fighting heart disease and stroke
european heart network

Cardiac and Stroke Rehabilitation
a European Heart Network paper • 2018 Update

Executive Summary

Across the European Union, 49 million patients live with the sequels of heart attacks and strokes.[1] A crucial part of the treatment is rehabilitation including counselling, medical treatment and psychological support. Cardiac and stroke rehabilitation programmes help prevent recurrence, improve functional capacity, recovery and psychological well-being. They help patients regain as normal a life as possible, optimise their quality of life, and reduce the burden on health services by reducing hospital readmissions.

However, access to and uptake of quality cardiac and stroke rehabilitation is patchy in most European countries and is considered an under-utilised resource. Yet, the benefits that rehabilitation bestows on patients as well as the wider society are considerable and suggest that every eligible patient should be legally entitled to participate in rehabilitation programmes. Improving the implementation of cardiac and stroke rehabilitation programmes, optimising the balance between similarities and differences, for example by implementing joint rehabilitation protocols and personnel training, makes economic sense. These services are cost-saving and cost-effective and represent an investment rather than an expense.

In order to allow patients' access to and uptake of quality cardiac and stroke rehabilitation programmes, the European Heart Network (EHN) recommends that:

- Cardiac and stroke rehabilitation programmes must be an integral part of the patient's treatment plan and financed by the national health-care system/relevant schemes
- Rehabilitation programmes should be accessible for all eligible patients, regardless of gender, age, socio-economic status, ethnicity or their place of living
- Appropriate healthcare professionals should automatically refer their eligible patients to rehabilitation programmes and motivate them to take part in these programmes
- Hospitals and healthcare professionals should adhere to national or European guidelines when implementing rehabilitation programmes, also taking into account the geographical and economic conditions
- Quality data collection, national registries and audits on the provision of rehabilitation should be carried out and include the following: an ability to capture and report on the

[1] Wilkins E., et al. European Cardiovascular Disease Statistics, 2017 Edition. European Heart Network. 2017. Available at: http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf .

eligible population, uptake, availability, cost-effectiveness, referral to patient groups, components of teams and programmes, and span the spectrum of care provision including hospital, community and nursing homes

- Innovative eHealth solutions aiming at complementing rehabilitation should be investigated further
- Awareness-raising campaigns could be considered to improve understanding of the benefits of rehabilitation programme aiming at: the public, employers, appropriate health-care professionals and patients.

Aim

With this paper, EHN and its members aim to:

a) Take stock of the current availability and accessibility of rehabilitation programmes across Europe
b) Showcase rehabilitation as an integral component of cardiovascular care and as economically viable
c) Encourage/call on relevant stakeholders (from policymakers, to regulators as well as health providers and professionals) to improve the lives of those that have suffered a cardiac event or a stroke

1. Introduction

Across the European Union, 49 million people live with the sequels of heart attacks and strokes.[2] Cardiovascular diseases are chronic diseases that can be controlled, but at present, cannot be cured.

Cardiac prevention and rehabilitation services are effective and efficient channels for the delivery of care designed to stabilise, minimise or reverse the progression of the disease and its complications (e.g., heart failure), prevent psychological complications, and aid vocational rehabilitation.[3]

Stroke rehabilitation services help to prevent a recurrent stroke and complications, as vascular dementia, ensure proper management of general health functions, , aid vocational, cognitive and physical rehabilitation, encourage resumption of self-care activities, as well as prevent psychological complications and provide emotional support to the patient and family.

In the future, approaches to both cardiac and stroke rehabilitation programmes will need to be re-designed to consider individual demographical (age, sex/gender, education, ethnicity) and genetic/epigenetic features.

This paper provides an overview of the benefits that rehabilitation programmes offer to patients and society.

[2] *Ibidem.*
[3] Piepoli, M.F., et al. European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts); Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). 2016. Available here.

