

Effects of cardiac rehabilitation referral strategies on referral and enrollment rates

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Abstract

Despite recommendations in clinical practice guidelines, evidence suggests cardiac rehabilitation (CR) utilization following indicated cardiac events is 15–20%. Referral strategies such as automatic referral have been advocated to improve CR utilization. This Review evaluated the effects of referral strategies on CR referral and enrollment. Referral strategies were categorized as ‘automatic’ based on use of electronic health records or systematic discharge order sets, as ‘liaison’ based on discussions with allied healthcare providers, or ‘other’. The highest rates of CR referral were achieved in studies implementing automatic referral orders, where referral reached 85%. The highest rates of CR enrollment were achieved with a combination of automatic and liaison methods (78% and 86%). Although there were some null findings, overall results suggest that innovative referral strategies significantly increase CR utilization. Automatic referral methods, such as the ‘Get With the Guidelines’ initiative, show promise for improving referral rates. The additional incorporation of a CR discussion resulted in enrollment rates that are double the rates seen after usual referral. While further investigation is needed, institutions should evaluate their CR referral practice in light of these findings.

Introduction

Coronary artery disease (CAD) is the leading cause of morbidity and mortality globally, and is associated with high health-care costs.{{4241 The World Health Organization (WHO)}} CAD onset and progression can be chiefly attributed to modifiable cardiac risk factors.{{188 Yusuf, S. 2004;4401 Williams, M.A. 1996;}} Secondary prevention measures, such as cardiac rehabilitation (CR), can effectively reduce this burden of risk factors, morbidity and mortality.{{305 Brown, A. 2003; 4242 Stone, J.A. 2001}} For instance, a Cochrane review demonstrated that when compared to no CR, participants can achieve 36% greater rates of smoking cessation, improved lipid profile and blood pressure reductions, and most notably 26% reductions in cardiac and 20% reductions on total mortality.

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Competing interests

The authors declare no competing interests.

CR is defined by the Canadian Association of Cardiac Rehabilitation as the “enhancement and maintenance of cardiovascular health through individualized programs designed to optimize physical, psychological, social, vocational, and emotional status”.{{867 Canadian Association of Cardiac Rehabilitation. 1999;}}. In general, the services are offered in an outpatient setting by a multidisciplinary team of cardiologists, nurses, exercise specialists, pharmacists, dietitians and psychologists{{2827 Thomas, R.J. 2007;4160 Fischer, J.P. 2008;}} Participants generally come on site one to two times a week for supervised exercise and education sessions. In the United States, a 3 month program is funded by workplace insurance programs or through Medicare.{{3551 Centers for Medicare and Medicaid Services (CMS)}}

Randomized controlled trials and quantitative reviews show that CR programs result in substantial reductions in morbidity, mortality, and the cost of care, and increases in quality of life when compared with usual care.{{4247 Alter, D.A. 2009; 2734 Lavie, C.J. 2006;1141 Boulay, P. 2004; 405 Taylor, R.S. 2004;4252 Digenio, A.G. 1997; 4246 Papadakis, S. 2008 }} On the basis of this evidence, clinical practice guidelines in the US,{{2827 Thomas, R.J. 2007;}} Canada,{{30 Canadian Association of Cardiac Rehabilitation 2004;}} Europe{{4253 Graham, I. 2007; 4254 Skinner, J.S. 2007;}} and Australia {{4239 Briffa, T.G. 2006; 4256 The Australasian Society of Cardiac and Thoracic Surgeons and The Cardiac Society of Australia and New Zealand 2004}} recommend CR referral as standard care for patients with acute coronary syndromes and those undergoing interventional cardiac procedures.{{2827 Thomas, R.J. 2007;}}

