



Spotlight on

Telemedicine in ongoing heart failure care



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Executive summary

There is a need for innovation in ongoing heart failure (HF) care, as traditional models have not been able to fully address the challenges of HF management.

Ongoing care aims to meet the complex needs of people living with HF by monitoring signs and symptoms, promoting adherence to treatment and empowering people to engage with their own care.^{1 2} This is crucial to improve outcomes. Several care models have been implemented with success,³⁻⁷ but HF mortality and hospital readmission rates remain high – often the result of preventable factors.^{8 9}

Telemedicine seems to be able to support HF care and help address some of the challenges of traditional models.

^{7 10-15} Telemedicine refers to interventions that merge telecommunications with computational systems to optimise healthcare.^{16 17} It may rely on telephones, mobile apps, wearables or implantable devices. In HF, these interventions are generally used to monitor signs and symptoms remotely,^{18 19} and to deliver information and support so people with HF can self-care.²⁰ Telemedicine can improve access to care^{17 18 21} and help reduce HF-related hospital admissions and mortality.^{7 10-15}

Despite reported benefits, there are many barriers to the wider adoption of telemedicine in HF.

For example, some healthcare professionals may not fully recognise the value of these interventions. They may perceive a number of barriers, such as concern that telemedicine might result in incomplete assessments or undervalue their clinical expertise.²²

The need for new infrastructure and accountability protocols has also been a barrier to the wide adoption of telemedicine.

These services rely on data collected remotely, which calls for secure databases.²³ In addition, data collected via telemedicine should be accessible by all members of the HF care team, some working in different healthcare settings, which adds another layer of complexity to service development.²⁴ Furthermore, telemedicine platforms need clear strategies for data analysis and intervention, ensuring a clear assignment of responsibilities, which is essential to achieve the potential benefits.²⁴

Reimbursement is another significant challenge in the development and implementation of telemedicine services in HF.

For example, funding is required not only for equipment but also for the time clinicians spend reviewing data. However, funding models that are currently available across Europe do not seem to address all cost elements of telemedicine.^{18 20} The limited evidence of cost-effectiveness makes it a challenge for decision-makers to assess the value of implementing telemedicine interventions. This prevents the development of innovative and adequate reimbursement models.¹⁸

There are clear actions that can be taken to support the development and implementation of telemedicine services for HF care in Europe. Financial, organisational and legislative commitment in these areas offers the best prospects for telemedicine to play its part in supporting the delivery of optimal HF care.

Key actions to increase implementation of telemedicine in ongoing HF care

<p>1. Raise awareness of the demonstrated benefits of telemedicine in ongoing HF care</p>	<p>The benefits of telemedicine must be disseminated to healthcare professionals, people living with HF and key decision-makers.</p>
<p>2. Support clinical research to improve understanding of the value of telemedicine in ongoing HF care</p>	<p>Further research is needed to help identify which technologies are most effective in HF care, who can benefit most and under which circumstances. Additional evidence of cost-effectiveness is also required.</p>
<p>3. Involve healthcare professionals and people with HF in the development and implementation of telemedicine interventions</p>	<p>To help secure buy-in, healthcare professionals should be involved in the implementation of telemedicine systems from an early stage. Involving people living with HF can help ensure interventions address their needs and preferences.</p>
<p>4. Develop models for investment in and reimbursement of telemedicine</p>	<p>Funding models are needed to ensure telemedicine interventions and equipment are adequately funded and widely available both at a local and system level.</p>
<p>5. Develop guidance for the use of telemedicine in HF management</p>	<p>National and regional guidance is needed to support healthcare professionals to identify those who can benefit from telemedicine interventions and under which circumstances.</p>

Note on terminology

This report uses the term 'telemedicine' to refer to a group of innovative technologies that merge telecommunications with computational systems and are applied to medical services to optimise ongoing HF care and improve quality of life. Other terms used in the literature include telehealth, digital health, eHealth and mobile health (or mHealth).

What is telemedicine and why does it matter in ongoing heart failure care?