2. Cardiac and Stroke Rehabilitation

2.1 What is it and who is it for?

Rehabilitation programmes are multi-faceted and multi-disciplinary interventions, which improve functional capacity, recovery and psychological well-being.[4] While cardiac and stroke rehabilitation programmes differ in content and complexity (given the higher likelihood of problems relating to cognition, language, functional loss and multi-morbidity associated with stroke), they share the same objective: allowing patients to get back to a normal life, in so far as possible, and with an optimal quality of life by addressing risk factors and optimising (dosage of) medical therapy.

Cardiac Rehabilitation

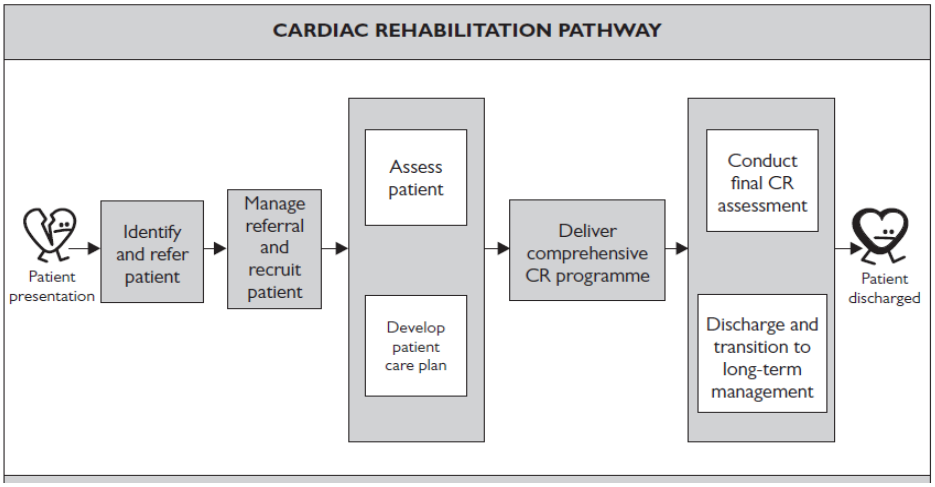
After a cardiac event, patients (see box 1), require counselling to avoid recurrence or worsening of their disease. Cardiac rehabilitation is a structured programme of care to help patients slow the progression of coronary disease through changes in lifestyle[5] and appropriate use of medication[6] to help them have the best quality of life possible and get back to work where appropriate. Traditionally cardiac rehabilitation is divided into phases involving acute management, core rehabilitation and long term management.[7] However, in reality, rehabilitation is an on-going lifelong process that equips patients with the skills to self-manage their condition.

Box 1: ***Eligible patients for cardiac rehabilitation***

- Coronary artery patients (including patients who have undergone revascularisation therapy)
- Patients with chronic heart failure (HF)
- Patients with heart transplant and ventricular assist device
- Patients who have received intra-cardiac defibrillator implants or cardiac resynchronisation therapy
- Patients with heart valve replacement

Source: European Guidelines

Image 1: *Cardiac Rehabilitation (CR) Pathway. Source: British Heart Foundation*



[4] Piepoli, M.F., et al. Secondary prevention through cardiac rehabilitation: from knowledge to implementation. A position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation, European Journal of Cardiovascular Prevention and Rehabilitation 2010, 17:1–17.
[5] Piepoli , M.F et al. Secondary prevention through cardiac rehabilitation: physical activity counselling and exercise training, European Association of Cardiovascular Prevention and Rehabilitation, 2010.
[6] British Heart Foundation, The National Audit of Cardiac Rehabilitation, Annual Statistical Report 2010, 2010.
[7] Zwisler, A.-D.O., et al. Cardiac rehabilitation services in Denmark: Still room for expansion. Scandinavian Journal of Public Health 33: 376-383. 2005.

Stroke Rehabilitation

Rehabilitation programmes are crucial for all patients having survived a stroke; nearly 30% of stroke victims are permanently disabled,[8] and 'lesser' degrees of physical, cognitive and psychological disability can have a major impact on employment and well-being. Effective rehabilitation interventions initiated early after stroke can enhance the recovery process and minimise the impact on activity and participation.[9]

Stroke rehabilitation is the process of overcoming or learning to cope with the effects of the stroke.[10] It is provided when the patient is medically stable, after a specialised stroke unit has assessed his/her condition at the time he/she was on the ward. Every stroke patient should have access to the appropriate levels of specialised short and long-term rehabilitation in hospital and in the community with therapists attached to their primary care team.

