

Telehealth- A Developing Medical Field

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ABSTRACT

Telehealth makes use of information technology and telecommunication to help to provide clinical care over distances. This article outlines the potential for improving clinical care using these interventions, the current evidence base for tele-health programmes and the challenges to their efficacy.

Introduction

Telehealth makes use of information technology and telecommunication to help to provide clinical care over distances. While initially indicated for rural communities, the technology is more widely used now for people who have difficulty physically accessing healthcare regardless of their location. In recent years increasing attention has been paid to the role of telehealth in reducing the costs of care, the premise being that patients themselves will take over routine measurements with oversight from professionals, who can advise with a brief phone-call rather than a more time-consuming clinic or domiciliary visit. There are an increasing number of elderly people throughout the Western world and the number with long-term conditions is set to double in the next twenty year. This is compounded by a relative diminishing of the pool of clinically trained people throughout the world over the same time period. For many governments around the world telehealthcare is seen as a solution to this growing challenge.

Telehealth has been applied in a variety of long-term conditions. In this article I will focus on its use in the areas in which it is most frequently applied namely, congestive cardiac failure (CCF), chronic obstructive pulmonary disease (COPD), asthma, diabetes mellitus and high blood pressure (HBP). In COPD, CCF and asthma the aim of telehealth is to alert the patient and the clinician of a deteriorating clinical condition in time to allow intervention to prevent serious deterioration and hospital admission (with for example antibiotics in COPD or increased diuretic in CCF). In diabetes and hypertension it can be used to titrate medication more quickly and accurately to achieve optimal glycaemic and blood pressure control.

There are several variations on how telehealth may be applied from simple open access for example by phone to a clinician,¹ through video-consulting or automatic feedback based on symptoms or physiological monitoring combined with daily monitoring from a call-centre² or specialist nurse or physiotherapist. Systems may be based on simple telephone landlines, mobile SMS or internet, or wired internet. Most current systems make use of a mixture of symptom checklists and physiological measures, for example oxygen saturation, pulse-rate, spirometry/peak-flow-rate, temperature, weight, blood pressure and blood glucose. In COPD and CCF symptom checklists are sometimes linked to algorithms to determine the likelihood of exacerbation.

What is the evidence base?

There is increasing evidence that telehealth can be effective in improving outcomes, however, there are few rigorous economic evaluations. This section will outline the current evidence base for telehealth programmes.

CCF: The current evidence base on the effectiveness of telemonitoring in the management of CHF is inconclusive.³ While the most recent meta-analyses indicate that telemonitoring may improve clinical outcomes on patients with CHF,⁴⁻⁵ these conclusions have been challenged by the findings of more recent large randomised controlled trials.⁶⁻⁷ The result of a large UK RCT is expected soon.⁸

COPD: There have been a large number of descriptive and uncontrolled studies and some small good quality randomised controlled trials which are promising,⁹⁻¹² suggesting reduction in re-admission rates, emergency room attendance, reduced hospital bed stays and improved quality of life. However systematic reviews in the area have been more circumspect,¹³⁻¹⁵ drawing attention to the fact that the telemonitoring intervention is often provided alongside enhanced care in the form of specialist nurses or other clinicians which is not available to the normal care group. It has therefore been difficult to determine if telemonitoring *per se* has added any value. Given the large investment required to roll-out telehealthcare services it is essential that it is based on the best possible evidence. The results of two large RCTs⁹⁻¹⁶ are expected soon one of which has attempted to determine the separate effects of telemonitoring.

Asthma: The evidence for the use of telemonitoring in asthma is less clear when compared with routine self-monitoring. One meta-analysis suggests some impact in terms of preventing hospital admissions,¹⁷ but a recent large randomised trial of mobile phone use in asthma has shown no effect.¹⁸ Once again, it can be difficult to unpick the effects of telehealth from other services provided alongside it. The authors conclude that the technology might be best reserved for those with the most serious unstable disease.