Telemedicine may help address problems faced in conventional heart failure management

The potential for innovative technologies to improve both quality and access to care in heart failure (HF), at scale and in a cost-effective way, has long been of interest to leading HF clinicians.^{1 10 17} Key elements of best practice in HF care are widely recognised,¹ but too many people living with HF still do not receive effective ongoing care.²⁵

HF is a complex clinical syndrome with significant personal impact

HF occurs when the heart becomes weak or stiff, making it unable to pump sufficient blood to meet the body's needs.^{26 27} This results in serious symptoms including breathlessness, extreme fatigue and swelling, in addition to an increased risk of anxiety and depression.^{1 10} HF can have a significant impact on a person's quality of life, and can be life-threatening.²⁵ As many as 40% of people hospitalised for HF die within a year.¹⁰

Ongoing care is a cornerstone of optimal HF management

Ongoing HF care refers to management of the syndrome after diagnosis, or following hospital discharge in the case of acute HF. Its goal is to meet the complex needs of people living with HF in the community, by promoting adherence to medication and recommended interventions, supporting people with HF to understand and engage with their own care, managing comorbidities and monitoring signs and symptoms.^{1 2} Several care models have been implemented with success; for example, HF clinic-based programmes and home visiting interventions have been shown to significantly reduce hospital readmissions up to six months post-discharge.³⁻⁷ Cardiac rehabilitation also brings benefits: it may reduce HF-related hospital admissions by over 40% for up to 12 months after discharge.²⁸

Traditional models of ongoing care often do not meet the needs of people living with HF

HF remains a leading cause of hospital admissions in people over 65 in most economically developed countries, and is one of the greatest contributors to hospital readmission.^{9 10} Yet around two-thirds of hospital readmissions for HF are caused by potentially preventable factors, including inadequate discharge planning, non-adherence to medication, insufficient follow-up, lack of integration of care and delays in seeking medical attention.^{8 9}

Telemedicine for HF can employ a range of tools to support ongoing care

Telemedicine usually refers to a group of innovative technologies that merge telecommunications with computational systems and are applied to medical services to optimise ongoing care and improve quality of life (*Figure 1*).^{16 17} Other terms used in the literature include telehealth, digital health, eHealth and mobile health (or mHealth).²⁹ Telemedicine allows for some elements of clinical decision-making to take place remotely.¹⁸ It also allows for a greater amount of data to be collected, processed and shared with the HF care team, prompting action if needed – either at the clinician’s discretion or according to a predefined protocol. Shared data collected and transmitted using non-invasive devices may include body weight, blood pressure and temperature.^{18 30} Implantable devices can be used to measure HF-related parameters, such as cardiac filling pressures or pulmonary artery pressure (monitoring devices), or to assess heart function and administer treatment (therapeutic devices).¹⁸ Therapeutic implantable devices like defibrillators – which send shocks to correct the heart rhythm when this is abnormal³¹ – may be designed to also transmit information about heart function.¹²

Telemedicine in HF is used primarily to monitor symptoms and improve patients’ knowledge

Two overlapping areas within telemedicine in HF account for the vast majority of emerging interventions:

- **Telemonitoring** – where signs and symptoms are monitored remotely through the use of communications technologies.^{18 19} This increases levels of contact between healthcare professionals and people living with HF, and therefore facilitates the early identification of worsening symptoms, allows for appropriate medication adjustment and helps to prevent hospital admissions.¹⁹
- **Delivery of information and advice** – interventions that focus on increasing people’s knowledge of HF and ability to self-care.²⁰ Information can be based on each day’s signs and symptoms, making it very specific and contributing to person-centred care.