Suited to the condition of the patient, stroke rehabilitation programmes may be composed of physiotherapy, occupational therapy, treatments for communication and cognition deficits and depression monitoring.[11]

2.2 What are the benefits?

Rehabilitation services have proven to be effective both for heart and stroke patients. Greater access to rehabilitation reduces disability and long-term institutionalisation, increases independence, quality of life and the likelihood of survival. Pathways to specialist intensive neuro-rehabilitation services are also required for a proportion of people with complex disability needs due to stroke.

Cardiac Rehabilitation

A systematic review of randomised controlled trials of 8 940 patients found that cardiac rehabilitation reduced the risk of dying from coronary heart disease by 26%, increased level of physical activity in 1 patient out of 5 and reduced the number of smokers by 36%.[12] An important aspect of cardiac rehabilitation is identifying and alleviating the anxiety and depression that often accompany heart disease. A small scientific analysis of 104 patients aged 42 to 54 years old following cardiac rehabilitation programmes with specific psychological support has demonstrated a decrease in anxiety (-46%) and depression (-58.5%), and an increase in quality of life (15.8%).[13] And conversely, studies show that stress reduction leads to better cardiac outcomes as it improves treatment and cardiac rehabilitation adherence.[14]

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[8] World Health Organization. Global Burden of Stroke. Part three: the burden. The Atlas of Heart Disease and Stroke, WHO, 2004.
[9] Royal College of Physicians, 2016 National Clinical Guideline for Stroke, UK. Available at: https://www.rcplondon.ac.uk/guidelines-policy/stroke-guidelines.
[10] Northern Ireland Chest Heart and Stroke, Stroke Advice, 2010.
[11] Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008, European Stroke Organisation (ESO).
[12] Taylor, R.S., et al. Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials. 2004. American Journal of Medicine; 116: 628-692. Available at: http://mosaic.info/assets/resource_documents/Taylor_CHD.pdf
[13] Lavie et al. Adverse Psychological and Coronary Risk Profiles in Young Patients With Coronary Artery Disease and Benefits of Formal Cardiac Rehabilitation. 2006. Arch Intern Med. 2006;166:1878-1883.
[14] Chauvet-Geliner, J-C., et al. Stress, anxiety and depression in heart disease patients: A major challenge for cardiac rehabilitation. 2016. Available at: https://www.sciencedirect.com/science/article/pii/S1877065716305073

Stroke Rehabilitation

There is an abundance of data showing the clinical effectiveness of a rehabilitation programme for patients having suffered a stroke, especially when a multi-disciplinary team are involved in person-centred goal acquisition. It can reduce recurrence, improve vital functions[15] and decrease depression.[16,17] Stroke rehabilitation has proven to be effective in reducing death (4% in 6-month case fatality)[18] and time spent in hospitals (length of stays on average 8 days shorter).[19,20]

2.3 Who recommends? Who carries out?

Many national and international guidelines recommend rehabilitation. It has been shown that health-care professionals play a central role in impressing upon their patients the importance of following a rehabilitation programme. Cardiac rehabilitation in many European countries has been traditionally delivered in healthcare or community centres,[21] although alternatives such as home-based or online support are increasingly being considered. [22,23]

Cardiac Rehabilitation

Cardiac rehabilitation is recommended with the highest level of scientific evidence class I by the European Society of Cardiology in the treatment of patients with coronary artery disease (CAD),[24] and after a cardiac event.[25]

From a 2010 survey of 28 European countries, evidence showed that in 16 countries (57%), cardiac rehabilitation programmes were based on national guidelines.[26] It is recommended that cardiac rehabilitation teams should be composed of a cardiologist, specialist cardiac nurse, and

