

# Telehealth Support for Patients with Long Term Conditions: Evaluation of a Rural Pilot

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## Abstract

*Congestive Heart Failure and Chronic Obstructive Pulmonary Disease are two chronic conditions that have important impacts on both the quality and length of life of individuals and on utilisation of health services. In the context of limited health funding, workforce restrictions, and an ageing population, there is increasing interest in the use of remote monitoring technologies to improve the quality of life of patients with these conditions, and to reduce unplanned use of hospital services.*

*In 2009 Lake Taupo Primary Health Organisation (PHO), Lakes District Health Board (DHB) and Healthcare of New Zealand Ltd, entered into a strategic partnership to pilot telehealth devices to support chronic care management in the Lake Taupo community, using a small randomised control trial approach, with ten patients in each arm. Sapere Research Group was commissioned to independently evaluate the 12 month pilot, and found good evidence that the telehealth remote monitoring technology was accepted by both Maori and non-Maori participants; that quality of life was significantly better in the telehealth group than in the control group; and some indications of a trend toward improved survival in the telehealth group. Hospitalisations were reduced in both the control (-19%) and telehealth group (-25%). Results should be considered tentative given the small numbers in the trial, but are consistent with findings of improved survival, quality of life and cost savings from recent international reviews. The impact of the telehealth intervention may have been partially masked by the simultaneous implementation of the Healthright disease management programme.*

## 1. Introduction

According to World Health Organisation estimates, 80 million people have moderate to severe chronic obstructive pulmonary disease (COPD). More than 3 million people died of COPD in 2005, which corresponds to 5% of all deaths globally [1]. CHF is estimated to consume 1% - 2% of the total health resources of industrialised countries [2].

In New Zealand, chronic conditions are the leading cause of hospitalisations [3]. They account for 80% of all preventable deaths and are estimated to consume a major proportion of our health care funds. Chronic conditions contribute to a major share of the disparity in life expectancy between Māori and non-Māori. They also account for a higher proportion of illness and deaths among people on low incomes and Pacific peoples than among the general population [4]. Addressing these inequalities and reducing the burden of disease is a constant challenge for healthcare providers and funders.

Overseas studies have shown that remote tele-monitoring technology can reduce mortality, reduce hospitalisations, improve quality of life and decrease healthcare costs [5-12]. The largest study [13], a multicentre randomised study which included 460 people showed large and statistically significant reductions in hospital readmissions (Hazard Ratio of 0.50 (0.34-0.73)) and a probable reduction in mortality (HR of 0.45 (0.19 – 1.03)) in a population with CHF. Other large studies often find at least one statistically significant improvement in measures such as hospital readmissions, ED attendances, and physician contacts. The studies consistently find a high level of patient satisfaction with the technology. Most recently (2011) a Cochrane Collaboration meta-analysis [14] reviewed 25 studies evaluating structured telephone support and telemonitoring in the management of patients with CHF. The review found telemonitoring reduced all-cause mortality (RR 0.66, 95% CI 0.54 to 0.81, P<0.0001) and reduced CHF-related hospitalisations (RR 0.79, 95% CI 0.67 to 0.94, P=0.0008).

However, little is known about the acceptability, utility, or cost effectiveness of telehealth services in a New Zealand context. Both CHF and COPD are more prevalent among Māori than non-Māori and the cultural acceptability of home based remote monitoring technology has not been tested.

In order to test the acceptability and utility of telehealth monitoring in a NZ environment a 12 month pilot involving the trial of ten telehealth remote monitoring machines in Turangi and Taupo project was implemented by Lake Taupo PHO, Lakes DHB and Healthcare NZ.

The objectives of the pilot were to:

1. obtain qualitative evidence on the acceptability and usefulness of telehealth technology for Māori and other users with CHF or COPD in a rural New Zealand environment;
2. obtain preliminary evidence on the impact on health outcomes of telehealth monitoring and proactive early intervention;
3. obtain preliminary evidence on the impact of telehealth monitoring and proactive early intervention on health service utilisation and models of care; and
4. inform future use of Telehealth systems in chronic care management programmes in New Zealand.

## **2. Method**

### **2.1. Pilot design**

Patients residing in the Turangi or Taupo areas, who had been discharged from hospital in the previous 12 - 24 months with a diagnosis of CHF or COPD, were recruited and assigned randomly to either a control or intervention group. Proportions of Māori/non-Māori, and COPD/CHF were balanced between the telehealth and control groups to the extent possible within the confines of the pilot. Both the control and telehealth group consisted of ten patients at commencement (total N = 20) and at 6 months, with additional recruitment at 6 months on a matched basis to replace those who died or withdrew in the intervening period. The pilot lasted from 1 October 2009 to September 2010.