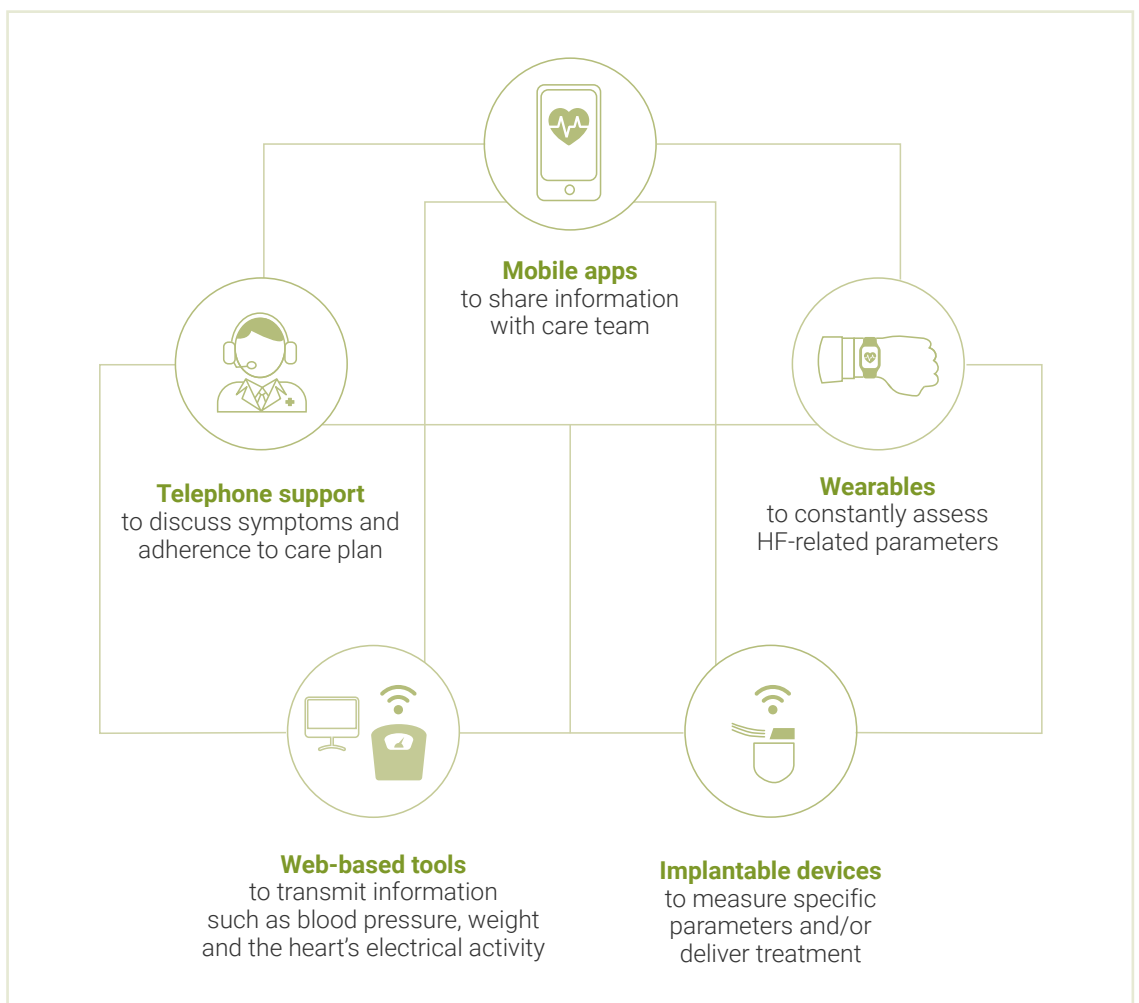
Telemedicine should be delivered as part of multidisciplinary HF care

Optimal management of HF should be multidisciplinary and integrated;²⁵ therefore, telemedicine should support this and should be adaptable to the wide-ranging needs of people living with HF.^{32 33} Increasingly, telemedicine services are being used in combination to create comprehensive and integrated HF care interventions. For example, the delivery of information and advice is often an element of telemonitoring.³⁰

'Telemedicine "solutions" are tools rather than solutions. They must be planned according to the goals they serve and integrated into a wider plan for HF management.'

Dr Dulce Brito, Portugal

Figure 1. Available telemedicine solutions in ongoing HF care^{12 18 21 30 34}



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How can telemedicine improve ongoing care in heart failure?

