Institution: University of Exeter		
Unit of Assessment: UoA 2 Public Health, Health Services and Primary Care		
Title of case study: Informing policy and expanding access to effective cardiac rehabilitation for people with heart disease		
Period when the underpinning research was undertaken: 2007-2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Professor Rod Taylor	Professor of Health Services Research, Co-Director of Exeter Clinical Trials Unit & NIHR Senior Investigator	2005 to March 2020
Professor Hayes Dalal	Honorary Clinical Associate Professor	2008 to date
Dr Lindsey Anderson	Research Fellow	2007 to 2017
Dr Linda Long	Research Fellow	1999 to 2019
Dr Sarah Walker	Research Fellow	2010 to 2019
Dr Oriana Ciani	Research Fellow	2014 to date
Dr Fiona Warren	Senior Lecturer in Medical Statistics	2010 to date
Period when the claimed impact occurred: 2013 - 2020		
Is this case study continued from a case study submitted in 2014? No		

1. Summary of the impact (indicative maximum 100 words)

Heart disease is the leading cause of death in the UK and worldwide; in the UK each year over 70,000 people survive heart attacks and around 200,000 people are diagnosed with heart failure. Wider access to effective cardiac rehabilitation is therefore a significant priority.

Research by Taylor and Dalal's team has led to **changes in policy and clinical practice nationally and internationally**. Their programme of eleven Cochrane systematic reviews has directly informed national policy (England, Scotland) and nine international clinical guidelines (in the USA and Europe) on the delivery of cardiac rehabilitation services.

Their Rehabilitation Enablement in Chronic Heart Failure (REACH-HF) research and trial developed a programme of home-based cardiac rehabilitation specifically for patients with heart failure and has directly informed the NICE Guideline for management of heart failure (2018). Since 2019, this *BMJ* award-winning care programme has been rolled out in eight 'beacon' NHS organisations in England, N Ireland and Scotland – areas with an estimated 43,000 people living with heart failure. The adoption of home-based cardiac rehabilitation has expanded significantly, and during the Covid pandemic the REACH-HF model of cardiac rehabilitation has been adapted as a digital/electronic intervention with online training, ensuring that this critical new approach was available to any patients needing such care.

2. Underpinning research (indicative maximum 500 words)

Taylor and Dalal's Exeter-led research includes a long-standing programme of secondary research about cardiac rehabilitation (11 Cochrane Heart Group systematic reviews) and two major grants to develop and evaluate a theory-based, home-based, self-management cardiac rehabilitation intervention (REACH-HF) in heart failure patients. This work has incorporated a range of research methods, including systematic reviews, individual participant level meta-analysis, intervention mapping, randomised controlled trials, mixed methods process evaluation, economic modelling, and implementation science. This has been underpinned by six NIHR grants from 2007 to 2019, worth >£3M, which were all led by Taylor and/or Dalal.

2.1 Systematic reviews of cardiac rehabilitation in heart disease

Since 2008, Taylor and his team have led a portfolio of Cochrane systematic reviews/meta-analyses that now includes 11 systematic reviews. Within the health systems of high-income countries and in international clinical professional associations Cochrane systematic reviews are widely regarded as the most rigorous and authoritative sources of evidence on the effectiveness of health care interventions. This portfolio has demonstrated that exercise-based cardiac rehabilitation (CR) can substantively reduce the burden of heart disease and reduce the downstream costs of care for health systems **[3.1; 3.2]**.

These systematic reviews have concluded that for a variety of heart disease populations (including after myocardial infarction, after revascularisation, heart failure, atrial fibrillation, and post valve surgery) CR can result in important gains in patients' health-related quality of life, reduce their risk of hospital admission, and therefore reduce health care costs **[3.1; 3.2]**.

2.2 Cardiac rehabilitation for heart failure

Despite current national guideline recommendations, many heart failure patients who could benefit from CR do not receive it. Typically, less than 10% of patients with heart failure in UK, Europe and US have been offered CR (National Audit of Cardiac Rehabilitation data). Lack of resources and commissioning were seen as major barriers to offering traditional hospital-based CR to all eligible patients. The REACH-HF programme of studies, co-led by Taylor and Dalal, has developed and evaluated the outcome and costs of a home-based rehabilitation alternative to centre-based CR. The intervention was developed following systematic reviews of the literature, including qualitative synthesis of the experiences, attitudes, beliefs, and expectations of self-management of heart failure and Cochrane reviews and meta-analysis of cardiac rehabilitation in people with heart failure.