Diabetes Mellitus: In a systematic review of the management of diabetes using telemonitoring Paré and colleagues¹⁹ concluded that, while there was evidence that the technology may achieve a reduction of HBA1c, the scale of that reduction was small. Many of the studies considered were small and methodologically weak. They concluded that further research was required to confirm benefit and also to explore the cost-effectiveness of the technology. Such trials have been completed and the results awaited or are ongoing.²⁰

Hypertension: Systematic reviews in the use of telemonitoring,²¹⁻²² in hypertension suggest that telemonitoring in high blood pressure is effective in lowering blood pressure in people whose blood pressure has been difficult to control. Once more, many of the studies considered were methodologically weak or involved additional interventions.

Qualitative work exploring telehealth from the patient and carer perspective is generally very positive in COPD and CCF.²³⁻²⁴ Patients perceive improved access to care and are reassured that someone is monitoring them. Concerns that the technology might lead to increased dependence on the healthcare team and reduced self-care is not apparent for the majority of people. On the contrary patients say that daily recording of symptoms and physiological measures has improved their knowledge of their condition and their self-confidence in managing their condition. Negative views are largely down to technology problems and occasionally due to concerns that clinicians may not always be watching or responding in time to symptoms.

Clinical staff and service planners are less enthusiastic about the introduction of telehealthcare. While generally seeing that it will be an important part of future strategies, to some it is seen as a 'disruptive technology,'²⁵ with little evidence base, particularly a health economic base which leads to a necessary reorganisation of care pathways. They are

worried about increased workloads as a result of improved access, time wasted by 'false alerts' and the creation of a group of patients obsessed with their health status. Such fears are not groundless. In a pilot study in Lothian, Scotland the introduction of telehealth in COPD led to a doubling in prescribing of antibiotics and steroids and a five-fold increase in telephone calls. Multiple alerts were also a problem with eighty per cent of patients raising red alerts on some days.

Challenges for telehealth

Large-scale implementation

One of the biggest challenges facing telehealth is in large-scale implementation. What is possible for a small group of enthusiastic people to achieve is harder to replicate on a larger scale. Imagine the eighty per cent alert rate mentioned above if that were multiplied a hundred fold. While reliable inexpensive technology is important, what is most important is integrating telehealth within the existing or creating new clinical pathways. To achieve this clinicians have to believe that it will make their jobs easier or at the very least no harder. The evidence for this remains patchy. While patients undoubtedly like the improved care and attention that telehealth brings them, it may not be affordable as it currently stands.

Improved physiological measures and algorithms

It is not yet entirely clear how helpful some physiological measures are. There is a wide day-to-day variation in parameters such as spirometry, pulse rate, oxygen saturation and blood pressure which can make interpretation difficult and it is not clear how in a home setting how these interact with symptoms. Newer potentially more predictive physiological measures have the potential to improve the management of patients. There is increasing interest in measuring respiratory rate and activity as early predictors of decline in COPD and CCF but it is not known if adding in such parameters will merely increase the complexity of telehealthcare without increasing its positive predictive value with respect to warning of impending clinical deterioration.

One way to reduce the clinical monitoring workload is by creating new algorithms which may filter out unnecessary alerts. This must be a priority for the future of telehealth and smarter machines, using routines tailored to individuals, based on their existing risk profile and learning from their previous clinical presentations may be able to provide basic advice for example to repeat an unusual reading only contacting a professional if initial management fails or symptoms are worrying. In addition, some of the lower level monitoring could be taken over, using a social media approaches, by friends and family or even possibly by communities of patients themselves.

Varying telehealth input according to need

In the early phase of telehealth a single solution was applied to all patients. What has become apparent is that patients vary over time in their requirement for telehealth monitoring with more intensive input being required for example at the time of a hospital discharge and gradually, with coaching from monitoring staff, the patient taking on self-monitoring and no longer requiring oversight, but with a 'hot-line' for advice if necessary. Newer models of telehealth will incorporate people being monitored or self-managed at different levels.

Conclusion

Telehealthcare is and will become an important means of managing long term conditions. It is popular with patients. For some conditions it improves quality of care and for others the evidence is less certain, although information from large trials will be available soon. The

current evidence suggests that it may not save resources in the short term, but this may change in the longer term. However, for it to be economically viable new automated methods of monitoring and management must be found for it to realise its full potential.

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