Title Page

1. Making an Evidence-based Business Case for Cardiac Rehabilitation
2. Gore L, and Doherty PJ
3. Louise Gore. Northern Lincolnshire and Goole NHS Foundation Trust, Cardiac Rehabilitation, Scunthorpe General Hospital, Cliff Gardens, Scunthorpe, North Lincolnshire, DN15 7BH.

Prof Patrick Doherty. Department of Health Sciences, Seebohm Rowntree Building, University of York, YO10 5DD.

1. Cardiac Specialist Nurse

Chair in Cardiovascular Health

1. Louise Gore. Northern Lincolnshire and Goole NHS Foundation Trust, Cardiac Rehabilitation, Scunthorpe General Hospital, Cliff Gardens, Scunthorpe, North Lincolnshire, DN15 7BH. louise.gore1@nhs.net 03033 302895
2. 30 day; readmission; cardiac rehabilitation.

Abstract

Background

Cardiovascular disease and its management, is associated with a sizeable burden, on the NHS and UK economy each year. In addition to reducing mortality and improving quality of life cardiac rehabilitation is effective at reducing unplanned readmissions.

Purpose

This study was undertaken to ascertain if the national Cardiac Rehabilitation (CR) cost model, promoted by the Department of Health, promoting the benefits achieved through reduced unplanned readmissions could be replicated in a real NHS setting using local data.

Methodology

Patient data was retrospectively analysed for thirty-day unplanned readmissions within specific cardiac diagnosis and treatment codes. National audit data was reviewed to ascertain local uptake of CR and local databases used to ascertain the individual cost of providing CR and the cost per unplanned readmission. The CR readmissions costs were applied in the context of NHS England’s ambition of 65% and 33% uptake in conventional cardiac patients and those with heart failure respectively.

Results

The Department of Health model applied in the local context conventional CR patients shows a potential saving, after taking into consideration the cost incurred in delivering a CR programme to conventional cardiac patients at 65% uptake this would lead to a saving of over £26,000. The equivalent model applied to 33% of eligible heart failure patients yields a potential benefit of over £19,000.

Conclusion

A cost saving readmissions approach, based on the Department of Health model, has been applied locally and could, if implemented, yield significant savings if CR programmes uptake was delivered at the recommended levels.

Introduction

Despite improvements in mortality rates, cardiovascular disease (CVD) continues to be a leading cause of death, with more than 1 in 4 deaths in the United Kingdom (UK) (Cardiovascular Disease Statistics 2015).

Treatments have progressed to prevent and slow the effects of CVD, but despite these advancements CVD continues to place a significant health burden on the UK, it also confers an economic burden through the costs of treating and supporting individuals (Cardiovascular Disease Statistics 2015). One of the challenges arising from the success in managing CVD is the increase in the number of older patients with more complex, often multi-morbid conditions.

Admission rates, generally, are estimated to rise by over 50% in the next 25 years, which will clearly impact on NHS budgets. For example it is suggested that Heart Failure (HF), with a prevalence of approximately 900,000 people in the UK, is responsible for approximately 5% of medical admissions, with the readmission rate within three month of discharge estimated, by the Health and Social Care Information Centre, to be as high as 50% (Sutherland 2010). Clinical practice and research has shown that the extent of readmissions across all major cardiac conditions is a sizeable burden to the National Health Service (Anderson 2016,Taylor 2014, CVD\_OS 2013).

Cardiac rehabilitation (CR) is a clinically effective and cost effective comprehensive intervention including supervised exercise, education and psychosocial support for patients following myocardial infarction and those with HF (Anderson et al 2016, NICE CG172 2013, NICE CG 108 2010, Fidan at al 2007). CR supports and encourages health related behavioural change and is proven to improve quality of life and reduce unplanned hospital readmissions (Anderson et al 2016, Taylor 2014).

National Institute for Health and Clinical Excellence clinical guidelines for myocardial infarction (NICE CG 172 2013) and Chronic Heart Failure (NICE CG 108 2010), recommend that rehabilitation programmes should offer a supervised exercise-based group rehabilitation to all eligible patients.

Based on figures from the National Audit for Cardiac Rehabilitation (NACR 2016) the mean uptake to CR is 50%, although NACR have seen a marked increase in the number of programmes offering cardiac rehabilitation to HF patients fewer than 5% of patients registered on the national audit have a primary diagnosis of HF which falls short of the ambition set out in the NHS England CVD Outcomes Strategy (CVD\_OS 2013) of 65% for CVD and 33% for HF.