Telemedicine can improve care and outcomes for people living with HF

While the evidence is not yet fully conclusive, many studies have shown that telemedicine can contribute to better outcomes for people living with HF.¹⁰⁻¹⁵ A systematic review of existing studies found that telemonitoring programmes can reduce both mortality and HF-related hospitalisations by at least 20%,⁷ although results have yet to be replicated in large randomised trials.¹⁸⁻³⁵ People who use telemedicine services to monitor and manage HF also seem to perceive a range of benefits including increased access to care and greater peace of mind.³⁶⁻³⁸ Telemedicine can also help people with HF reduce healthcare costs, for example by avoiding the expenses and work loss associated with travelling to hospital.¹⁶

'I think people with heart failure feel more comfortable contacting their specialist with a question when they can just call or send a message. You don't feel like you're wasting their time.'

Lilian van Doesburg, Netherlands

For information about the challenges associated with telemedicine in HF care, see Section 3.

Telephone support can reduce hospital admissions

Telephone support has been widely trialled as an extension of clinic-based services, and is one of the most common types of remote HF management.¹⁸ Typically, HF programmes incorporating this service enhance frequency and quality of care, for example by discussing symptoms and treatment adherence on a regular basis.¹⁸ Evidence suggests that telephone support can reduce HF-related hospital admissions by around 15% and mortality by around 13%.⁷



'People with long-term conditions can feel fairly isolated from care services. I think that being easily connected to healthcare professionals and knowing that someone is looking at clinical data and will react if they perceive a problem reassures people with HF.'

Professor Mark Hawley, UK

Implantable devices show considerable promise in reducing hospitalisation

Monitoring devices implanted to measure pulmonary artery pressure and transmit it to the HF care team have been shown to reduce HF-related hospitalisation by 38%.³⁹ European Society of Cardiology (ESC) HF guidelines state that such devices may be considered to reduce the risk of hospitalisation in people with HF.¹ Similarly, therapeutic devices may also improve outcomes for people with HF.^{12 18}

Telemedicine can facilitate home-based cardiac rehabilitation

Telerehabilitation has been used to improve access to cardiac rehabilitation,^{28 32 40} which is a crucial care element in HF that brings significant benefits.^{32 41} It is particularly important because access to cardiac rehabilitation is limited – most European countries report fewer than half of those eligible actually enrolled in these programmes.⁴² Telerehabilitation has been implemented around the world and has shown a range of benefits, including increased physical activity and improved physical capacity in people living with HF.⁴¹ Remote cardiac rehabilitation can be organised in different ways – for example, one programme in Poland used at-home electrocardiogram (ECG) readings later shared with the HF care team, and a mobile app to provide automated advice before and during exercise sessions.⁴⁰ Another programme, in Canada, was designed to use a live video feed and biomedical sensors during exercise sessions so that physiotherapists could monitor people in real time.⁴³

'Remote services offer the benefit of delivering specialised care to patients who would not otherwise be able to access it, either because they are frail or because they live too far from a clinic.'

Dr Josep Comín-Colet, Spain

The benefits of telemedicine may vary with clinical characteristics

Telemedicine may not help all people living with HF in the same way. For example, its potential to prevent hospital admissions and reduce mortality may be greatest among those with more severe HF,⁴⁴ as their more frequent need for medication adjustments can be facilitated through remote monitoring.²² Some interventions may be particularly effective in reducing mortality among people with HF and a history of atrial fibrillation, possibly because remote monitoring helps to detect fluctuations in heart rhythm more quickly, allowing for more prompt action.¹¹ On the other hand, telemedicine may be less effective for people suffering from depression,⁴⁵ which could be because this population is less likely to self-care or adhere to prescribed treatment regimens.⁴⁶

