



# TELEREHABILITATION IN SCOTLAND: CURRENT INITIATIVES AND RECOMMENDATIONS FOR FUTURE DEVELOPMENT

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## ABSTRACT

Rehabilitation services are set to become central to modern health care systems as they strive to support an increasingly ageing population to live as independently as possible, while maintaining quality services. Alternative service delivery options such as telerehabilitation may assist in meeting the growing demand for services and many countries are exploring the potential use of telerehabilitation within their health care systems. The Scottish Centre for Telehealth commissioned an independent scoping study and subsequent report into the potential development and realisation of telerehabilitation services across Scotland. The scope of the report was restricted to adult rehabilitation services and aimed to identify opportunities for the use of telerehabilitation and to recommend clear and achievable steps toward implementation of telerehabilitation. This article outlines many of the telerehabilitation initiatives currently underway in Scotland and discusses some of the key recommendations made in the report to the Scottish Centre for Telehealth for the future advancement and application of telerehabilitation across Scotland.

## INTRODUCTION

Scotland is geographically relatively small with a land mass of just 78,772 square kilometres (30,414 square miles) and in 2008 had a population of 5,168,500 (<http://www.scotland.org/about/fact-file/index.html>). As part of the United Kingdom, the people of Scotland have access to free healthcare at the point of care through the National Health Service (NHS). In Scotland, the NHS is governed by the Scottish Government Health Directorate and is comprised of 14 territorial health boards which deliver frontline health services and eight special health boards which provide additional services across the whole of Scotland (e.g., Scottish Ambulance Service; NHS24 - an online and telephone-based health advice service). In addition, social care services are funded through 32 local government authorities. Recent initiatives have seen partnerships develop between the NHS and local authorities to more fully integrate health and social care services.

As in many other countries, Scotland has an ageing population, which is influencing the provision of quality health care services, including rehabilitation services. Rehabilitation services are set to become central to modern health care services as they strive to support an increasingly ageing population to live as independently as possible, while maintaining the quality of services. The use of information and communication technologies in

the provision of rehabilitation (i.e., telerehabilitation) may assist in meeting the growing demand for rehabilitation services. Telerehabilitation services hold the promise of increasing access to rehabilitation services for those who live in rural and remote areas or have restricted mobility. Telerehabilitation research will assist in improving evidence-based practice, redefining outcome measurement, and optimising the rehabilitation process.

In 2008 the Scottish Centre for Telehealth (SCT) commissioned an independent scoping study and subsequent report into the potential development and realisation of telerehabilitation services across Scotland. The scope of the report was restricted to adult rehabilitation services and aimed to identify opportunities for the use of telerehabilitation and to recommend clear and achievable steps towards implementation of telerehabilitation. Engagement with staff from the health boards, universities, patient support groups, and professional associations provided the author with an overview of current rehabilitation practice in Scotland and helped inform the 15 recommendations made in the report for the future development and implementation of telerehabilitation services in Scotland. The report was delivered to the SCT in March 2010 for their consideration.

This article contains information gathered during the scoping study on some of the telerehabilitation initiatives

currently underway in Scotland and outlines some of the key recommendations made in the report to the SCT for the future advancement and application of telerehabilitation across Scotland. This is not intended as a comprehensive review of all telerehabilitation initiatives in Scotland.

## THE SCOTTISH TELEHEALTHCARE CONTEXT

Scotland is a nation that has actively encouraged and promoted the use of information and communication technology across the health and social care sectors. The Scottish Government has demonstrated its commitment to telehealthcare through its establishment and funding of such agencies as the Scottish Centre for Telehealth (SCT) and the National Telecare Development Programme within the Joint Improvement Team, as well as the publication of an e-Health strategy in 2008. The National Telecare Development Programme promotes the use of telecare in daily community care practice across the 32 local community care partnerships in Scotland. There have been many telecare successes with some partnerships having taken significant steps towards embedding telecare within their local community care services. The role of the SCT has been to provide the 14 territorial Scottish health boards with expert guidance in the development and evaluation of telehealth pilot studies and service programs. Over the last 4 years two areas have evolved into national telehealth programs – paediatric and stroke care. The Paediatric Telemedicine Network currently links 10 sites with the Royal Hospital for Sick Children in Glasgow for the rapid diagnosis of children with cardiac or surgical problems, while the Scottish Telestroke Program aims to provide nationwide access to thrombolysis for acute stroke. A number of other projects coordinated by the SCT are in the planning or early implementation stages (see <http://www.sct.scot.nhs.uk/initiatives.html> for an up-to-date list of telehealth initiatives). The recent move of the SCT to the special health board, NHS24, presents an opportunity to expand telehealth programs more uniformly across Scotland and develop new national telehealth services.