As a result, a home-based CR intervention was developed for heart failure patients and their carers, facilitated by a healthcare professional – 'the REACH-HF intervention'. This was assessed in a multicentre randomised controlled trial of the clinical and cost-effectiveness of the CR intervention in heart failure patients **[3.3]**.

The trial showed that the REACH-HF intervention improved health-related quality of life at 12 months and offers a cost-effective alternative to traditional centre-based CR. Delivering REACH-HF costs 12% less than the NHS reimbursement cost for centre-based CR **[3.3]**. Cost-effectiveness modelling also showed that the REACH-HF intervention is cost-effective use of NHS expenditure (according to current cost-effectiveness criteria applied by NICE **[3.4]**).

2.3 Other related research

The NIHR Health Technology Assessment programme funded an individual patient data meta-analysis to determine the effectiveness of exercise-based cardiac rehabilitation in subgroups of heart failure patients – 'ExTraMATCH II' project. This research confirmed the results of trial level meta-analyses, that CR results in an improvement in health-related quality of life of heart failure patients. In addition, this research showed that the effects of these benefits appear to be consistent across patients with different characteristics **[3.5; 3.6]**.

3. References to the research (Exeter authors in **bold text**)

3.1. **Anderson L**, Sharp GA, Norton RJ, Dalal H, **Dean SG**, Jolly K, Cowie A, Zawada A, **Taylor RS**. Home-based versus centre-based cardiac rehabilitation. *Cochrane Database Syst Rev.* 2017 Jun 30;6:CD007130. DOI: 10.1002/14651858.CD007130.pub4.

3.2. **Long L**, Mordi IR, Bridges C, Sagar VA, Davies EJ, Coats AJS, **Dalal H**, Rees K, Singh SJ, **Taylor RS**. Exercise-Based Cardiac Rehabilitation for adults with Heart Failure: *Cochrane Database Syst Rev.* 2019, Issue 1. Art. No.: CD003331. https://doi.org/10.1002/14651858.CD003331.pub5

3.3. **Dalal HM, Taylor RS,** Jolly K, Davis RC, Doherty P, Miles J, van Lingen R, **Warren FC, Green C,** Wingham J, Greaves C, **Sadler S,** Hillsdon M, **Abraham C, Britten N,**

Frost J, Singh S, Hayward C, Eyre V, Paul K, Lang CC, Smith K. The effects and costs of home-based rehabilitation for heart failure with reduced ejection fraction: The REACH-HF multicentre randomized controlled trial. *Eur J Prev Cardiol*. 2019, 26(3):262-272 10:2047487318806358. DOI: 10.1177/2047487318806358.

3.4. **Taylor RS, Sadler S, Dalal MH, Warren FC**, Jolly K, Davis RC, Doherty P, Miles J, Greaves C, Wingham J, **Hillsdon M, Abraham C, Frost J**, Singh S, Hayward C, Eyre V, Paul K, Lang CC, Smith K. The cost effectiveness of REACH-HF and home-based cardiac rehabilitation in the treatment of heart failure with reduced ejection fraction: a decision model-based analysis. *Eur J Prev Cardiol*. 2019, 26(12):1252-1261. DOI: 10.1177/2047487319833507

3.5. **Taylor RS, Walker S,** Smart NA, Piepoli MF, **Warren FC, Ciani O**, O'Connor C, Whellan D, Keteyian SJ, Coats A, Davos CH, Dalal HM, Dracup K, Evangelista L, Jolly K, Myers J, McKelvie RS, Nilsson BB, Passino C, Witham MD, Yeh GY, Zwisler AO; ExTraMATCH II Collaboration. Impact of exercise-based cardiac rehabilitation in patients with heart failure (ExTraMATCH II) on mortality and hospitalisation: an individual patient data meta-analysis of randomised trials. *Eur J Heart Failure*. 2018 Dec;20(12):1735-1743. DOI: 10.1002/ejhf.1311

3.6. **Taylor RS, Walker S,** Smart NA, Piepoli MF, **Warren FC, Ciani O**, Whellan D, O'Connor C, Keteyian SJ, Coats A, Davos CH, Dalal HM, Dracup K, Evangelista LS, Jolly K, Myers J, Nilsson BB, Passino C, Witham MD, Yeh GY; ExTraMATCH II Collaboration. Impact of exercise rehabilitation on exercise capacity and quality-of-life in heart failure: Individual participant meta-analysis. *J Am Coll Cardiol*. 2019;73:1430-1443. DOI: 10.1016/j.jacc.2018.12.072