3

Challenges surrounding the use of telemedicine in ongoing heart failure care

Telemedicine brings new organisational demands to health systems

Despite the potential benefits telemedicine may offer in HF care, various barriers to large-scale implementation exist. Technological interventions are not always a simple extension of traditional care models, and it may be difficult to integrate these services into existing working methods. For example, data collected remotely should be accessible to all members of the HF care team, and this calls for interoperable information technology (IT) systems (e.g. electronic health records) and clear methods for data sharing.²⁴ This will likely require protocols that take ethical and legal concerns into consideration. There is a need for secure databases and processes to protect the safety and privacy of each person with HF. Platforms must ensure data are transmitted and stored safely and in line with European data protection regulations.²³

Telemedicine poses new challenges in terms of clinical accountability

The requirements of working with telemedicine often differ from traditional care. Data collected remotely must be reviewed regularly and may require action,¹⁸ which could lead to additional responsibilities for clinicians as they need to analyse data without face-to-face contact with the person with HF.²³ Clear strategies are therefore needed for data analysis and intervention, including plans for out-of-hours monitoring and algorithms or protocols for action.²² It should be made clear who is responsible for reviewing and acting on transmitted data, and when – and artificial intelligence may have a role in the process.¹⁸ This is crucial to minimise the potential for errors in reviewing, interpreting or acting on data collected remotely. These processes may vary with healthcare systems¹⁸ and must therefore be tailored to local contexts,²⁴ which hinders the development of detailed guidance for implementation of telemedicine services.

'Although telemedicine can theoretically facilitate faster, easier communication between the person with HF, their HF specialists and other specialists, it is necessary to have an effective and integrated circuit of information in place to ensure benefits.'

Dr Dulce Brito, Portugal



Some healthcare professionals may not recognise the value of telemedicine in ongoing HF care

Research suggests that the value of telemedicine in ongoing HF care is not always recognised by healthcare staff.⁴⁷ Some professionals may believe that using digital platforms for communication could threaten the clinician–patient relationship and result in incomplete assessments and fragmented care, or prevent the multidisciplinary work central to HF management.¹⁶ They may also feel that systems that guide decision-making or circumvent face-to-face interaction undervalue their clinical expertise.²² This is a substantial barrier, as telemedicine interventions depend on the involvement of healthcare professionals, not least because they need to learn new care pathways and protocols.³³

‘Healthcare organisations underestimate what it takes to introduce a different way of working and all of the concerns of the staff in relation to that.’

Professor Mark Hawley, UK

It can be difficult for decision-makers to assess the value of telemedicine in HF care

While several studies have shown that telemedicine can improve HF outcomes, the existing evidence base requires careful navigation, namely to fully understand which technologies should be provided for whom, and under which circumstances.^{22 35} For example, trials of telemedicine services, including implantable therapeutic cardiac devices, have found varying degrees of effectiveness and cost-effectiveness.^{11 20 28 35 48} Experts have suggested that this variation may be a consequence of differences in healthcare contexts,¹⁸ meaning that one intervention may not have the same impact in all health systems, and therefore countries.⁴⁹ Experts have also highlighted concerns about the lack of statistically significant results in some trials⁵⁰ and limited evidence of cost-effectiveness.²² Variation in patients’ needs and potential benefit from telemedicine may complicate the development and implementation of innovative services and the associated policies and guidelines.²² This uncertainty, compounded by the rapid pace of change in the field, creates difficulties for regulators, reimbursement authorities and healthcare organisations.¹⁸



'In contrast to drugs or implants, the inclusion of this technology in HF care depends on contextual factors, which differ from one country to another. That makes it difficult to provide guidance for implementation.'

Professor Friedrich Köhler, Germany

Inadequate reimbursement models and lack of alignment between levels of government may impede implementation

The setting up of telemedicine services requires investment in tools such as monitoring equipment, databases, websites and apps. In addition, the time healthcare professionals spend analysing data should also be reimbursed. However, there are currently few funding models in Europe that recognise these costs,²⁴ which prevents the scaling up of pilot or local programmes.^{51 52} For example, in Germany, several HF telemonitoring projects have been implemented locally, but they have yet to be scaled up due to reluctance from funding bodies regarding reimbursement.⁵¹ In Italy, experts have pointed to a lack of alignment between national and regional decision-making as a barrier to nationwide implementation of telemedicine services.¹⁷

'Even when policymakers recognise the value of eHealth in managing chronic conditions, the lack of established reimbursement models is one of the main barriers they face.'