Despite the established benefits of CR, evidence shows that referral to, and subsequent enrollment in, CR programs is disconcertingly low. The largest and most comprehensive study to date reported that an average of 18.7% of cardiac patients in the US received outpatient CR after hospital discharge.{{2997 Suaya, J.A. 2007;}} The UK is the only country to establish targets for CR utilization, where the aim is to achieve an 85% referral rate.{{4403 United Kingdom Department of Health 2000;}} Reasons for low rates of CR utilization are multifactorial, and include health-system,{{1757 Cortes, O. 2006;117 Grace, S.L. 2004;2944 Grace, S.L. 2008;4286 Cohen, M.J. 2006;}} health-care provider,{{3264 Ades, P.A. 1992; 146 Cabana, M.D. 1999; 3333 Witt, B.J. 2005; 3602 Grace, S.L. 2008; 2731 Grace, S.L. 2008; 2607 Grace, S.L. 2005; 359 Daly, J. 2002; 4248 Gurewich, D. 2008; 4160 Fischer, J.P. 2008; 4278 Comoss, P. 2008;}} and patient level{{4297 Brown TM, Hernandez AF, Bittner V, Cannon CP, Ellrodt G, Liang L, Peterson ED, Pina I, Safford MM, Fonarow GC. 2008;4294 Williams, R.I. 2004;1757 Cortes, O. 2006; 2997 Suaya, J.A. 2007; 3602 Grace, S.L. 2008;2731 Grace, S.L. 2008; 4338 Rhodes, R. 1992; 3264 Ades, P.A. 1992}} factors. Lack of CR referral is the most common reason given by patients when they are asked why they did not attend CR after a cardiac event or procedure.{{396 Pasquali, S.K. 2001; 109 Grace, S.L. 2002; 3963 Scott, L.B. 2008;}} Referral for CR is dependent upon a physician initiating a referral discussion, then securing, completing, signing, and transmitting an institution-specific CR referral form.{{2827 Thomas, R.J. 2007;}} Clearly there is wide variation in referral practice among health-care providers in the US, given that the state-wide rates of CR utilization range from 5.2% to 42%.{{2997 Suaya, J.A. 2007;}}

To address these disparities in care, systematic strategies to promote CR referral are warranted. Automatic referral, defined as “the implementation of standing referral orders to CR based on eligible diagnoses supported by clinician guidelines”,^{4160 Fischer, J.P. 2008;} has long been advocated and has begun to be implemented, but the strategy has rarely been evaluated.^{142 Cardiac Care Network. 2002;3661 Grace, S.L. 2004;2953 Grace, S.L. 2007;} Indeed the American Association of Cardiovascular and Pulmonary Rehabilitation released a multidisciplinary discharge checklist including CR referral to promote adoption of automatic referral.^{2827 Thomas, R.J. 2007;} Through key informant interviews with healthcare professionals, CR managers, and other stakeholders,^{1936 Grace, S.L. 2006} another common referral strategy termed ‘liaison’ has been identified, which involves a personal discussion about CR between an allied health professional and the patient. Although this method is not systematic and can be cost-prohibitive, it is informative to patients and promotes CR endorsement.^{3264 Ades, P.A. 1992;}

There are two published reviews that have examined multiple CR utilization interventions and their effects on CR enrollment and adherence,^{3299 Beswick, A.D. 2004;350 Beswick, A.D. 2005;} but neither investigated effects on CR referral rates. Moreover, the effect of referral strategies on CR utilization has not been specifically reviewed. Automatic referral strategies in particular are attractive and deserve investigation given their low cost, suitability for wide implementation and adoption, and their potential to facilitate increased and equitable access to CR, while reducing the burden of referral completion on the healthcare provider. In the Review, we examine the data from primary studies of the effects of referral strategies on CR referral and enrollment.

CR referral strategies

In addition to liaison strategies, there are two main ‘automatic’ referral strategies aimed at improving CR utilization rates. One of these strategies involves electronic medical records. Here, established performance improvement tools can be used, or local solutions have been developed to prompt referral to CR for indicated cardiac conditions. The Get with the Guidelines tool for example was developed by the American Heart Association as an electronic program for in-hospital quality improvement.^{4407 American Heart Association 2009;} Most often, prior to discharge, the computer will prompt the healthcare provider completing the standard order checklist to complete referral to a CR program.^{4160 Fischer, J.P. 2008;} Electronic records can be programmed to transmit referral information to the on-site CR program.

The second automatic referral strategy is similar, but electronic health records are not employed. Here, manual paper-based hospital discharge order sets are approved by the unit Medical Advisory Committees and include referral to CR. The nurse or case manager responsible for the patient’s care would supply every eligible chart with a CR discharge form for the provider’s signature.^{4160 Fischer, J.P. 2008;} The form would then be faxed to a CR centre, and the program would then contact the patient to arrange enrolment. Sample forms for inpatient referral using this strategy are shown in AHA’s Performance Measures publication.