Box 2: *Core components of Cardiac Rehabilitation*

- *Patient assessment with medical control*
- *Physical activity counselling*
- *Prescription of exercise training*
- *Diet/nutrition counselling*
- *Weight-control management*
- *Lipid management*
- *Blood pressure (BP) monitoring and management*
- *Smoking cessation*
- *Vocational support*
- *Psychosocial management*

Source: European Journal of Preventive Cardiology

[15] Langhorne et al. Estimating the impact of stroke unit care in a whole population: an epidemiological study using routine data, J Neurol Neurosurg Psychiatry 2010;81:1301-1305 doi:10.1136/jnnp.2009.195131, 2010.
[16] Ostir GV, et al. Patterns of change in depression after stroke. J Am Geriatr Soc 2011; 59(2):314-320.
[17] Gordon et al, Physical Activity and Exercise Recommendations for Stroke Survivors, 2004, Circulation. 2004; 109: 2031-2041.
[18] Foley et al, The Efficacy of Stroke Rehabilitation, The Evidence-Based Review of Stroke Rehabilitation, August 2011. Available at: www.ebrsr.com.
[19] Langhorne et al, Estimating the impact of stroke unit care in a whole population: an epidemiological study using routine data, J Neurol Neurosurg Psychiatry 2010;81:1301-1305 doi:10.1136/jnnp.2009.195131, 2010.
[20] Langhorne P, et al: Early supported discharge services for stroke patients: a meta-analysis of individual patients' data. Lancet 2005;365:501-506.
[21] Hasnain M., et al. Cardiac Rehabilitation, The British Medical Journal, doi: 10.1136/bmj.h5000 29 September 2015,. Available at: http://www.bmj.com/content/bmj/351/bmj.h5000.full.pdf
[22] Buys, R., et al, Cardiac patients show high interest in technology enabled cardiovascular rehabilitation, 2016, DOI: 10.1186/s12911-016-0329-9, available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4949752/
[23] FP7-StrokeBack project. Modern Stroke Rehabilitation through e-Health-based Entertainment, 2015, available at: http://www.springer.com/gp/book/9783319212920 and https://www.strokeback.eu/
[24] Piepoli et al. Secondary prevention through cardiac rehabilitation: from knowledge to implementation. A position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation, European Journal of Cardiovascular Prevention and Rehabilitation 2010, 17:1–17
[25] European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR), Perk et al, 2012. Available at: https://academic.oup.com/eurheartj/article/33/13/1635/488083
[26] Bjarnason-Wehrens, B., The European Cardiac Rehabilitation Inventory Survey (ECRIS), German Sport University Cologne, on behalf of the European Association of Cardiovascular Prevention and Rehabilitation, 2010.

physiotherapist, exercise specialist, smoking cessation counsellor, occupational therapist, dietician, psychologist, cardiac rehabilitation coordinator, pharmacist, vocational counsellor and social worker.[27] A multi-disciplinary team will deliver on the core services and components of cardiac rehabilitation (see box 2[28]).

Stroke Rehabilitation

Regarding stroke, in its guidelines, the European Stroke Organisation, recommends with scientific evidence class I that acute stroke patients are admitted to a stroke unit to receive coordinated multi-disciplinary rehabilitation.[29] Moreover, a greater awareness on pre-hospital management of stroke both for citizens and health professionals has been recently recommended by the European Academy of Neurology and the European Stroke Organization. For example, calling the emergency medical services immediately after a stroke will reduce the delay between onset and hospital arrival.[30]

Stroke rehabilitation teams are multi-disciplinary and normally consist of stroke physician (geriatrician, neurologist or rehabilitation physician), stroke nurse specialists and nurses with training in stroke care and rehabilitation, physiotherapist, occupational therapist, speech and language therapist, dietician and psychologist[31] (see box[32]).