## POLICY CONTEXT FOR THE INTRODUCTION OF TELEREHABILITATION SERVICES

The introduction of telerehabilitation into the telehealthcare landscape in Scotland is timely. Not only can telerehabilitation provide a clear link between the telecare and telehealth initiatives already planned, but the implementation of recommendations from Co-ordinated, integrated and fit for purpose: A Delivery

Framework for Adult Rehabilitation Services (2007) a key policy document published by the Scottish Government, highlights the growing importance of rehabilitation to the health and social care sectors. A number of other policies and strategies associated with rehabilitation or the use of technology in health and social care sectors also support the development and use of telerehabilitation:

1. Delivering for Remote and Rural Healthcare (2008)
2. e-Health Strategy (2008)
3. The Self Management Strategy for Long Term Conditions (2008)
4. Shifting the Balance of Care (2009)
5. Healthcare Quality Strategy (2009)).

Furthermore, the imminent appointment of an Allied Health Professional (AHP) Director to NHS24 acknowledges the value of clinical leadership and supports the development and advancement of national telerehabilitation services in Scotland.

## TELEREHABILITATION INITIATIVES IN SCOTLAND

During the scoping exercise it became evident that while telerehabilitation was not yet embedded into rehabilitation services in Scotland, a number of initiatives and pilot studies were underway. Many of the initiatives were small scale 'tryouts' of various technologies within the provision of current rehabilitation services, with some larger research projects developing novel technologies that may be used in telerehabilitation. The following is a brief description of some of the telerehabilitation initiatives currently underway in Scotland. The information presented has been provided by the investigators involved and where possible, website links are provided for access to more detailed information.

### REMOTE PULMONARY REHABILITATION

Despite Scotland being a relatively geographically small nation it does contain many rural and some extremely remote areas. Naturally, this remoteness impacts upon the accessibility of rehabilitation services. In order to improve access to pulmonary rehabilitation, two groups have initiated pilot studies to provide this service via videoconferencing. The Perth and Kinross Physiotherapy Service within NHS Tayside implemented a pilot study to determine the feasibility of linking a remote group via videoconferencing to the pulmonary rehabilitation group session at the Perth Royal Infirmary (<http://www.sct.scot.nhs.uk/copdtayside.html>). A physiotherapy assistant, who was provided with additional training in pulmonary rehabilitation, supervised the remote group. This supplementary training was seen as crucial to the development of skills, confidence, and relationships with

other staff members. The remote patients were initially assessed face-to-face at the Perth Royal Infirmary by the pulmonary physiotherapist specialist who deemed this essential to the safe delivery of pulmonary rehabilitation via telerehabilitation. A Tandberg 880 videoconferencing unit with a 23-inch monitor at each site was found to provide a reliable and stable link. The investigators reported that the clinical outcome measures such as spirometry, shuttle walk tests, goal setting, and quality of life factors were comparable to those from previous pulmonary rehabilitation programmes. As existing equipment was used in the pilot study, the economic evaluation centered on the additional travel and staffing costs associated with providing pulmonary rehabilitation to people residing outside of Perth across three service delivery models: an outreach model, a centralized model and the telerehabilitation model (see Table 1). Preliminary evaluation of the travel and staffing costs required to provide pulmonary rehabilitation to patients residing outside of Perth found the telerehabilitation model to be more cost effective than the other two models. As all of the patients who participated had moderate to severe Chronic Obstructive Pulmonary Disease (COPD) and would not have been able to travel to the Perth site for every session, this method of service delivery was seen as particularly useful in increasing access to those in rural areas.

Table 1. *Additional costs in providing pulmonary rehabilitation to patients residing outside of Perth across three service delivery models.*

	<b>Outreach Model</b>	<b>Centralised Model</b>	<b>Tele-health Model</b>
	Send specialist staff out to rural areas to conduct group session	Patients travel into Perth to join group session	Videoconference link between Perth and remote site
<b>Cost of staff time</b>	4 hours Band 7 per session (£448)	No additional staffing costs	2 hours Band 4 per session
<b>Mileage costs</b>	£16.24 per journey	£114.86* per session	
<b>Total cost per block of 10 weeks</b> (8 weeks treatment; 2 weeks assessment)	<b>£7728.00</b>	<b>£2297.20</b>	<b>£246.20</b>
Note: * cost as per patient transport figures assuming all would come on 1 patient transport vehicle.			