Several studies have involved testing of automatic electronic referral,^{34,42,46–50} automatic manual referral,⁵¹ liaison methods,^{37,52–55} and a combination of these approaches.^{56–60} Comparisons have been made between electronic and manual automatic referral, liaison methods, and usual referral,⁶¹ and the effects of CR information letters provided to patients have also been investigated.^{62,63} Strategies involving referral to CR before and after hospital discharge have both been studied.^{37,52,53}

Effects on CR referral rates

Studies examining the effects of a referral strategy on CR referral rates are shown in Table 1. Referral strategies were associated with significant positive effects on referral rates in the majority of these studies, but two studies showed that referral strategies did not significantly increase referral rates when compared with usual care.{{4238 Nori, D. 2002;1247 Grace, S.L. 2005}} Another two studies did not incorporate a comparison group, but described referral rates only.

Electronic or manual automatic referral

Several studies have tested the effects of automatic electronic {{4297 Brown TM, Hernandez AF, Bittner V, Cannon CP, Ellrodt G, Liang L, Peterson ED, Pina I, Safford MM, Fonarow GC. 2008; 2953 Grace, S.L. 2007; 3962 Grace SL., Tam C., Leung Y., Oh O., Reid R., Fair T., Anand S., Rush J., Williamson K., Gupta M., Braga M., Petro J., Brister S., & Stewart DE. October 2008;3965 LaBresh, K.A. 2007;1698 LaBresh, K.A. 2004;3967 Mazzini, M.J. 2008;}} and automatic manual strategies on CR referral rates.{{4238 Nori, D. 2002}} Automatic electronic referral strategies were associated with significant positive effects on referral rates in five of these studies.{{2953 Grace, S.L. 2007;3967 Mazzini, M.J. 2008;3962 Grace SL., Tam C., Leung Y., Oh O., Reid R., Fair T., Anand S., Rush J., Williamson K., Gupta M., Braga M., Petro J., Brister S., & Stewart DE. October 2008;1698 LaBresh, K.A. 2004;3965 LaBresh, K.A. 2007}} Grace et al. (2007) conducted an observational prospective cohort study that included 661 ACS inpatients.{{2953 Grace, S.L. 2007}} Subjects were recruited from either a site which automatically refers eligible patients via a computerized prompt, or from a site that refers with the usual method at the provider's discretion. The results showed that the automatic electronic strategy resulted in significantly higher referral rates (67%) compared to usual referral (34%, $P < 0.001$). In another study by the same researchers, rates of CR referral with automatic means were compared with usual referral strategies in a multicenter, prospective trial of 1,836 cardiac inpatients.⁶¹ At the 1 year follow-up, automatic manual referral (85.1%, odds ratio [OR] 6.98, 95% CI 2.53–19.30) and automatic electronic (69.3%; OR=2.76, 95%CI 1.25–6.11) strategies resulted in significantly higher referral rates compared to usual referral (45%).

In the study by Mazzini et al. (2008), the authors conducted a retrospective chart review of 780 myocardial infarction (MI) inpatients.{{3967 Mazzini, M.J. 2008}} This study evaluated the success of the GWTG program at one hospital in the United States. Patients that were under the electronic program pathway were more likely to receive a CR referral (55%) compared to patients that were not on the program pathway (38%, $P < 0.03$). Two other studies examined the effect of the GWTG tool in a quality improvement initiative, and

results showed that there were significant increases prior to program inception through to the follow-up phase.{{ 1698 LaBresh, K.A. 2004;3965 LaBresh, K.A. 2007 }} In the first study, Labresh et al. (2004) conducted a one-group pretest posttest pilot study of 1738 CAD inpatients at 24 hospitals in the United States. Hospitals participated in the GWTG program for at least 1 year. Outcome measurements of the quality improvement intervention were taken at the beginning of the program (baseline), at 4–6 months and at 10–12 months. At baseline, CR referral rates were 34% and by the 12 month follow-up, they had significantly increased to 73% ($P < 0.05$). After the success of the pilot project, a larger interventional study followed. Labresh et al. (2007) assessed the impact of a national quality improvement program on adherence to guidelines in these patients at 92 hospitals from across the United States that participated in the GWTG program for at least 1 year.{{ 3965 LaBresh, K.A. 2007 }} Quarterly measurements of the quality indicators were taken over the course of the intervention. A total of 45,988 patients with acute MI, unstable angina, revascularization, or peripheral vascular disease were included in this evaluation. There was a significant improvement in the CR referral rate from the baseline measure (59%) to the first quarterly measure (67%, $P < 0.01$). Further, of the 11 measurements taken, referral to CR had the third largest increase, which represented a 12.6% improvement over the course of program use ($P < 0.0001$). The referral rate at the 1-year follow-up assessment was 72%.