Dr Josep Comín-Colet, Spain

'The use of devices to monitor pulmonary artery pressure can really change HF practice and improve outcomes, but in many countries, including Belgium, this is not reimbursed.'

Professor Anne-Catherine Pouleur, Belgium



4

Case studies of real-world use of telemedicine in ongoing heart failure care

Several models of HF care across Europe have demonstrated the potential of telemedicine

A variety of remote monitoring systems and mobile educational tools have been tested, and some implemented.³⁻⁷ The case studies below can serve as examples of best practice in effectively using telemedicine to improve ongoing HF care.

Case study

Telemonitoring of people with HF undergoing cardiac resynchronisation therapy¹²

The Medical Centre of the Hungarian Defence Forces in Budapest ran a management programme in which people with HF who required an implanted resynchronisation defibrillator were offered a choice between remote monitoring and conventional follow-up. People who selected remote monitoring received a defibrillator capable of transmitting data, and a remote monitoring system sent the data to a team of cardiologists and electrophysiologists.

The programme ran between January 2011 and June 2016, and included a follow-up period per participant of 28 months on average. People with HF in the telemonitoring group visited the outpatient HF clinic more often than those in conventional follow-up. Mortality was significantly lower in the remote monitoring group.

Case study

Virtual communication between general practitioners and HF specialists⁵³

The Heartbeat Trust in Ireland developed a virtual consultation service that enables general practitioners (GPs) to discuss HF cases with cardiologists in real time, reducing the need for referral to outpatient departments. This service limits unnecessary travel for the person with HF and also increases GPs' knowledge and confidence in managing HF.

Over the initial 18 months of the service, only 17% of patients discussed in the virtual clinic needed a review in the outpatient department. The service has been running for over two years, with virtual consultations taking place twice a week.



Case study

Personalised remote monitoring for people at high risk of rehospitalisation⁵⁴

The Centro Hospitalar Universitário Lisboa Norte in Lisbon, Portugal operates a telemonitoring programme individually tailored for people with chronic HF and considered at high risk of hospitalisation. Each person in the programme has access to medical equipment at home and a mobile app to transmit a range of parameters including heart rate, body temperature and blood pressure, along with the readings from a three-lead ECG, which is performed three times per week. Data are transmitted automatically every day (and manually, if needed) to an intermediary team of cardiopneumologists and HF-trained nurses. This team receives an alert if any parameters fall outside of predefined limits, which are tailored to each person based on readings taken when they join the programme and are adjusted monthly.

When an alert is received, a member of the intermediary team immediately contacts the person with HF (or their carer) to confirm the readings and collect further information using a validated questionnaire. This questionnaire is used to decide whether a member of the cardiology team at the hospital needs to be involved. In this case, all members of the cardiology team receive an alert, and a prespecified member of the team takes responsibility for the case – they contact the person with HF and make a clinical decision, such as adjusting treatment or asking them to come to the hospital for a consultation.

The programme currently has 30 participants and there are plans to expand it. Adherence has been high at approximately 92% per year. Both mortality and HF rehospitalisations have been significantly reduced, and other outcomes including quality of life and functional capacity have improved.

Case study

Management of HF at home

The IN-TIME trial has shown benefits of remote monitoring using therapeutic cardiac implantable electronic devices in people with HF with reduced ejection fraction (HFrEF).¹⁸ The trial was conducted across 36 tertiary clinical centres and hospitals in Europe (Austria, Czech Republic, Denmark, Germany and Latvia), Israel and Australia. The intervention included automatic and daily telemonitoring of the implanted device, with data transmitted to and reviewed by a team of research nurses and physicians working from a central monitoring unit. Data received could trigger a clinical response; for example, based on changing symptoms or rapid weight gain, the HF team could call the person with HF to assess their overall condition and adherence to medication, and depending on this could recommend a GP visit or an appointment at an HF clinic.