The other group investigating remote pulmonary rehabilitation is Remote Rehabilitation, a collaboration between Distance Lab, National Health Service (NHS) Highland and the Centre for Rural Health. The Remote Rehabilitation (<http://www.distancelab.org/projects/remote-rehabilitation/>) project aims to develop a new communication system that will enable persons with COPD (and potentially other conditions) to participate in group physical exercise regimes from the comfort of their own homes. Utilizing Internet video-conferencing technologies in a unique communication system, participants will be able to see and talk to each other as well as the physiotherapist who will lead the rehabilitation

session. This project builds upon research conducted by Wu et al. (2006) in which group tele-exercise sessions focusing on balance were transmitted into participants' homes. The Remote Rehabilitation project also plans to explore how to use Internet-based communication and information technology to maintain positive group effects while patients participate in rehabilitation programs from their homes. Interactive design, visualisation, and physiological monitoring are also being investigated as part of this project.

## NEUROLOGICAL REHABILITATION

The need to provide specialist allied health services across Scotland has also led to other telerehabilitation initiatives. NHS Grampian (a territorial health board) was granted funding to establish a videoconference link between the Aberdeen-based occupational therapist consultant with expertise in stroke and a remote stroke unit. Initially, the video connection will be used to provide access to specialist input for goal setting with stroke patients; however, use of the equipment for other rehabilitation services is also planned. The Motor Neuron Disease team in Grampian also employed videoconferencing technology to provide specialist services to persons living with motor neuron disease across the entirety of the north of Scotland. Needing to cover an area similar in size to Switzerland and with an ever-increasing caseload without additional specialist staffing, the clinical specialist had already begun using SMS text and email to stay in touch with some patients. However, with the assistance of the SCT, videoconferencing has been integrated into the service to provide access to specialist services either from the patient's home or their local doctor's clinic. The videoconferencing units are also being used for case conferences, training, and team meetings. Future plans will see an expansion of the service to include remote access to the motor neuron multidisciplinary clinic.

## MOBILE TECHNOLOGY USE FOR REHABILITATION

The use of mobile devices has grown enormously around the world and mobile technology is being used in two telerehabilitation initiatives in Scotland. The Fife Rehabilitation Service (NHS Fife) is exploring the use of Personal Digital Assistants (PDAs) to assist with the cognitive rehabilitation of people with an acquired brain injury. The PDAs have been loaded with three multimedia software applications: a schedule assistant; a visual

assistant; and a way finder application. With the ability to customise each application by using familiar voices and images it is hoped that the PDA applications will increase the independence of the users.

Mobile technology is also being harnessed by the Multimodal Interaction Research Group (MMIG) based at the Glasgow Caledonian University (<http://www.mmig.mobi>). One of the projects currently underway at MMIG is “Changing People’s Activity Patterns” which in collaboration with the Paths to Health organization, aims to understand people’s activity levels and patterns in everyday life. A mobile device loaded with customised software is used to track a person’s activity levels, location, time of day and other data. This information is collected and analysed to provide information on the number of trips outdoors, trip duration, distance travelled, type of activity (e.g., walking for exercise or in-home movement), and comparative information such as the proportion of travel on foot versus other modes of transport. Such information can be used to accurately assess the benefits of rehabilitation programs.

### CONSORTIA AND PARTNERSHIPS CONDUCTING RESEARCH IN TELEREHABILITATION

A number of Scottish universities and consortiums have begun research programs that will assist in the future development of telerehabilitation services. HealthQWest is a research consortium for the West of Scotland region. The consortium is comprised of Glasgow Caledonian University, University of Strathclyde, University of Glasgow, University of Stirling, University of the West of Scotland, The Nursing Midwifery & Allied Health Professions Research Unit and NHS Scotland. The HealthQWest Research Consortium’s Function for Living research programme (2006-2010) identifies telerehabilitation as an area for further research within the methodological and technical cluster of the programme (<http://www.healthqwest.org/functionforliving/>). A current research project within the Function for Living research programme aims to assess the effectiveness of an innovative method of digital visualisation of biomechanical data across a variety of rehabilitation applications. The dynamic visualisation methods will be assessed across five RCT Phase II trials involving:

1. improving uptake of exercise in older people
2. reducing falls in older people
3. better community rehabilitation following knee arthroplasty
4. improving coordination and mobility early after stroke
5. visualisation to aid the fitting of Ankle Foot Orthoses following stroke

A number of work packages in the grant envisage the delivery of the interventions using telerehabilitation methods.