Nori et al. (2002) conducted a nonrandomized randomized controlled study in 125 MI patients that examined the effects of introducing an automatic manual discharge worksheet based on clinical practice guidelines.{{ 4238 Nori, D. 2002; }} The discharge worksheet was introduced to staff for use with patients surviving an MI. This study randomly searched patient charts to screen for worksheet use and calculate a patient discharge score by summing the number of quality indicators present in the charts (including evidence of CR referral). The authors compared the rates of CR referral among patient charts absent of the worksheet (62%), with incomplete worksheets (58%) and completed discharge worksheets (82%). There were no differences between the three groups, such that the addition of the automatic manual discharge form did not significantly impact referral rates.

Liaison strategies

The effects of liaison strategies on CR referral have been investigated by Grace *et al.* {{ 1247 Grace, S.L. 2005;3962 Grace SL., Tam C., Leung Y., Oh O., Reid R., Fair T., Anand S., Rush J., Williamson K., Gupta M., Braga M., Petro J., Brister S., & Stewart DE. October 2008 }} In one randomized controlled pilot study, patient liaison—involving a motivational interview and provision of an educational brochure was compared with usual care in 80 female patients who had undergone percutaneous coronary intervention at two treatment centers in Toronto, ON, Canada.{{ 1247 Grace, S.L. 2005; }} The liaison intervention was conducted by a research assistant and not offered by an allied health professional involved in in-patient care. After 8 weeks, there was a nonsignificant trend towards greater referral to CR in the liaison group (34%) compared to the control group (17%, $P = 0.09$). In another study by the same researchers, rates of CR referral with liaison were compared with usual referral strategies in a multicenter, prospective trial of 1,836 cardiac inpatients.{{ 3962 Grace SL., Tam C., Leung Y., Oh O., Reid R., Fair T., Anand S., Rush J., Williamson K., Gupta M., Braga M., Petro J., Brister S., & Stewart DE. October 2008 }} As outlined above,

at 1 year follow-up, automatic manual referral was associated with the highest CR referral rate, (85.1%, odds ratio [OR] 6.98, 95% CI 2.53–19.30) followed by liaison (personal referral discussion) with an allied health-care professional (70.0%, OR 2.85, 95% CI 1.14–7.15) resulted in almost 3 times greater referral rates than for the standard referral procedure (45.0%).⁶¹

Automatic and liaison referral strategies

Various combinations of referral strategies on CR referral rates have also been investigated. {{4289 Kalayi, C. 1999;4270 Mehta, R.H. 2000}} Kalayi *et al.* used a pretest–post-test study design to compare automatic manual referral with automatic electronic referral in combination with a liaison strategy.{{4289 Kalayi, C. 1999}} Five hundred and sixty one MI patients from a critical care unit at a single centre in the United Kingdom were recruited for the study. In the pre-test phase, the critical care unit ward used manual (paper-based) referral orders for CR. The authors instituted an electronic referral pathway through electronic patient records where a CR referral screen automatically flagged patients with a MI diagnosis. In addition, staff visited all wards weekly to raise awareness about CR and referral. The combined strategy resulted in significantly higher CR referral rates (79%) than did automatic referral alone (65%, $p = 0.0002$). Mehta *et al.* implemented a quality-improvement program in patients with acute MI.{{4270 Mehta, R.H. 2000}} This initiative incorporated a critical management pathway based on ACC/AHA guidelines together with a patient education tool that was reviewed by the patient in consultation with their physician prior to hospital discharge. The program was targeted toward improving all aspects of care. The proportion of patients that were referred to CR through the automatic electronic critical pathway was 69%. The study did not incorporate a comparison group at the critical pathway referral level, but the use of the patient educational tool (liaison) was associated with a significantly greater percentage of patients being referred to CR than when the tool was not used (87% vs. 63%, $P = 0.001$).