A systematic review by Taylor et al (2014) found significant reductions in hospital admissions for all causes (RR 0.75; 95%CI 0.62 to 0.92; P value = 0.005) and for HF-specific admissions (RR0.61; 95% CI 0.46 to 0.80; P value = 0.002). Significant findings were also found through improvement in health related quality of life following exercise training. The review found no evidence to suggest that taking part in an exercise training programme would cause any harm to patients. The impact of CR on readmissions is not new as it has been evidenced in other cardiac patients. Anderson et al (2016) found that CR reduced hospital admissions [RR 0.69 (95% CI 0.51, 0.93)] in the shorter term (<12 months follow-up) in those who had MI, coronary artery bypass graft, percutaneous transluminal coronary angioplasty or angina pectoris.

The CVD Outcomes Strategy (CVD\_OS 2013) acknowledges the huge improvements that have been made in the prevention and treatment of CVD in the last decade; however, despite these improvements, when compared with other countries England could do better in reducing unplanned readmissions and quality of life for patients. In 2013 the NHS published ‘Making the case for Cardiac Rehabilitation’ (Kaiser et al 2013) which proposed a model to assess the potential impact of CR on readmissions at a national level. This approach has been used to support the case nationally but has not been validated in a local setting.

Aims

The study set out to evaluate if the national findings of the cost saving approach for CR could be replicated in the local real-world NHS setting. This was achieved through; testing the feasibility of the DH readmissions business case in a local hospital.

Research Design

This research used a systematic and robust retrospective analysis of routinely collected data to implement the DH model and evaluate the impact of CR, delivered at the recommended uptake levels in a local hospital, on readmissions.

The study is the first to test the statistical approach and model proposed in a paper entitled ‘Making the case for Cardiac Rehabilitation’ (Kaiser et al 2013) and endorsed by the NHS England CVD Outcomes Strategy where they used readmission data across primary care trusts and imputed expected or typical gains to quantify the impact of CR.

Methodology

The study collected local audit data, from which the analysis was undertaken; the data was interpreted for the local service.

Study population

The study population was established using a list of specific ‘in scope’ cardiac diagnoses and treatment codes, denoting eligibility for CR. These codes were initially derived from the Department of Health Commissioning Pack for Cardiac rehabilitation (DHCP) (DH 2010) and were used in the analysis of ‘Making the case for Cardiac rehabilitation’ (Kaiser et al 2013).

For the purpose of this analysis, a ‘readmission’ is defined as any emergency admission with a cardiac cause in the 12 month period of 2016/17. Readmissions were considered within 30 days of discharge of the initiating event which is a period that reflects current financial incentives through Payment by Results system.

Data from the sample group remained anonymous.

Data collection

Patient activity was obtained via the local Business Support and Benchmarking Manager, and passed onto the researchers with no patient identifiers. This service exists as a routine part of NHS practice.

The number and percentage uptake for CR was determined locally using the NACR tool. This is used locally and keeps an accurate and up-to-date record of all patients that access the local CR service. This information was collected by the Data Input Clerk and no patient identifiers were passed onto the researchers.

Cost model

The Department of Health’s Cardiac Rehabilitation Commissioning Pack (DHCP) (2010) and Making the case for Cardiac Rehabilitation (Kaiser et al 2013) indicate the average weighted cost of an unplanned cardiac readmission as £3,637. This figure was multiplied by the number of readmissions, giving an indication as to the cost at a local level. The NICE Cardiac Rehabilitation Commissioning Guide (CMG40 2011) indicates the cost of delivering a high quality CR service is £477 per patient. A calculation was undertaken to establish an understanding of the cost in providing a comprehensive CR service to 65% of eligible patients locally.

Ethical and research governance approval was obtained through the local Research and Development Department.

Results

Data was collected on the specific ‘in scope’ cardiac diagnosis and treatment codes and analysis of all the treatment codes was made. The total number of unplanned cardiac readmissions to one of the three hospitals within the authors local Trust, which occurred within the 12 month period of 2016/17, was sixty one. As the DHCP (2010) states the average cost of a cardiac readmission is £3,637, therefore the cost that these unplanned thirty day readmissions cost the Trust was £221,857 in the 12 month period.

In-scope included Myocardial Infarction; Primary Percutaneous Coronary Intervention; Percutaneous Coronary Intervention, Coronary Artery Bypass Graft and heart failure. As uptake of CR for Myocardial Infarction; Primary Percutaneous Coronary Intervention; Percutaneous Coronary Intervention, Coronary Artery Bypass Graft patients is below the achievable ambition of 65% set out in the CVD Strategy (2013) at only 29%, there is unused capacity in the service meaning increasing the uptake to 65%, as set out in the CVD Strategy, would not result in an increased cost to the Trust. However, if 65% of eligible patients were to take part in CR, a potential reduction of 30% in unplanned readmissions could be made (Kaiser 2013 and Taylor 2014), meaning the Trust could potentially save £26,186.