Box 3: ***Key services of an ischaemic stroke rehabilitation programme***

- *Physiotherapy*
- *Occupational therapy*
- *Speech and language therapy*
- *Stroke liaison and information provider (incl. around sexuality and intimacy)*
- *Prevention of complications (such as depression, shoulder pain, falls, urinary disturbances and aspiration pneumonia)*
- *Input from other therapists depending on the patient (e.g., dieticians, orthoptists and social workers)*

Source: European Stroke Organisation

2.4 What is provided and what is the uptake?

Cardiac Rehabilitation

In a 2010 survey[33] all countries included reported the availability of phase II cardiac rehabilitation, with differences in types and durations of the programmes. In the majority of the countries (64%), both in-patient and out-patient programmes were available. However, according to the 2010 survey, in 15 out of the 28 countries the uptake by eligible patients for core cardiac rehabilitation does not exceed 30%.

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[27] Wood D.A., et al, on behalf of EUROACTION Study Group. Nurse-coordinated multidisciplinary, family-based cardiovascular disease prevention programme (EUROACTION) for patients with coronary heart disease and asymptomatic individuals at high risk of cardiovascular disease: a paired, cluster randomized controlled trial. Lancet. 2008; 371:1999–2012.

[28] Piepoli, M.F., et al. Secondary prevention in the clinical management of patients with cardiovascular diseases. Core components, standards and outcome measures for referral and delivery: A Policy Statement from the Cardiac Rehabilitation Section of the European Association for Cardiovascular Prevention & Rehabilitation. Endorsed by the Committee for Practice Guidelines of the European Society of Cardiology, European Journal of Preventive Cardiology, Vol 21, Issue 6, pp. 664 – 681. Available at: http://journals.sagepub.com/doi/full/10.1177/2047487312449597#articleCitationDownloadContainer.

[29] Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008, the European Stroke Organisation, 2009. Available at http://www.congrex-switzerland.com/fileadmin/files/2013/eso-stroke/pdf/ESO08_Guidelines_Original_english.pdf.

[30] Kobayashi, A. et al., European Academy of Neurology and European Stroke Organization consensus statement and practical guidance for pre-hospital management of stroke. J. Eur J Neurol. 2018 Mar;25(3):425-433.

[31] Northern Ireland Chest Heart and Stroke, Stroke Advice, 2010.

[32] Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008, European Stroke Organisation, 2009. *Ibidem.*

[33] Bjarnason-Wehrens, B., The European Cardiac Rehabilitation Inventory Survey (ECRIS), German Sport University Cologne. 2010. *Ibidem.*

Considering long-term cardiac rehabilitation, figures are less encouraging. Indeed, the same survey indicated that even if 25 countries out of 28 provided for long-term maintenance, the uptake was very low as in 7 countries out of 28, only 10% of patients follow the programmes.[34] Based on information received from EHN members, there may be a trend towards improved uptake; however, inconsistencies in data cannot confirm it.

Stroke Rehabilitation

Despite the severe consequences of stroke, the provision of stroke rehabilitation programmes is still under-developed in many European countries. One national study across the spectrum of care showed deficits in rehabilitation services and staffing in prevention, hospital, community and nursing home sectors.[35,36]

2.5 What is the duration?

Cardiac Rehabilitation

Rehabilitation programmes vary in intensity and duration, depending on the country, as well as in the format in which they are delivered - cardiac rehabilitation programmes are traditionally delivered via healthcare or community centres.[37] These programmes tend to last from three to six months (out-patient) and some European countries have residential programmes of three to four weeks.

Stroke Rehabilitation

Although depending on each case, patients surviving a stroke are likely to need rehabilitation for a minimum of six months (for minor stroke) to one to years or even decades (for severe or massive strokes) to achieve relevant improvements.[38]

2.6 The economics of rehabilitation

In addition to the significant health benefits that rehabilitation programmes bring to patients, there are important economic gains (see box 4[39]).

2.6.1 Cost savings to the public

A direct economic consequence for public finances of absence of rehabilitation is an increase in hospital stays and medication.