Effects on CR enrollment rates

Studies examining the effect of referral strategies on CR enrollment rates are shown in Table 2. The majority of studies reported that referral initiatives significantly increased enrollment in CR programs, but three studies that such strategies were not associated with positive effects on enrollment.{{3967 Mazzini, M.J. 2008;482 Mosca, L. 1998;2876 Suskin N, Irvine J, Arnold JMO, Turner R, Zandri J, Prior P, Unsworth K. 2007}} Three of the studies described enrollment rates but did not incorporate comparison groups.{{4290 Leibowitz, M. 2004;4285 Higgins, R.O. 2008;1805 Smith, K.M. 2006}}

Electronic or manual automatic referral

Some of the studies reported above also assessed the impact of referral strategies on CR enrollment. In one observational cross-sectional comparison study, a sample of 501 CAD patients were recruited that had been admitted to a tertiary care center in Ontario, Canada. {{1258 Grace, S.L. 2004;}} Hospital electronic patient records were used to prompt the standard order of a CR referral for all eligible cardiac patients. Further, an information package including a personalized letter stating the name of the referring physician, a

program brochure and a request that the patient call to book an appointment was mailed to the patient's home. Patients living outside the geographic region received a CR referral to the site closest to home. Data about enrollment were obtained through access to the CR cardiac patient database. Rates of CR enrollment were 43%. This rate was then compared to regional and provincial data that utilized the usual referral method.{{404 Suskin, N. 2003;142 Cardiac Care Network. 2002}} Automatic referral resulted in significantly greater enrollment rates compared to both regional (16%, $p < 0.025$) and provincial data (22%, $p < 0.005$). In another observational study by Grace et al. (previously described above) CR enrollment rates were compared between automatic and usual referral methods.{{2953 Grace, S.L. 2007;}} Enrollment was self-reported by patients on a survey and verified with the CR site. The automatic electronic referral strategy resulted in significantly greater enrollment rates compared to the usual referral method (52% versus 32% respectively, $P < 0.001$).

In contrast to these results, Mazzini et al. (previously described above) did not find that the automatic electronic referral strategy (19%) resulted in significantly greater enrollment rates compared to the control group (6%), although a trend was noted ($P=0.08$). Mosca et al. used an interventional pretest–post-test study design that evaluated the implementation of an automatic electronic referral system{{482 Mosca, L. 1998;}} The electronic intervention used a critical care pathway to prompt physicians to refer MI patients to CR upon hospital discharge. CR enrollment was verified from the hospital records, and of the 199 MI subjects in the study, 108 (54%) enrolled in the program, The intervention was found to have no significant effect on enrollment rates (OR=1.9; 95% CI = 0.6–5.5). No published studies were found that evaluated CR enrollment following automatic manual referral.

Liaison strategies

The effects of a liaison strategy on CR enrollment has been investigated in several studies of various designs. In one randomized controlled study, 247 unpartnered, older adults with MI or coronary artery bypass surgery were allocated to either standard care or standard of care plus an intensive liaison intervention post-discharge.{{4291 Carroll, D.L. 2007;}} This consisted of a community-based intervention of a home visit within 72 hours of hospital discharge, telephone calls at 2, 6, and 10 weeks from an advanced practice nurse, and 12 weekly telephone calls from a peer advisor. Baseline comparisons of enrollment rates were similar between the two groups. Over the course of the intervention, significantly more patients from the intervention arm enrolled in CR at 3 months ($n=34$, OR=2.79, 95% CI 1.4–5.5), 6 months ($n=42$, OR=1.82, 95% CI 1.0–3.2), and 12 months ($n=46$, OR=2.0, 95% CI 2.2–3.6) follow-up compared to the control group. In another randomized study, a liaison strategy was compared to standard care among 597 adult patients from 67 general practices in the United Kingdom.{{42 Jolly, K. 1999;}} The liaison intervention involved a personal discussion about CR between the nurse and the patient. Additionally, patients held a record card to prompt and guide follow-up. At 1-year post-recruitment, patients in both groups self-reported CR enrollment, and it was found that the intervention resulted in significant greater CR enrollment (42%) compared to the control group. (24%, $P < 0.001$) Pasquali et al. (2001) tested a liaison intervention using a one-group pretest posttest design in 100 post-bypass patients at a single site in the United States.{{396 Pasquali, S.K. 2001;}} The intervention

involved patient phone calls at 6 to 12 weeks after cardiac surgery. Subjects were provided with information regarding the potential health benefits of CR and if interested, they were assisted with the referral process. Phone calls were made 3 to 7 weeks after initial contact to determine subsequent enrollment in CR. Enrollment rates increased significantly after the intervention (56%) compared to the pre-intervention phase (31%, $P < 0.0001$) Finally, an interventional nonrandomized study reported enrollment rates among 5418 CAD patients after a liaison strategy that involved a staff-patient CR conversation and a CR site visit on the day of hospital discharge.{{4290 Leibowitz, M. 2004;}} The CR enrollment rate was reported to be 34%. However, there was no comparison group incorporated, thus no conclusions can be made about the effects of this referral strategy on enrollment.