4. Details of the impact (indicative maximum 750 words)

4.1 Informing clinical guidelines in the UK (NHS)

Heart disease:

The suite of eleven Exeter-led Cochrane reviews, published and updated since 2009, have directly informed the recommendations of the following UK clinical guidelines on the provision of rehabilitation for heart disease patients **[5.1]**. NICE clinical guidelines, while not mandatory, are effectively national policy on clinical best practice in the NHS in England and are typically also adopted in Wales and Scotland. The evidence base cited in NICE CG172 [*Myocardial infarction: cardiac rehabilitation and prevention of further cardiovascular disease,* November 2013] recommendations state that "All patients (regardless of their age) should be given advice about and offered a CR programme with an exercise component" and "Offer cardiac rehabilitation programmes in a choice of venues (including at the person's home, in hospital and in the community)" **[5.2]**.

Heart failure:

More recently, the NICE Heart Failure guidelines (CG108) were updated and replaced by NG106 Chronic heart failure in adults: diagnosis and management (September 2018) **[5.3]**. The latest update of the Cochrane review of home- vs centre-based CR **[3.1]** was used by the guideline committee (in January 2017, before its publication by Cochrane) to inform its guideline update **[5.4]**. This in turn has informed the NICE Quality Standards in relation to CR, specifically that adults with chronic heart failure are offered "the choice of undertaking the programme at home, in the community or in a hospital setting" and based on the stated rationale that "people with chronic heart failure are typically older and may be frail or have comorbidities. This can make it difficult for them to attend group-based programmes at hospitals or clinics." **[5.5]**

4.2 Informing international clinical guidelines

The collection of Exeter-led Cochrane reviews by Taylor's team have also been directly cited in support of nine non-UK clinical or policy guidelines, covering the USA (incl. American Heart

Association, American Association of Cardiovascular and Pulmonary Rehabilitation, American College of Cardiology – 3 guidelines) and Europe (European Society of Cardiology - 6)**[5.1]**.

Exeter-led reviews formed the core publications in informing the recently published *European Society of Cardiology*'s 2020 'Position paper' on 'Secondary prevention through comprehensive cardiovascular rehabilitation' **[5.6]**. This paper provides a comprehensive update of 'the practical recommendations on the core components and goals of cardiac rehabilitation intervention in different cardiovascular conditions. It cites five of the Cochrane systematic reviews produced by Taylor's team at Exeter (including **[3.1; 3.2]**), and the findings of the ExTraMATCH II Collaboration's individual patient data meta-analysis **[3.6]** as evidence of the benefits for long-term improvements in prognosis and quality of life.

Exeter research by Taylor and Dalal has also directly informed the *European Society of Cardiology*'s international guideline on '*sports cardiology and exercise in patients with cardiovascular disease*' published in 2020 **[5.7]**. The guidance and recommendations cite seven Exeter research publications by Taylor and Dalal, including four of their Cochrane systematic reviews **[5.1]**.

4.3 Expansion of home-based cardiac rehabilitation for heart failure in the UK

The first stage of the roll-out of the Exeter-developed REACH-HF model of cardiac rehabilitation began in April 2019 with the implementation of the REACH-HF intervention in four 'Beacon' sites in England/N Ireland, following a national competitive process for applications. The four NHS hospitals/trusts piloting and providing the REACH-HF model of CR for their heart failure patients, are: Gloucester, UCL Hospital London, the Wirral, and Belfast. The primary purposes of the Beacon sites are: (a) to provide a foundational infrastructure and learning to stimulate other sites across the NHS to take up REACH-HF and overcome the current NHS national shortfall of the provision of rehabilitation for heart failure (as highlighted in the 2018 NICE guidance on heart failure and the 2019 *NHS Long Term Plan*); (b) to collect routine data (*National Audit for Cardiac Rehabilitation* (NACR) – part of NHS Digital) on heart failure patients at each site, so we can assure that similar improvements in health outcomes in the 'real world' setting are achieved as seen in our RCTs.**[5.8]**

In parallel with this, we have been working with stakeholders and the *National Association of Cardiac Rehabilitation* on more general roll-out of REACH-HF cardiac rehabilitation across the NHS, so that it can become available to all heart failure patients **[5.9]**. In Spring 2020, four further sites (Health Boards) in Scotland started implementing the REACH-HF model of cardiac rehabilitation for their existing and newly diagnosed heart failure patients. The Scottish Health Boards involved include urban (Forth Valley), rural (Lanarkshire, Ayrshire and Arran) and remote populations (Inverness, Shetland, Orkney).