Cardiac Rehabilitation

In 2015, coronary heart diseases cost almost €19 billion in direct healthcare costs to the national health systems of the EU Member States.[40] This amount does not include indirect

[34] *Ibidem*.
[35] Horgan F., et al. From prevention to nursing home care: a comprehensive national audit of stroke care. Cerebrovasc Dis. 2011;32(4):385-92.
[36] Bernhardt J., et al. Advances in Stroke 2017. American Heart Association Journal - Stroke. 2018. Available at: http://stroke.ahajournals.org/content/49/5/e174.short
[37] Hasnain M., et al. Cardiac Rehabilitation, The British Medical Journal. 2015. Available at: http://www.bmj.com/content/bmj/351/bmj.h5000.full.pdf
[38] Communication from EHN members
[39] Wilkins, E., et al. European Cardiovascular Disease Statistics 2017 edition. European Heart Network. 2017. *Ibidem*
[40] Wilkins, E., et al. European Cardiovascular Disease Statistics 2017 edition. European Heart Network. 2017. *Ibidem*

costs. Cardiac rehabilitation programmes, if applied efficiently, may reduce these direct costs, especially by reducing re-admissions to hospitals. Rehabilitation programmes may increase the chances of patients getting back to work and have the potential to reduce disability allowances (allowances depend on the country, in Sweden 64% of the former income, in Switzerland 60%).[41]

Stroke Rehabilitation

The majority of stroke costs relate to chronic aspects of the illness.[42] An early and continuing rehabilitation offers an opportunity to make significant savings, as well as a major reduction in personal suffering. Stroke is also a huge and increasing burden to healthcare costs, estimated at over €20 billion in 2015 to the Member States of the EU.[43]

2.6.2 Cost savings to the private sector

The main cost for the private sector is loss of productivity for employers due to sick leave and increased absenteeism.[44] A potential additional cost that may affect the private sector is the lost productivity due to informal care. Indeed, many patients need help from family or friends who may require a more flexible work schedule.

Cardiac Rehabilitation

A study from 2009 showed that heart patients leave the labour market 10 years before people who share a similar lifestyle and socio-economic background.[45] In 2015, productivity loss and informal care cost of coronary heart disease amounted to €41 billion in the EU.[46]

Stroke Rehabilitation

In 2015, productivity loss and informal care cost amounted to over €25 billion in the EU.[47]

Box 4: ***Potential cost savings (considering total cost of disease)***

Source: EHN CVD Statistics 2017

CARDIAC	
Direct healthcare costs	€ 18,875.78
Productivity loss due to mortality	€ 13,783.88
Productivity loss due to morbidity	€ 6,031.16
Informal care costs	€ 20,636.60
STROKE	
Direct healthcare costs	€ 20,058.31
Productivity loss due to mortality	€ 5,440.59
Productivity loss due to morbidity	€ 3,983.87
Informal care costs	€ 15,855.18

2.6.3 Costs savings to the patient

Of course, patients are the ones that suffer the most economically when they can no longer return to work and, therefore, lose their incomes.[48] Further to these economic costs, the loss

[41] Communication from EHN members
[42] Smith S., et al. The cost of stroke and transient ischaemic attack in Ireland: a prevalence-based estimate. 2012. Available at: https://www.ncbi.nlm.nih.gov/pubmed/22134905
[43] Wilkins, E., et al. European Cardiovascular Disease Statistics 2017 edition, European Heart Network; 2017
[44] U.S. Department of Health and Human Services, http://aspe.hhs.gov/health/prevention/index.shtml#CARDIOVASCULAR.
[45] Kruse, M., et al 2009: Short and long-term labour market consequences of coronary heart disease: a register-based follow-up study. European Journal of Cardiovascular Prevention & Rehabilitation; 16 (3), 387-91
[46] Wilkins E, et al. European Cardiovascular Disease Statistics 2017 edition, European Heart Network; 2017.
[47] *Ibidem*.
[48] Cardiac rehabilitation: clinical effectiveness and utilisation in Belgium – Supplement KCE reports 140S Belgian Health Care Knowledge Centre, 2010.

of quality of life as a result of being left with avoidable disability is likely the heaviest burden for patients.