The Research Consortium in Speckled Computing at the University of Edinburgh is developing ‘specks’

technology for use in telerehabilitation (<http://www.specknet.org/>). These miniature semiconductor devices combine sensing, processing and wireless communication activities with energy storage capabilities. The group is investigating how these ‘specks’ might be applied in healthcare. Current projects use ‘specks’ in non-invasive respiratory rate measurements in the remote monitoring of COPD, in intensive care medicine, and sleep research. They are also being studied in projects utilising wireless motion capture, such as in identifying risks for falls, gait analysis and smart prosthetics.

The Centre for Rural Health and NHS Highland is one partnership involved in the “Competitive Health Services in Sparsely Populated Areas” project partly funded by the European Union Northern Periphery Programme (<http://www.abdn.ac.uk/crh/research/current/competitive-health-services/>). Other partners come from Finland, Sweden, Norway, and Ireland. The goal of the project is to identify successful e-Health services in the partner countries and then pilot the transferability of these services in the home country. In Scotland, the pilot study involving rehabilitation is the transfer of a remotely delivered speech and language therapy service from Sweden. In Sweden, this telerehabilitation service is now embedded into the Västerbotten County Council’s local health service and is the preferred service delivery model for people living more than 50 kms from Umeå in need of a range of speech and language therapy services. Researchers from the Centre for Rural Health and NHS Highland are looking at the feasibility of developing a similar service between the towns of Inverness and Wick and Golspie, using existing NHS Highland videoconferencing facilities.

Another group involved in European partnerships is the Heart Manual Department at the Astley Ainslie Hospital, Edinburgh. The Heart Manual is a clinically effective, evidence-based self-management cardiac rehabilitation programme developed in Scotland and used widely throughout the world (<http://www.theheartmanual.com>). The Heart Manual Department has been invited to contribute to a European Seventh Framework Programme (7FP) research project, “HeartCycle.” This Europe-wide, large-scale integration project has partners from the healthcare, electronics, information and communication technologies, and textile sectors. The project aims to develop a closed loop disease management solution for patients suffering from heart failure and coronary heart disease and includes potential comorbidities such as hypertension, diabetes and arrhythmias.

### PROJECTS WITH INDUSTRY

The final group identified as having potential to assist in the future development of telerehabilitation in Scotland, consists of private software development companies. For example, Propeller Rehabilitation Software (<http://www.propeller.net/>) has worked in collaboration with

speech and language therapists from NHS Borders to design, develop, and produce a range of communication rehabilitation software products that are now used extensively across the UK and in other parts of the world. The company has ambitions to move its computer-based therapies online and create new programs that will link with other telerehabilitation developments, as well as online social networks to support individuals at home.

## KEY RECOMMENDATIONS FROM SCOPING STUDY AND REPORT: THE FUTURE OF TELEREHABILITATION IN SCOTLAND

There is a wealth of clinical and technical skill and talent available in Scotland for the development of robust and innovative telerehabilitation applications. Furthermore, the organisational structure of the NHS in Scotland provides a unique opportunity to design and implement national telerehabilitation programs that utilise service provision across health boards. The report arising from the scoping study of the potential for telerehabilitation services in Scotland was delivered to the SCT in March 2010 and made 15 recommendations for future development and implementation of telerehabilitation services. The first of the recommendations suggested that the clinicians, researchers, and organizations already involved in telerehabilitation initiatives form the basis of a working group which, along with representatives from relevant government and voluntary sector groups, will guide and drive the development and implementation of telerehabilitation in Scotland. This group would also play a central role in realising the other recommendations from the report, particularly those involving the development of education and training programs in telerehabilitation.