The eight Beacon sites in England/Northern Ireland (since April 2019) and Scotland cover a population of 2.7 million people and an estimated 43,000 people living with heart failure. However, due to the COVID pandemic, by the end of November 2020 only 158 people had received the complete REACH-HF rehabilitation intervention at the England/NI sites (National Audit of Cardiac Rehabilitation data). Nevertheless, NACR data also show that from 2019 (May-Jan) to 2020 (Feb-Aug) the proportion of patients enrolling in home-based CR had increased substantially from 22% to 74%. The Wirral Cardiovascular Prevention and Rehabilitation Programme has integrated home-based rehabilitation for patients with heart failure (REACH-HF) through new delivery methods, both prior to and during the COVID-19 pandemic, and has been added to NICE's *Shared learning database* of implementation examples (linked to NG106, NG185 and QS9 NICE guidelines and standards **[5.2]**,**[5.3]**,**[5.5]**).

In March 2020, Dalal was awarded a further £159,000 from the *British Heart Foundation* to further expand the development and implementation of the REACH-HF model of rehabilitation as a digital/electronic intervention with online training for care professionals. Between May and December 2020, 102 health care professionals (cardiac nurses, physio/exercise therapists) from over 50 NHS centres have received the REACH-HF online training. Each was also given at least 10 REACH-HF intervention packs to support over 1000 vulnerable heart failure patients affected by restricted access to cardiac rehab during the pandemic.

Together, these achievements have led to the REACH-HF Collaboration receiving the *2020 BMJ Award* for Stroke and Cardiovascular care **[5.10]**.

In summary, for over a decade, an extensive programme of research encompassing systematic reviews and meta-analyses, feasibility studies and randomised trials of cardiac rehabilitation interventions in heart disease, have directly informed national policy (e.g. NICE & SIGN Guidelines) and international clinical guidelines in Europe and North America. The provision of home-based cardiac rehabilitation has expanded, and the REACH-HF model of home-based cardiac rehabilitation for heart failure has been shown to be feasible, effective and cost-effective in NHS contexts, and is also being rolled out in a growing number of areas around the UK.

5. Sources to corroborate the impact (indicative maximum of 10 references)

5.1. Table of 4 national and 9 international clinical guidelines, and how Exeter-led Cochrane Review evidence informed them. Shows which specific recommendations in each piece of published guidance cited each Exeter Cochrane systematic review or other research publication.

5.2. NICE Clinical Guideline [CG172]. Myocardial infarction: cardiac rehabilitation and prevention of further cardiovascular disease. Published 13 November 2013. URL: https://www.nice.org.uk/guidance/cg172/evidence In Appendix G Clinical Evidence Tables, including the RCT by Dalal and Taylor. Now incorporated in evidence folders for NG185 (2020): https://www.nice.org.uk/guidance/ng185/evidence

5.3. NICE Guideline [NG106]. Chronic heart failure in adults: diagnosis and management. Published 12 September 2018. URL: https://www.nice.org.uk/guidance/ng106

5.4. Letter from the Chief Operating Officer of the National Guideline Centre.

5.5. Quality statement 7; NICE Quality Standard [QS9]: *Chronic Heart Failure in Adults*, Updated 12 Sept 2018. https://www.nice.org.uk/guidance/qs9/chapter/Quality-statement-7-developmental-Options-for-cardiac-rehabilitation

5.6. Ambrosetti M, Abreu A, Corra U, et al. Secondary prevention through comprehensive cardiovascular rehabilitation: From knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. *European Journal of Preventive Cardiology*, 2020. https://doi.org/10.1177/2047487320913379

5.7. The Task Force on sports cardiology and exercise in patients with cardiovascular disease of the European Society of Cardiology (Pelliccia et al 2020). *Eur Heart Journal* 2020. doi: 10.1093/eurheartj/ehaa605

5.8. National Audit of Cardiac Rehabilitation data from the England/N Ireland NHS Beacon sites project [to Qtr 4 2020 ***NB COVID-impacted***]

5.9. Letter from NIHR PGfAR, supporting the REACH-HF four NHS Beacon sites (England) proposal extension/implementation project.

5.10. *2020 BMJ Awards*: Stroke and Cardiovascular Award; in recognition of "the extraordinary and innovative work of healthcare teams across the UK" and "collaborations to improve services in a wide range of settings across the NHS and healthcare" http://thebmjawards.bmj.com/showcase/