2.7 Cost-effectiveness of rehabilitation

Numerous analyses show that rehabilitation programmes are cost-effective.[49]

Cardiac Rehabilitation

A 2004 study found that, compared to no cardiac rehabilitation, a cardiac rehabilitation programme resulted in an incremental cost-effectiveness ratio of about €9 000 per quality adjusted life year (QALY)[50] (the internationally recognised benchmark is around €38 000 per QALY).

Stroke Rehabilitation

Stroke rehabilitation is also highly cost-effective, with an incremental cost-effectiveness ratio of stroke units care followed by early supported discharge of €12 338 per QALY.[51]

3. Discussion: utilisation of rehabilitation programmes

There is a need to reinforce access to and uptake of quality cardiac and stroke rehabilitation. Adherence is effective in reducing risk of mortality, relapse, decreasing risk factors and other main complications particularly heart failure and vascular dementia, improving quality of life and makes economic sense.

> "There is a massive problem regarding social inequity in rehabilitation that has not yet been effectively addressed. A much more serious focus on systematic referral, differentiated activities and national monitoring of the area is mostly needed to further develop this area."
>
> - *Danish Heart Foundation*

Availability, access to and uptake of rehabilitation programmes are linked to healthcare policies and health (delivery) systems as well as social, psychological, medical and demographic factors.[52]

The last 10 years of cardiac rehabilitation have established that while some patients are attracted to group-based exercise programmes, the majority of eligible patients (two thirds) do not take up this option. As digital solutions evolve, e-cardiology and e-health have the potential to complement access to and facilitate patient participation in rehabilitation programmes across the total eligible population.[53,54]

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[49] Cheuk-Man Yu, et al. A short course of cardiac rehabilitation program is highly cost effective in improving long-term quality of life in patients with recent myocardial infarction or percutaneous coronary intervention, 2004, doi:10.1016/j.apmr.2004.05.010. Saka et al, Cost-Effectiveness of Stroke Unit Care Followed by Early Supported Discharge, 2009, doi: 10.1161/STROKEAHA.108.518043.

[50] Clinical and cost effectiveness of cardiac rehabilitation presented to the group developing the NICE guideline: Secondary prevention in primary and secondary care for patients following a myocardial infarction, Angela Cooper, Royal College of General Practitioners, 2004.

[51] Saka, et al. Cost-Effectiveness of Stroke Unit Care Followed by Early Supported Discharge, 2009, doi: 10.1161/STROKEAHA.108.518043.

[52] Mampuya, W.M., Cardiac rehabilitation past, present and future: an overview, 2012. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3839175/

[53] Buys, R.. et al. Cardiac patients show high interest in technology enabled cardiovascular rehabilitation, 2016, DOI: 10.1186/s12911-016-0329-9, available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4949752/

[54] FP7-StrokeBack project. Modern Stroke Rehabilitation through e-Health-based Entertainment, 2015. *Ibidem*

It is also suggested that collecting data and establishing registries can improve the understanding of challenges and drivers of access and uptake of cardiac rehabilitation programmes.[55]

Cardiac Rehabilitation

Despite the evidence of significant benefits for patients, uptake is not optimal. The majority of the countries surveyed (15 out of 28) reported a patient participation of less than 30%.[56]

Reasons for under-utilisation of cardiac rehabilitation programmes may include low referral rates (approximately 30% in Europe but around 50% in the UK)[57] especially for certain groups such as women, ethnic minorities, elderly, people from lower socio-economic groups as well as people living in rural areas.[58] Other barriers to patient participation or adherence may be related to lack of understanding of the benefits – potentially due to low endorsement by the healthcare professionals, distances to rehabilitation facilities, work inflexibility, sickness and lack of motivation or depression, among others.[59,60]

It is thus extremely important that patients are provided with and informed about the opportunity to follow a cardiac rehabilitation programme. The information should be given by health-care professionals, as referrals from general practitioners, cardiologists, diabetologists or lipidologists are crucial to ensure optimal patient adherence. Health-care professionals must refer their patients to rehabilitation after discharge and they must carefully explain the benefits to their patients so as to encourage them to take part in a cardiac rehabilitation programme.[61]