Currently there is limited provision of CR for those who have been diagnosed and treated with HF meaning in 2016/17 30 day readmissions for heart failure cost the Trust £134,569. If the Trust were to successfully achieve the CVD strategy ambition, and provide CR to 33% of HF patients, the trust would need to spend £32,579. However, if the trust were successful in achieving this ambition, there would be a potential reduction in unplanned HF specific admissions by 39% (RR 0.61; 95% CI 0.46 to 0.80; P value= 0.002) (Taylor et al 2014), this reduction in unplanned readmissions could save the trust £19,793.

Overall the cost saving to the Trust if the above ambitions were to be successful could potentially be £45,979 (£26,186 for CR and £19,793 for HF).

|  |  |  |  |
| --- | --- | --- | --- |
| Readmission cost HF (2016/17) | £134,569 | Saving for HF at 39% reduction | £52,372 |
| Readmission cost CR (2016/17) | £87,288 | Saving for CR at 30% reduction | £26,186 |
|  |  | Cost to provide CR | No extra cost to the trust as uptake only 29% |
|  |  | Cost to provide CR for HF | £32,579 |
| Current cost to Trust | £221,857 | Potential Saving | £45,979 |

Discussion

Cardiac Rehabilitation programmes are widely recognised as providing beneficial gains for patients and evidence is emerging for better healthcare utilisation following CR (Fidan at al 2007, Anderson et al 2016, Taylor et al 2014). Our results show CR has the potential, through reduced readmissions, to be cost neutral or potentially cost saving. Meshgin’s study (2008) show that conventional CR patients who attended a CR programme were readmitted less often and spent less time in hospital. This is supported by recent systematic reviews and meta-analysis by Taylor et al (2014) and Anderson et al (2016) suggesting that delivery of a comprehensive CR programme, as part of continuity of care, can reduce readmissions by 28-56%.

Along with the evidence to suggest that 30-day hospital readmissions are associated with a higher risk of mortality (Khawaja et al 2012), readmissions occur frequently, are expensive, and vary throughout hospitals (Hernandez and Granger 2012).

The results from this study show that by re-designing the existing CR service, to increase the uptake from 34 to 65% not only would the patients benefit from an improved quality of life and a reduction in unplanned readmissions in relation to their initial event, but the local Trust could benefit from a potential overall financial saving of £45,979. These results are supportive of the results set out in the document ‘Making the case for Cardiac Rehabilitation’ (Kaiser et al 2013).

Despite the significant benefits that taking part in a CR programme brings (Taylor et al 2014 and Anderson et al 2016) and the national guidelines and quality standards (NICE CG172 2013; NICE CG94 2010 and NICE QS9 2011) which recommend CR for specific cardiac conditions and treatments, it remains a chronically underutilised resource (NACR 2016).

NICE CG108 (2010) and Taylor et al (2014) make recommendations that CR programmes should be offered to patients diagnosed and treated for HF, along with The CVD outcomes strategy (2013) stating an ambition to increase the provision of CR. For the service in this case study HF patients are offered a service comprising discharge instructions; patient education; monitoring of symptoms and up-titrating medications. Although Basoor et al (2012) suggest that this type of support does in fact reduce readmission rates, it still falls short of the NICE CG108 (2010) recommendations for patients to be offered structured CR. Considering the above recommendations, the benefits CR has for patients with HF and the potential cost saving for the Trust, this is an ideal opportunity for CR to be implemented locally as part of a cost saving initiative.

Limitations

This study analysed data retrospectively that had been collected for other purposes, and could be suggested that this information may not have been collected in a rigorous manner in the first instance. This variation in purpose can introduce potential confounders that may impact on the analysis (Parahoo 2006, Mann 2003).

The model applied in this study used national tariff figures to determine the cost of delivering CR to the desired level which may not truly reflect local costs.

Conclusion

The findings from this study indicate the potential cost saving that a local hospital trust could make through reduced unplanned readmissions, if the current CR service were to be re-designed, to increase uptake from 34 to 65%. The DHCP for CR appears fit for purpose in a local context. When placed alongside the CR post discharge readmissions tariff, which states that these savings should be reinvested in the services that bought about the savings, it appears that CR programmes represent a substantial part of cardiology business case.

Recommendations

Given the pressure on all services to treat more patients with no extra investment it makes sense to utilise the DHCP readmissions saving model to try and develop a strong business case for your local CR programmes.