Telehealth patients had a telehealth terminal installed in their home, with an online link to a web portal that was reviewed regularly by local nurses, supported by clinical algorithms. The telehealth terminal is essentially a touch-screen computer with a range of measurement peripherals. The machines enable people to measure their own weight, oxygen levels, lung function, blood pressure, and other clinical signs. Results are uploaded over standard telephone lines to a central computer and included in a web-based patient record. Chronic care management nurses use the online patient record to monitor patients and to decide whether to contact patients for clinical intervention.

Control group patients did not receive the telehealth machine, but both control and telehealth patients received, in addition to usual care through their primary care provider, the Healthright nurse led disease management programme interventions, involving regular home visiting and systematised assessment and care planning.

The telehealth machines were used to deliver quality of life questionnaires to both the control and intervention groups at pilot commencement, 6 months and 12 months.

### **2.2. Evaluation approach**

The evaluation followed a mixed methods approach. Data were sourced from:

- the telehealth website to obtain patient quality of life and clinical indicator data (blood pressure, weight, oximetry, FEV)
- Lakes PHO & DHB to obtain service utilisation data (admissions, primary care attendances, ED attendances, days in hospital, mortality)
- Interviews of both patients and healthcare staff to obtain formative insights on the acceptability and usefulness of the telehealth technology from a user perspective. This complemented the quantitative data on the impact of the service

### 3. Key findings

#### 3.1. Remote monitoring technology can be successfully applied in a rural New Zealand community to aid in chronic disease management

Patient interviews indicated that the technology is acceptable and in fact warmly welcomed by most patients and their families – including by Māori. Comments made suggest that easy access to telehealth monitoring facilitated self management through a deeper understanding of the disease and quick feedback.

Those with diabetes, or CHF gained insight into how aspects of their life affect their condition, and the relationship between medication doses and the clinical measurements.

*“...helped W notice which foods elevated his blood sugars and blood pressure”- Healthright nurse*

*“L has more understanding with his flusemide and how it relates to his weight, heart health and how he manages his heart condition...”- Healthright nurse*

One COPD patient reported that taking their temperature regularly helped to detect early signs of infections - through the rising temperatures.

Māori patients were equally positive about having the machine in the house:

*“It’s like my new security blanket”- Māori, CHF/COPD patient*

Some reported that whanau felt more confident having the monitor in the house. One suggested that *“a Marae based monitor would be good for our Iwi”-Māori, COPD patient.*

Another stated that:

*‘A whanau measurement screen would be great for other members - other family members all have medical conditions – asthma, hypertension, diabetes, etc.’- Māori, CHF/COPD patient*

The comments suggest that Māori adopted the telehealth technology readily, and look positively at ways to involve other members of the whanau / hapu in self management through telehealth.

Staff also found the equipment useful:

*“The measurements have alerted [me] of changes in a client’s medical condition that enabled [me] to make a judgement call based on the data, e.g. rescheduling an earlier visit that had already been arranged. [Also] exacerbations were identified early and [I was] able to act quickly”- Healthright nurse*

Some reservations were expressed about the telehealth machine. These were mainly to do with the bulky nature of it.

*“My wife found it very bulky and not aesthetically pleasing to look at (lots of wires, hoses). It also interfered with the phone line”- Māori, COPD patient*

#### 3.2. Telehealth remote monitoring probably improves patient quality of life in the target group

The telehealth group showed a consistent trend towards improved self-reported quality of life on a range of quality of life instruments including the SF36, the St George Respiratory Questionnaire and the K10 (see Table 1). Patients in the control group, in contrast, showed no clear trend towards improvement. Specifically, the telehealth group improved by 20% on the St George score, by 16% in the SF36 overall score, and by 29% in the K10 score, compared to -2%, 5%, and 6% improvement for the same questionnaires in the control group. Despite the small sample size, the difference in the K10 was statistically significant ( $p < 0.0199$ ).

Quantitative findings of improved quality of life are congruent with comments from patients that they generally found the access to continuous home monitoring resulted in improved confidence, quality of life and in their ability to manage their condition.

Most patients felt reassured by the presence of the monitor in their home and reported an increased sense of confidence and wellbeing, particularly because their telehealth results were being monitored regularly by the nurse and that the nurse would contact them if worrying trends developed.