Automatic and liaison referral strategies

Three studies evaluated the effect of combined referral strategies on CR enrollment. Harkness *et al.* (2005) evaluated a liaison nurse phone call intervention following automatic referral in an retrospective cohort study of 3536 bypass patients at one site in Ontario Canada.{{4282 Harkness, K. 2005;}} The rate of CR enrollment significantly increased after the addition of the liaison phone call (78%) compared to automatic referral alone (50%, $P < 0.0001$).

Two other studies involving a combination of automatic and liaison referral strategies did not have comparison groups, however, they reported higher CR enrollment rates than what is reported in the literature following usual referral.{{1757 Cortes, O. 2006;}} Firstly, Higgins *et al.* conducted an observational, prospective cohort study at a single site which follows Australian CR guidelines for referral including automatic referral to CR of all eligible patients via a hospital discharge plan, a personal invitation to CR and a group exercise program in the ward prior to hospital discharge.{{4285 Higgins, R.O. 2008;}} Bypass? Patients completed questionnaires pre-operatively, and were tracked after referral to CR. Through patient self-report and CR site verification, it was reported that 72% of the xx patients enrolled in CR. Similarly, the study by Smith *et al.* (2006) also evaluated the performance of a combination of automatic manual referral and liaison methods in a retrospective cohort of 3536 CABG patients. The study reported a 60% enrollment rate as verified by patient medical records.

Other strategies

The remaining two studies to be presented in this Review were RCTs that evaluated the effect of a patient letter on CR enrollment. In the study by Wyer *et al.* (2001), the sample of 87 MI patients had a nurse liaison discussion regarding CR. Thereafter, the participants were randomized to either the control group or the interventional group{{308 Wyer, S. J. 2001;}} The intervention was based on the Theory of Planned Behaviour and took the form of two letters. All of those who agreed to take part in the research were given a standard letter. Half of the envelopes also contained the intervention letter and if received, the patient would place the patient in the experimental group. CR enrollment rates for the experimental group were found to be significantly higher compared to the control group (86% vs. 59% respectively, $P < 0.0025$). In the more recent RCT by Suskin *et al.* (2007){{2876 Suskin N, Irvine J, Arnold JMO, Turner R, Zandri J, Prior P, Unsworth K. 2007;}} all 548 consecutive

ACS, PCI, CABG patients were screened and if eligible were automatically referred to CR using a manual care map. Participants were then randomly assigned to the intervention of a personalized written physician endorsement accompanying the CR referral, or to the control group that received a non-personalized standard letter. The results showed no significant effect on enrollment (58.2% vs. 58.2%).

Quality and availability of data

Overall, the quality of studies discussed in this Review was rated as fair according to US Preventive Services Task Force criteria.⁶⁵ There are three main areas within the individual studies reviewed where methodological flaws were noted—study design, confounding bias, and the measurement of outcome. With regard to study design, the main methodological flaw pertained to the lack of randomized studies. We know of only four randomized controlled trials that assessed the effects of sending motivational referral letters to patients in combination with liaison,{{308 Wyer, S. J. 2001;}} and automatic referral,{{2876 Suskin N, Irvine J, Arnold JMO, Turner R, Zandri J, Prior P, Unsworth K. 2007;}} and two that involved a nurse–patient liaison discussion.{{4291 Carroll, D.L. 2007;42 Jolly, K. 1999;}} No randomized controlled trials have tested the effects of automatic referral versus usual referral on CR utilization. Given the potential of these referral strategies to improve access to proven chronic disease management services, more trials are urgently needed. In addition, many of the studies in this field have failed to incorporate control or comparison groups, which could have resulted in history or maturation bias. In particular, few multicentre studies with control groups have been conducted. There is certainly evidence from multicentre studies that the AHA’s ‘Get With The Guidelines’ program increases CR referral over time. {{3965 LaBresh, K.A. 2007; 1698 LaBresh, K.A. 2004}} However, without the incorporation of an appropriate control group in the study, the potential for the ‘Hawthorne effect’ or other sources of bias cannot be ruled out.

With regard to the second major limitation, many of the studies failed to take potentially confounding variables into consideration, and the results should therefore be interpreted with caution. For example, many studies failed to account for personnel training methods, charting consistency, characteristics of the health-care providers involved with patient care, the location of CR programs, administrative support and facilitation, and other characteristics of the health-care setting.

