures.

Technology Review

- Technologies of this nature may be based on mobile devices e.g., iPads/tablets, or dedicated touchscreen enabled devices. It may involve GPS, Bluetooth, WiFi, 4G/5G based services connectivity, and may or may not involve a base-set.
- It will likely use video capabilities to check-in and complete surveys on the device.
- TV with a set top box may be an alternative to tablets.
- Video privacy requirements are to be agreed.

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 has the ability to 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 telemonitoring 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 daily 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 after-hour services are managed by telemonitoring service providers.

Exception based alerts and manual intervention are essential and may be supported by the use of 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 and alerts for escalation around medico-legal review.
Services initially (for the first 6 weeks) generally will need a surge-based support approach and may be scaled back to 10-minute checks once or twice a week when independent living behaviours are established.

The cost to the user should be optimised to increase ready uptake of the service as costs is usually borne by the patient.

Stakeholder responsibilities

There are usually six parties in this arrangement service:

- Funder (which will likely by an institution or health agency, or self or a relative who is funded)
- Telemonitoring 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 or GP responsible for clinical management.

Maintenance and sustainability

- Most service provider goals for this type of programme will look at reducing unexpected readmissions or clinical contact/interventions. Therefore, managing physiological and social measures are required routinely 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.
- 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 5-10 mins 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. A log of data is not 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 telemonitoring implementations.
- New generation of telemonitoring services can be implemented using ‘Fully Managed Device Kits’ with integrated Mobile Device Management solutions. This means the simplicity of identifying a device (through a QR code or RFID), synchronisation to network and assigning to the user, and issue without further connectivity concerns. “It just works!”

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 compact 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/whanau-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 patient self-monitoring 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.

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

A telemonitoring 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.

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

AR/VR based assessments conducted by both parties with VR/AR devices in telemonitoring environments such as a home, car, marae, recreational vehicles/buses, or community hall environment.

Technology Review

- Wearables
  - Fitbit smartwatch range
  - Apple Watch range
  - Other wrist, clothing or head mounted wearables
- Implantables
  - Insulin pumps
  - Implantable cardioverter-defibrillators
- Swallowables
  - Medications with inert tags which transmit to an external device when ingested
  - Targeted drug delivery
- VR/AR Headsets with eye-ball tracking
  - Microsoft Hololens series
  - Oculus Quest 2
  - Google Glass
- Environmental sensors and IoT:
  - Weather
  - 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)

  EMF exposure from Wi-Fi or unshielded smart home technologies
  - Radiation from other sources such as radioactive or microwave sources
  - Geofence GPS to prevent dementia patients from wandering off
  - Atmospheric or exhalational O_2/CO_2 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

- AI/ML supported decision support suites
- Integration with Hira (national Health Information Platform) or equivalent patient records

Operating Environment:

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

Examples of Current Working Models

HEARTS Aotearoa

Nurse led, non-clinical team. To provide free ECG heart testing programmes targeting communities and people with historically high rates of heart disease and associated health issues. Early

identification to present results to respective GPs to refer those needed to health system care.

SekiLife

A full model of care aimed at screening for our 2 biggest killers, cancer and heart disease. Non lab, non-invasive, medical grade blood testing and ECG.

Continuous vital signs monitoring through mobile phone app and/or wearable watch.

Data is collated and used, with permission, to receive favourably priced health and life insurance.

Southseas Healthcare

Mobile nursing unit using technology to triage patients then connecting them remotely through video immediately to the GP. Nurse supervises the process in person.

Any prescriptions are sent by the nurse to the pharmacy then delivered to the patients home once ready.

Nganampa Health

Every household in the communities take daily vital signs measurements using their mobile device.

Nonclinical staff at the community hub monitors the trends through the algorithm. Downward trends mean contact with patient to either visit the hub or receive a visit from a nurse.

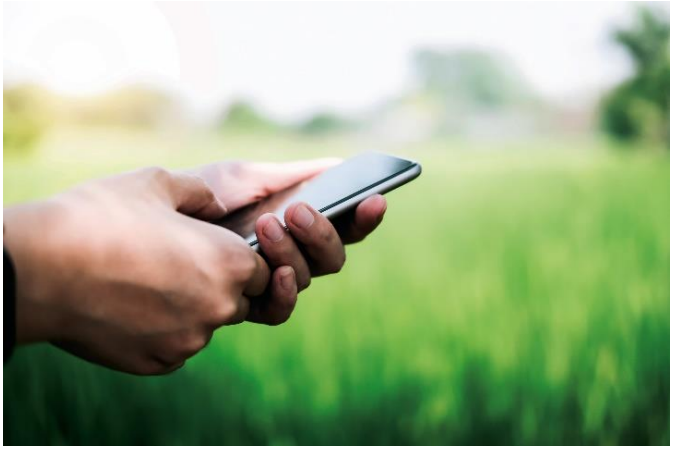
Mobile nursing unit using technology to triage patients then connecting them remotely through video immediately to the GP who is in Adelaide (15 hours' drive away) When the doctors make their scheduled visits to the community, they already have the information on hand making the visit more focused and time efficient.