**Table 1 - Quality of Life scores**

	St George COPD related Quality of Life scores (0 = best, 100 = worst)		K10 questionnaire scores (20 and under=best, 30 and over= worst)	
	Telehealth	Control	Telehealth	Control
<b>Baseline</b>	54	56	19.18	21.70
<b>Pilot 6</b>	49	53	16.33	18.13
<b>Pilot 12</b>	44	57	13.63	20.33
<b>% change</b>	20% (improvement)	2% (decline)	29% (improvement)	6% (improvement)

**Table 2 - Days alive and outside hospital**

	% of possible days	actual days	max possible days
<b>Telehealth</b>	98.8%	3,317	3,358
<b>Control</b>	84.6%	3,390	4,005

*“The machine tells me a lot... It changes your whole life. It has changed not only my medical condition but changed my life in general- mental and physical. I have a totally better outlook”- non Māori, COPD patient*

*“The monitor has given me and my wife and whanau an increased sense of confidence that instead of running to the doctor with every ache and pain, we knew if we did not hear from the nurse, that everything was ok”- Māori, COPD patient*

The alignment between the interview comments and the quantitative results leads to a higher degree of confidence that the effect is likely to be real rather than a statistical artefact.

### **3.3. Telehealth remote monitoring might improve life expectancy**

At the end of 12 months, there was a substantial but non-significant trend toward reduced mortality in the intervention group. Of the original ten members of the control group, four died during the study period, compared to one of the intervention group. This is suggestive of a trend towards a longer survival time for the intervention group. However, the numbers are not statistically significant at the  $p < 0.05$  level. Of note, nearly all deaths occurred amongst Maori patients.

Table 2 above shows that the Telehealth group lived outside of hospital for nearly 99% of the possible days, while the control group lived for only around 85% of possible days. The higher mortality in the control group represents nearly the entire gap between the two groups.

### **3.4. Review of clinical measures showed no obvious pattern of change**

Review of measurements of mean blood pressure, FEV1, heart rate, blood oximetry and weight for the control and telehealth group at baseline, 6 and 12 months showed no obvious patterns of change.

### **3.5. Telehealth remote monitoring did not demonstrate benefits over and above the Healthright disease management programme in reducing service utilisation.**

Inpatient admission rates declined for both the control and telehealth group – suggesting that telehealth remote monitoring conferred little additional benefit in this regard over and above the HealthRight disease management programme.

A comparison between telehealth remote monitoring and usual primary care (without the HealthRight disease management service) would be of interest as it might establish the relative cost and efficacy of remote telemonitoring relative to home visiting based disease management programmes.

Table 3 below summarises the average number of events across a range of services per patient year.

**Table 3 - Impact on service utilisation**

Service	Group	Mean number per patient / year		% change from baseline
		Baseline	12 months	
ED attendances	Control	0.92	0.96	5%
	Telehealth	1.50	1.42	-6%
Inpatient admissions	Control	0.92	0.75	-19%
	Telehealth	1.75	1.31	-25%
Inpatient bed days	Control	3.33	3.41	2%
	Telehealth	3.00	3.27	9%
Ambulance callouts <sup>1</sup>	Control	0.58	0.32	-45%
	Telehealth	1.25	0.65	-48%
GP visits	Control	7.33	5.97	-19%
	Telehealth	11.17	11.54	3%

It is possible that the positive impact of telehealth on hospital admissions observed in other international studies was partially masked in this pilot by the simultaneous introduction of Healthright.

#### 4. Conclusion

The pilot has demonstrated that remote monitoring technology can be successfully implemented in a New Zealand community to aid chronic disease management. The technology is found to be acceptable, and in fact warmly welcomed by most patients and their families – including by Māori.

Data from this small pilot suggest a trend toward reduced mortality and improved quality of life in the telehealth group relative to the control group. The findings are consistent with the results of much larger overseas studies, which, if the sample sizes are large enough, have generally found statistically significant positive impacts from telehealth remote monitoring. Based on the interviews with telehealth patients, it is likely that the access to quick authoritative information on current health status, and early identification of a downward trend, improved patient self management, and enable whanau to provide informed care for their family member. However, no clear difference was found on clinical measures or on service utilisation between the control and telehealth groups. This may be the result of the new Healthright disease management programme masking the impact of telehealth remote monitoring. Ideally, the overall model of care would be redesigned to take into account the utility of remote monitoring – however that was not possible with a small trial of only ten machines. Hence some of the potential cost effectiveness benefits would not have been experienced in this study because of lack of critical mass.

Care should be taken in drawing conclusions from the quantitative data in this pilot because of the small sample size. It is not possible to conclude from this study whether or not telehealth remote monitoring is cost effective. However, the pilot suggests that a wider implementation with a cost benefit evaluation strategy could be worthwhile.

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<sup>1</sup> Full ambulance data was only available from St John's for the first 6 month period – for the second 6 months the ED dataset was used as a proxy, but it is accepted that this will under represent ambulance callouts – since it excludes calls that did not result in an ED attendance.

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