> "The main achievement in Slovenia is the agreement by all relevant stakeholders that CR is a paramount life-saving intervention. (…) Most importantly, patients emerged as the driving force of such efforts — by expressing the need for, and demanding the formation of, a national CR network, and by emphasizing that CR is a lifelong process requiring empowerment and support."
>
> *– Slovenian Heart Foundation*

Digital solutions, when responding and tailored to the patients' needs, can also support cardiac rehabilitation by promoting the uptake of physical activity,[62] healthy dietary behaviours and smoking cessation in addition to disease management (e.g., reminders to take medication, track of weight evolution and provide psychological support).[63]

Stroke Rehabilitation

There is little data on the participation of patients in stroke rehabilitation programmes, but estimations from various countries indicate an extremely low uptake (an audit in Ireland showed that acute rehabilitation was only available to one in four patients).[64] Moreover, the provision of stroke rehabilitation services is still under-developed in Europe, despite efforts to improve it.

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[55] O'Neil, A. et al. A global perspective of cardiac rehabilitation registries: a systematic review. August 2017. Available at: https://academic.oup.com/eurheartj/article/38/suppl_1/ehx504.P3412/4089915
[56] Bjarnason-Wehrens, B., et al. The European Cardiac Rehabilitation Inventory Survey (ECRIS), German Sport University Cologne. 2010. *Ibidem.*
[57] Personal communication from EHN members
[58] Hasnain M., et al. Cardiac Rehabilitation, The British Medical Journal. 2015. *Ibidem*
[59] *Ibidem*
[60] Mampuya, W. M. Cardiac rehabilitation past, present and future: an overview. 2012. *Ibidem.*
[61] British Heart Foundation. The National Audit of Cardiac Rehabilitation, Annual Statistical Report 2011.
[62] Buys, R., et al, Cardiac patients show high interest in technology enabled cardiovascular, July 2016, available at: rehabilitationhttps://www.ncbi.nlm.nih.gov/pmc/articles/PMC4949752/
[63] HeartMan (EU Funded project). 2018. Available at: http://heartman-project.eu/
[64] The Irish Heart Foundation's National Audit of Stroke Care. 2008. Irish Heart Foundation, Dublin.

Suggestions have been made to move long-term rehabilitation to a community-setting with non-specialist teams once rehabilitation goals have been met. Equally, the role of self-management – potentially prompted by or with the support of digital solutions – could also improve rehabilitation outcomes.[65]

4. Recommendations

Considering the significant benefits that rehabilitation bestows on patients as well as the wider society, every eligible cardiac/stroke patient should be legally entitled to participate in rehabilitation programmes.

In order for patients to be able to benefit from the rehabilitation services in an equitable manner, these should be free of charge. As the cost savings and cost-effectiveness of such services have been demonstrated by several studies, rehabilitation programmes should be seen as an investment rather than an expense.

In order to allow all patients access to and uptake of cardiac and stroke rehabilitation programmes, several steps are necessary:

- Cardiac and stroke rehabilitation programmes must be an integral part of the patient's treatment plan and financed by the national healthcare system/relevant schemes
- Rehabilitation programmes should be accessible for all eligible patients, regardless of gender, age, socio-economic status, ethnicity or their place of living
- Appropriate healthcare professionals should automatically refer their eligible patients to rehabilitation programmes and motivate them to take part in these programmes
- Hospitals and healthcare professionals should adhere to national or European guidelines when implementing rehabilitation programmes
- Quality data collection and national registries, audits on the provision of rehabilitation should be carried out and include the following: an ability to capture and report on the eligible population, uptake, availability, cost-effectiveness, referral to patient groups, components of teams and programmes, and span the spectrum of care provision including hospital, community and nursing homes
- Innovative eHealth solutions aiming at supporting rehabilitation should be investigated further
- Awareness-raising campaigns could be considered to improve understanding of the benefits of rehabilitation programme aiming at: the public, employers, appropriate health-care professionals and patients.

For more information visit the European Heart Network at http://www.ehnheart.org/

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[65] Clarke, D. J. et al. Improving post-stroke recovery: the role of the multidisciplinary health care. September 2015. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590569/