Port Adelaide Football Club

Each top squad player has a device which monitors 15 health parameters including Blood Gases, Haemodynamics, Vital Signs. Daily measurements are sent to the club doctor which enables better analysis of trending health data which compliments athletic performance data to get a more detailed overview of both the athlete and the person.

Togetherai

Using science backed Heart Rate Variability measurements taken by mental health patients using their mobile phones. Social service workers monitoring the trends then, when required, initiating an online video call to spark conversation. Changing the narrative from asking affected individuals to call for help to monitoring scientific red flags to get on the front foot of care.



Concluding Points and Learnings

Do's and Don'ts

For high needs patients, never offer GPS or Bluetooth devices when managing multi-story facilities, as the systems can give incorrect readings. The exception is the use of Bluetooth beacons and/or correct response plans set for the client's normal residence.

Smartphone apps are generally not ideal for lower-tech consumers, due to the need to understand individual functions and dependencies unless special purpose apps are designed to handle the zero touch. Low tactile or vision patients will have difficulties touching specific sections of screens and locations, and audio instructions may be necessary.

Smartphone and tablet software needs to ensure hardware controls for connectivity such as ensuring Bluetooth/WIFI is on and has not accidentally activated flight mode. This means there is greater awareness required for those user types. There is also a need to reduce the chance of switching the app off accidentally. Wi-Fi can be problematical 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.

Any remote patient monitoring 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.

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, auto-detection of lack of connection and auto-re-enablement of communication channels may be necessary to ensure quality service delivery.

The use of design-led or co-designed services will significantly help improve the compliance and appropriateness of long-term use. It helps build trust and comfort in using the devices and platforms if patient suggestions on adapter.

Devices and platforms should adhere to interoperability standards defined by ISO/TC 215 Health informatics standards for telehealth.

Security guidelines should follow best practices defined by securing Telehealth Remote Patient Monitoring Ecosystem (nist.gov) and HISO 10029:2015 Health Information Security Framework (and future versions).

Needs assessments for people’s literacy, health literacy, trust, and comfort in use of digital services in people, the processes, and system operating the health technologies are required for successful implementation.

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.

Consent provision and withdrawal to allow patients to invite a relative is necessary. As absence of patient from the service away from being monitored, a rest period is often required.

Social benefits through a connected community using the platforms help build social networks and removes distance and time to social interactions. It alleviated burdens for family or primary caregivers when the RPM technology promotes improved social wellbeing by removing routine wellbeing questions. Enriches the interaction between caregivers and monitored

Remote Patient Monitoring Checklist

Task Functions	Valid?	Measuring variable
Stakeholders:		
Identified patient type	☐	
Supporting person	☐	
Clinical lead	☐	
Clinical Support team	☐	
Escalation processes	☐	

Task Functions	Valid?	Measuring variable
Technology review:		
Monitoring devices	☐	
Telecommunications plans	☐	
Device lifecycle plans	☐	
Transmission base stations or devices	☐	
Online portal for consumer and health providers	☐	

Care setting:		
Shared care arrangements	☐	
Environment suitable	☐	
Frequency of monitoring	☐	
Clinical variables agreed	☐	
Non-clinical variables	☐	

Software:		
Consumer monitoring software	☐	
Hardware assigned to consumer	☐	
Analytics package	☐	
Clinical alert settings	☐	
Reporting/review systems	☐	

Operating environment:		
Meets security standards	☐	
Approved for use in country	☐	
Interoperability standards	☐	
Privacy law adherence	☐	
Data governance	☐	

Maintenance & sustainability:		
Technical support and SLA	☐	
Training for providers	☐	
Patient support education	☐	
Schedule for testing devices	☐	
Funding model	☐	

Consumer Deployment Considerations Checklist

Needs assessment

- Identify list of eligibility criteria and benefits to prospective user ☐
- Assessment that the technology is appropriate for prospective user ☐
- Education material that is suitable for patients/user ☐
- Consent obtained from patient and carers ☐
- Identify 3-5 goals for the patient ☐
- Define metrics that is appropriate to goals ☐
- Assess barriers and risks such as language, disabilities, or cultural concerns ☐

Implementation

- Ensure set up is legally complaint to requirements (e.g., privacy, risks) ☐
- Patient scheduled check-ins and feedback mechanisms agreed ☐
- Funding stream sustainable and manageable ☐
- Patient access to data and guidance education ☐
- Conduct calibration and service testing mechanisms ☐
- Technical and clinical support mechanisms agreed ☐
- Agree ongoing engagement plan against care protocol including duration ☐
- Onboard primary healthcare providers for monitoring outcomes ☐

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Whanau Tahi – Phillip Jones

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Further Work Planned

Data transfer standards for Telemonitoring providers to medical home.

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