Study participants were followed-up for one year from enrolment. People who received telemonitoring support were less likely to experience worsening HF (including HF-related unplanned hospitalisation, worsening HF class or self-assessment, and death) than those who received standard care.¹¹ Established guidelines suggest that this intervention may be considered in symptomatic people with HFrEF.¹

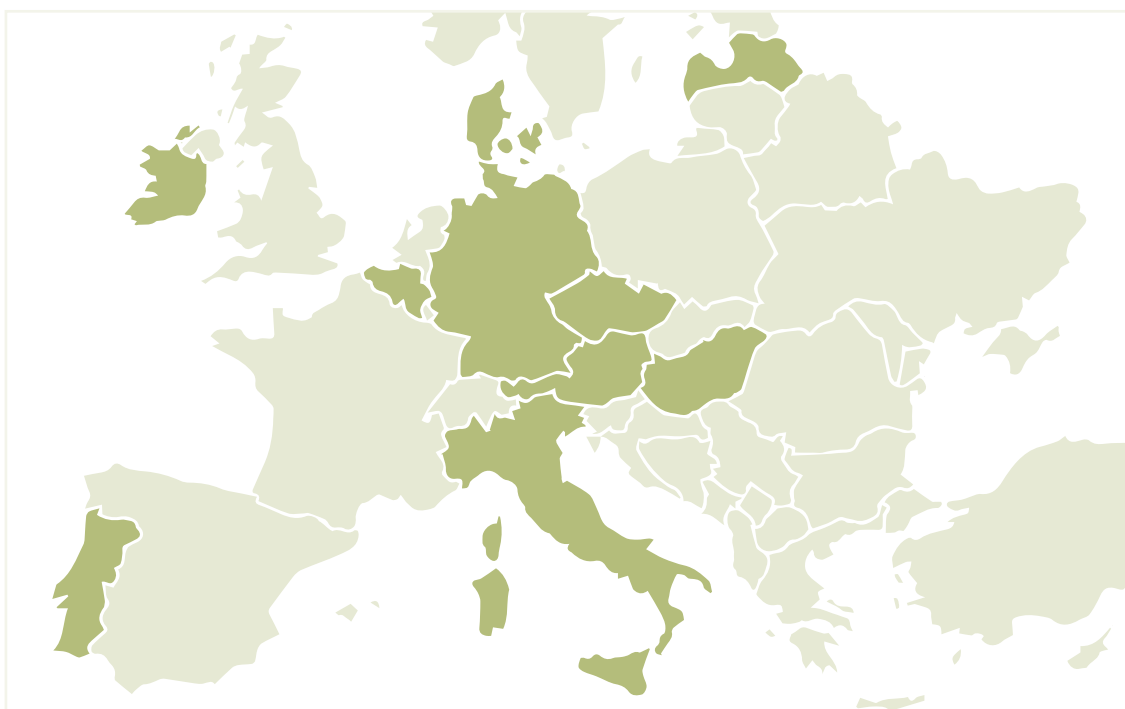
Case study

Supporting self-care in people living with HF

The European research and innovation programme Horizon 2020 is funding the HeartMan project to design and test a decision support system for management of HF rEF. The programme relies on a sensing wristband and a linked mobile app that transmits data to a web portal accessible by the HF team. The mobile app offers personalised advice on several aspects, for example nutrition and physical activity, based on the data collected from the wristband and personal input. It also delivers cognitive behavioural therapy (personalised messages and mental exercises) to help people modify unhealthy lifestyle behaviours. Finally, the programme incorporates a machine-learning algorithm to predict whether people will feel well or unwell each day.³⁰

Via the web portal, the care team can monitor HF remotely, including each person's adherence to self-care, medication or exercise plan. The portal also includes a dashboard that combines information from the HeartMan system with personal health records, giving the HF team a comprehensive view of the health status of each person in the programme.³⁰