References:

1. Anderson L, Oldridge N, Thompson D, et al (2016) Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease Cochrane Systematic Review and Meta-Analysis. Journal of The American College of Cardiology. Vol. 67, No. 1, 2016 Jan: 1-12.
2. Basoor A, Cotant J, Patel K, Choksi N, Halabi, A, & DeGregorio M. (2012) Decreased readmissions and improved quality of care with use of inexpensive checklist in heart failure free. Journal of American College of Cardiology. <http://onlinelibrary.wiley.com/doi/10.1111/chf.12031/full>. Accessed 23.06.2017.
3. British Heart Foundation (2015) Cardiovascular Disease Statistics.<https://www.bhf.org.uk/publications/statistics/cvd-stats-2015>. Accessed 19.06.2017.
4. Department of Health (2010) Cardiac Rehabilitation Commissioning Pack. [http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/Browsable/DH\_117504](http://webarchive.nationalarchives.gov.uk/20130107105354/http%3A//www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/Browsable/DH_117504) Accessed 28.06.2017.
5. Department of Health (2013) Cardiovascular Disease Outcomes Strategy Improving outcomes for people with or at risk from cardiovascular disease. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/214895/9387-2900853-CVD-Outcomes_web1.pdf> Accessed 19.06.2017.
6. Fidan D, Unal B, Critchley J, Capewell S. (2007) Economic analysis of treatments reducing coronary heart disease mortality in England and Wales, 2000–2010. QJM. <http://qjmed.oxfordjournals.org/content/100/5/277.long> Accessed 23.06.2017.
7. Hernandez AF, Granger CB. (2012) Prediction is Very Hard, Especially About The Future. Can We Prevent Events That Lead to Readmissions Following Percutaneous Coronary Intervention? Archives of Internal Medicine. 172(2): 117-119.
8. Kaiser M, Varvel M, Doherty P. (2013) Making the case for cardiac rehabilitation: modelling potential impact on readmissions. [http://webarchive.nationalarchives.gov.uk/20130221101407/http://www.improvement.nhs.uk/documents/Case\_for\_CR.pdf](http://webarchive.nationalarchives.gov.uk/20130221101407/http%3A/www.improvement.nhs.uk/documents/Case_for_CR.pdf) Accessed 20.06.2017.
9. Khawaja FJ, Shah ND, Lennon RJ, et al. (2012) Factors Associated With 30-Day Readmission Rates After Percutaneous Coronary Intervention. Archives of Internal Medicine.172(2): 112-117.
10. Mann C.J. (2003) Observational research methods. Research design II: cohort, cross sectional, and case-control studies. Emergency Medical Journal,20: 54-60.
11. Meshgin N and Canyon, S. (2008) Cardiac rehabilitation: reducing hospital readmissions through community based programs. Australian Family Physician, Vol. 37, No. 7, 2008 Jul: 575-7.
12. National Audit of Cardiac Rehabilitation (NACR). Annual Statistical Report. British Heart Foundation, 2016. <https://www.bhf.org.uk/publications/statistics/national-audit-of-cardiac-rehabilitation-annual-statistical-report-2016>. Accessed 03.07.2017.
13. National Institute for Health and Care Excellence (2013) Myocardial Infarction: cardiac rehabilitation and prevention of further cardiovascular disease.NICE clinical guideline CG172. <http://guidance.nice.org.uk/cg172> Accessed 26.06.2017.
14. National Institute for Health and Care Excellence (2010) Chronic Heart Failure in adults: management.NICE clinical guideline CG108. <http://www.nice.org.uk/CG108> Accessed 26.06.2017.
15. National Institute for Health and Care Excellence (2010) Unstable angina and NSTEMI: early management.NICE clinical guideline CG94. <http://publications.nice.org.uk/unstable-angina-and-nstemi-cg94> Accessed 26.06.2017.
16. National Institute for Health and Care Excellence (2011) Chronic heart failure in adults. NICE quality standard QS9. [http://publications.nice.org.uk/chronic-heart-failure-quality-standard-qs9 Accessed 26.06.2017](http://publications.nice.org.uk/chronic-heart-failure-quality-standard-qs9%20Accessed%2026.06.2017).
17. National Institute for Health and Care Excellence (2011) Commissioning guides Cardiac Rehabilitation Service. NICE clinical guideline CMG40 cited in Kaiser M, Varvel M, Doherty P. (2013) Making the case for cardiac rehabilitation: modelling potential impact on readmissions. [http://webarchive.nationalarchives.gov.uk/20130221101407/http://www.improvement.nhs.uk/documents/Case\_for\_CR.pdf](http://webarchive.nationalarchives.gov.uk/20130221101407/http%3A/www.improvement.nhs.uk/documents/Case_for_CR.pdf) Accessed 20.06.2017.
18. Parahoo K. (2006) Nursing Research Principles, Process and Issues**.** 2nd Edition. Palgrave Macmillan.
19. Sutherland K. (2010) Bridging the quality gap: heart failure. The Health Foundation.London. <http://www.health.org.uk/sites/health/files/BridgingTheQualityGapHeartFailure_0.pdf>. Accessed 28.06.2017.
20. Taylor RS, Sagar VA, Davies EJ, Briscoe S, et al (2014) Exercise-based rehabilitation for heart failure (review). The Cochrane Collaboration 2014. <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003331.pub4/pdf/standard> Accessed 20.06.2017.