With regard to measurement of CR utilization, outcome assessment should be interpreted with caution. The rates of reported referral and enrollment were ascertained from multiple sources including patient self-report, CR-site report, in-hospital report, and web-based or chart report by various health-care providers. However, evidence exists that there is almost perfect agreement between patient report and CR site-report of utilization.{{2938 Kayaniyil, S. 2009;}} Therefore, reporting methods may not in fact represent a potential threat to the validity of these findings. In addition, many of the studies in the literature report CR referral rates without reporting enrollment rates, particularly those that assessed the AHA’s ‘Get With The Guidelines’ program. The study by Mazzini *et al.* is the only exception.{{3967 Mazzini, M.J. 2008;}} Although the effect of automatic and liaison strategies on CR referral

can now be considered established, CR enrollment is the outcome that ultimately impacts public health and, as such, should always be included as an outcome indicator.

Other areas that deserve future research attention include the effect of referral strategy, not only on patient enrollment, but also on the degree of patient participation in CR. In addition, the mixed findings on the effects of sending the patient a CR referral letter warrant future study. This strategy is a low cost and widely implemented method of promoting CR utilization. Whether sending a letter to the patient, in conjunction with automatic referral could significantly affect CR utilization should be established.

Preliminary evidence also indicates that the use of automatic referral strategies could reduce inequities in access to CR.{{2287 Arthur, H.M. 2006;1757 Cortes, O. 2006;4400 Grace, S.L., Suskin, N., Arthur, H.M., & Stewart, D.E 2007;}} By contrast, however, recent evidence shows that the AHA's 'Get With The Guidelines' referral strategy does not appear to mitigate CR access inequities, such as age, gender, ethnicity and the nature of the cardiac condition or procedure.{{4432 Brown, T.M. 2009;4297 Brown TM, Hernandez AF, Bittner V, Cannon CP, Ellrodt G, Liang L, Peterson ED, Pina I, Safford MM, Fonarow GC. 2008;3967 Mazzini, M.J. 2008;}} The increased risk of poor cardiac outcomes and low representation in CR programs in certain groups, such as women, ethnocultural minorities, and those of low socioeconomic status, has been well established{{350 Beswick, A.D. 2005;}} and deserves further research.

Improving practice in CR referral

The studies reviewed in this article show that rates of CR referral for 'standard' strategies range from 17% to 45%. By comparison, CR referral rates for automatic manual and electronic referral, for liaison, and the combination of automatic and liaison strategies are 38–85%, {{4297 Brown TM, Hernandez AF, Bittner V, Cannon CP, Ellrodt G, Liang L, Peterson ED, Pina I, Safford MM, Fonarow GC. 2008; 2953 Grace, S.L. 2007; 3965 LaBresh, K.A. 2007; 1698 LaBresh, K.A. 2004; 3967 Mazzini, M.J. 2008; 4238 Nori, D. 2002; 3962 Grace SL., Tam C., Leung Y., Oh O., Reid R., Fair T., Anand S., Rush J., Williamson K., Gupta M., Braga M., Petro J., Brister S., & Stewart DE. October 2008;4432 Brown, T.M. 2009 }} 34-70%,{{1247 Grace, S.L. 2005; 3962 Grace SL., Tam C., Leung Y., Oh O., Reid R., Fair T., Anand S., Rush J., Williamson K., Gupta M., Braga M., Petro J., Brister S., & Stewart DE. October 2008}} and 69–79%,{{4270 Mehta, R.H. 2000; 4289 Kalayi, C. 1999}} respectively. Enrollment rates for 'standard' referral procedures range from 6–32%, whereas the rates for automatic manual and electronic referral, liaison, and the combination automatic and liaison methods are reported to be 19–54%,{{2953 Grace, S.L. 2007; 1258 Grace, S.L. 2004;3967 Mazzini, M.J. 2008; 482 Mosca, L. 1998}} 32–56%, {{4291 Carroll, D.L. 2007; 42 Jolly, K. 1999; 4290 Leibowitz, M. 2004; 396 Pasquali, S.K. 2001}} and 42–78%{{4282 Harkness, K. 2005; 4285 Higgins, R.O. 2008; 1805 Smith, K.M. 2006}} respectively. Strategies that use automatic or liaison strategies combined with a patient CR letter intervention have been shown to result in 58–86% enrollment rates.{{2876 Suskin N, Irvine J, Arnold JMO, Turner R, Zandri J, Prior P, Unsworth K. 2007; 308 Wyer, S. J. 2001}}