The impact of this programme was tested in a clinical trial in Belgium and Italy, where it was shown to improve self-care behaviours and reduce depression and anxiety. Other outcomes, including ejection fraction and one-year mortality risk, were also improved. People who used the programme for longer, or more intensively, experienced the greatest improvements in clinical and psychological outcomes.⁵⁵



The way forward

Telemedicine has the potential to improve care across Europe, but collaboration is needed

Research suggests that telemedicine can have a promising role in ongoing HF care, and may contribute to an improvement in outcomes.^{7 39 56} However, the effective use of telemedicine relies on its successful integration into existing best-practice models and multidisciplinary work, and the degree to which it offers adaptability and flexibility to the person with HF. Telemedicine programmes will be highly dependent on local systems and the involvement of patients. Therefore, their implementation should involve decision-makers, staff across the healthcare system and patient representatives.³⁷

Concerted efforts are required to realise the potential of telemedicine in ongoing HF care

We propose actions to improve understanding and support implementation of telemedicine in ongoing HF care, so that its benefits can be fully realised.

1. Raise awareness of the demonstrated benefits of telemedicine in ongoing HF care

The potential impact of telemedicine in improving HF care and outcomes is not widely recognised by people living with HF, healthcare professionals and decision-makers.^{22 33 47} While it is true that there is a need for more evidence to fully clarify the value of telemedicine in HF care, several studies have shown the potential it has in improving outcomes¹⁰⁻¹⁵ and contributing to patient satisfaction.³⁶⁻³⁸ This potential needs to be disseminated so there is greater awareness of the benefits of telemedicine in HF care.

2. Support clinical research to improve understanding of the value of telemedicine in ongoing HF care

Further research is needed to understand the effectiveness and cost-effectiveness of telemedicine interventions for ongoing HF care. Studies should help identify which technologies are most effective and for whom, for example in terms of type of HF or stage of disease. Clarifying how, and when, telemedicine can support HF management will help reduce the HF burden on each individual person and alleviate pressures on the health system. It is important to involve decision-makers in discussions about research and reimbursement of telemedicine in HF to encourage innovation.



3. Involve healthcare professionals and people with HF in the development and implementation of telemedicine interventions

It is crucial to secure buy-in for telemedicine from healthcare professionals at both the local and system level. Representatives from all relevant professional groups should be involved in the development of these interventions in HF to help ensure they support multidisciplinary and integrated care. People living with HF should also be involved in the development stages to help ensure new services meet their needs and preferences.¹⁶

4. Develop models for investment in and reimbursement of telemedicine

The value of telemedicine may vary with the healthcare context, which means that each region or country will need to identify the best way to leverage each intervention. This will include, for example, an understanding of the platforms, models or devices that most appropriately address the local, regional or national challenges. This will be critical in securing support from all stakeholders. When consensus is clear, policymakers and healthcare commissioners should be prepared to implement innovative models and reimburse telemedicine interventions appropriately – for example, considering costs of new equipment and the additional resource demands of professionals analysing great amounts of data and preparing interventions.^{16 33}

5. Develop guidance for the use of telemedicine in HF management

It is crucial to develop accountability protocols for the use of telemedicine in HF so each healthcare professional knows their responsibilities and how data are to be used. New guidance will help to clarify which interventions may be appropriate for whom, and the circumstances under which these services should be offered. While the development of such guidance would be expected to fall on national or regional governments, the European Union may have a role in establishing key quality elements that would support local recommendations.

As telemedicine becomes increasingly established in healthcare, it is crucial to understand how these interventions can be used in HF

We hope this report and the actions proposed will lead to a better understanding of how telemedicine can play its part in improving the lives of the millions of people living with HF across Europe.

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About the Heart Failure Policy Network

The Heart Failure Policy Network is an independent, multidisciplinary group of healthcare professionals, patient advocacy groups, policymakers and other stakeholders from across Europe whose goal is to raise awareness of unmet needs surrounding heart failure (HF) and its care. All members provide their time for free. All Network content is non-promotional and non-commercial. The Secretariat is provided by The Health Policy Partnership Ltd, an independent health policy consultancy based in London.



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