The second recommendation from the report addressed a key finding from the scoping study that there is increasingly limited access to specialist rehabilitation services across Scotland. It was recommended that a web-based teleconsultation system would allow AHPs across Scotland to access specialist AHP consultation as required, while a national telerehabilitation service would provide assessment and treatment services where local specialist AHPs were not available. The web-based teleconsultation system leverages the experiences within the Dutch health care system in which such a system was shown to speed-up appropriate referral and support primary care (Visser et al., 2009; Vollenbroek-Hutten et al., 2009). Other benefits that may come from the implementation of a teleconsultation system include increased access to specialist AHP expertise for those areas where such expertise is not available or is only sporadically available, as well as increased multidisciplinary case management, especially where resourcing in specific disciplines is limited. Streamlining

the resource of specialist AHPs through a teleconsultation system may reduce waiting times and assist in meeting the rising demand for specialist rehabilitation services. Furthermore, specialist AHPs currently working part-time or on parental leave might be able to contribute and maintain their skills through the teleconsultation system. As the system is asynchronous, the specialist AHP can review the cases at a time when it suits them or fits in with their clinical workflow. With an expansion of NHS infrastructure and security systems, AHPs would be able to access this teleconsultation network from their home. Such a teleconsultation system would allow for the maintenance and expansion of specialist AHP services, as it would allow for the exchange of professional knowledge and provide an avenue for increased training or professional development in speciality areas. The web-based system would build upon skills currently employed by all AHPs and a relatively small amount of training would be required for AHPs to use the system. Furthermore, the web-based format of the system is not too far removed from current technology used in managed knowledge networks.

The development and implementation of a national telerehabilitation service would further enhance the provision of specialist AHP services. In addition to the many benefits shared with the web-based teleconsultation system, a national telerehabilitation service would have the capacity to escalate rehabilitation cases without the need for local specialist AHP services. The capacity to provide specialist rehabilitation in a local environment, familiar to the patient may provide additional functional benefits. From the point of view of specialist AHPs, telerehabilitation has the potential to develop into a speciality of its own and have a significant impact upon the re-design of all rehabilitation services. Designing and implementing the telerehabilitation service would provide NHS Scotland with opportunities to contribute to the evidence-base for telerehabilitation services.

It is acknowledged that while the implementation of a web-based teleconsultation system and national telerehabilitation service in Scotland would increase access to specialist AHP services, some risks exist, such as the potential degradation of existing specialist AHP services in rural areas. Likewise, it is acknowledged that some rehabilitation services are not suited to telerehabilitation, and so there is still a need for good access to 'hands on' specialist AHP services. Please refer to the complete report (available from the SCT) for a full discussion of the benefits and limitations of this recommendation and a schematic representation of the web-based teleconsultation system and national telerehabilitation service.

Other recommendations from the report were specific to the development and implementation of telerehabilitation services for a variety of conditions such as communication disorders, musculoskeletal disorders and other long term conditions, or rehabilitation streams

such as pulmonary, cardiac, neurological and vocational rehabilitation. Further recommendations encompassed utilising telerehabilitation in the roll out of fall prevention programs and using care homes as community-hubs for group telerehabilitation programs. The establishment of robust links between telecare or telemonitoring services and telerehabilitation programs was also considered important for the future integration of rehabilitation services and social care services. Recommendations on general infrastructure, security, and privacy requirements for telerehabilitation were not detailed in this report as these requirements will be determined by the specific telerehabilitation services chosen for implementation. Finally, it was suggested that a similar scoping exercise be commissioned around paediatric rehabilitation services, with a specific focus upon the transition between paediatric and adult rehabilitation services, as this was an area identified by AHPs as a potential service gap.

As NHS Scotland confronts the daunting prospect of providing high quality rehabilitation services in the face of an ever-increasing demand for these services, in a climate of financial restraint, now is the time to carefully develop, evaluate, and implement a range of telerehabilitation services to augment and improve upon current rehabilitation programs. If the future goal is to have national telerehabilitation services available across all of Scotland, there is much work to be done. However, Scotland has a long and proud history of innovation, particularly in the healthcare arena, so it can be expected that the SCT and the Scottish telerehabilitation working group will rise to the challenges ahead as they develop and implement clinically relevant and patient-centred telerehabilitation services.

## ACKNOWLEDGEMENTS

The author served as Telerehabilitation Research Consultant for the Scottish Centre for Telehealth (SCT) from March 2009 – March 2010, and gratefully acknowledges the support of the SCT in the completion of the scoping study and report on the future use of telerehabilitation in Scotland. The author also extends her thanks to each of the groups who participated in the scoping study and granted permission for their work in the area of telerehabilitation to be presented in this article.

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