These findings, when taken in the context of the caveats outlined below, can be used to start a dialogue about improving practice in CR referral. Certainly, automatic referral results in significant increases in CR utilization, but the addition of a liaison discussion or motivational letter could potentially achieve the highest enrollment rates. This premise is corroborated by research indicating that patients who are automatically referred for CR are not always aware that they have been referred.{{2953 Grace, S.L. 2007;1936 Grace, S.L. 2006;}} Once a patient is referred to CR, liaison discussions could positively influence patient motivation, CR knowledge, and attitudes, and could also reduce ambivalence and noncompliance.{{4308 Everett B, Salamonson Y, Zecchin R, Davidson PM. 2009;}} The incorporation of patient liaison into automatic referral strategies is supported by the preliminary results of the CRCARE study,{{3962 Grace SL., Tam C., Leung Y., Oh O., Reid R., Fair T., Anand S., Rush J., Williamson K., Gupta M., Braga M., Petro J., Brister S., & Stewart DE. October 2008;}} which demonstrates through a multicenter, controlled, observational design that automatic referral in combination with patient liaison can result in CR enrollment rates of up to 72%. This combined approach to CR referral resulted in a CR referral rate 11 times higher than for 'standard' referral methods, after adjustment for the effect of recruitment center (Grace, S. L. *et al.* unpublished work).

Key informants, including CR administrators and providers, as well as physicians and allied healthcare providers providing inpatient cardiac care, suggest that the main factors facilitating improved practice in referral include endorsement by the physician, a systematic discharge order, a personal two-way discussion with the patient, the involvement of all health-care staff in completing the CR referral process, early outpatient education, and booking the CR intake appointment before hospital discharge.{{1936 Grace, S.L. 2006;}} These procedures have been recommended in Australian CR guidelines{{488 Goble, A.J. 1999;}} and have been shown to result in a 72% CR enrollment rate.{{4285 Higgins, R.O. 2008;}} Because of the uncontrolled nature of the study design and the small sample size however, conclusions about the effect of these CR referral mechanisms cannot be drawn until further evidence is available. The use of these methods in a comprehensive referral strategy represents an exciting avenue for future research.

Clinical and health policy implications

The broad implementation of the CR referral strategies discussed in this Review could result in public health benefits. Although this contention needs to be tested empirically, an increase in CR enrollment from approximately 20% to 70% as we are showing can be achieved could mean that another 50% or half of eligible cardiac patients could also be realizing the CR benefit of 25% reduced mortality compared to usual care. {{405 Taylor, R.S. 2004;2418 Taylor, R.S. 2006;}}

However, implementing automatic and liaison referral strategies to increase utilization of CR programs has several implications. Chiefly, CR programs might not have sufficient staff or funding to handle such increases in patient volumes, increasing waiting times for patients to access CR. Such delays could result in deterioration in the patient's health{{1685 Dafoe, W. 2006;}} and pose a major barrier to program attendance.{{408 Tod, A.M. 2002;}} Ensuring that CR programs have adequate resources to provide timely access based on the patient's

health status and referral indication{{1685 Dafoe, W. 2006;}} is imperative. For example, patients undergoing percutaneous coronary intervention could benefit from CR weeks before a patient who has undergone bypass surgery would be ready for exercise.{{1685 Dafoe, W. 2006;}} Increasing funds for additional staff or larger facilities, and referral to home or community-based CR where risk stratification supports such allocation may be indicated. Although there is no evidence to provide guidance on the optimum duration of CR programs, tailoring the length of programs on the basis of individual patient requirements should be pursued.

All patients do not have access to CR, despite being referred. Patients may live in rural settings or in geographic locations without CR programs. Patients may return to work soon after their event and may not be available for CR services during usual hours of operation. As outlined above, in such instances a home-based program would be a viable option. Such monitored CR programs have been shown to be an effective alternative to traditional centre-based programs, and are often preferred by cardiac patients.{{4750 Jolly, K. 2009;259 Sparks, K.E. 1993;2711 Dalal, H.M. 2007;2710 Taylor, R.S. 2007;}} Use of internet contact with CR is also gaining prominence.

Several studies have indicated that strong endorsement of CR by the patient's personal health-care provider is an important determinant of participation.{{3602 Grace, S.L. 2008;3264 Ades, P.A. 1992;359 Daly, J. 2002;}} An extensive public education campaign, aimed at both health-care providers and patients may be warranted to improve awareness of the benefits of CR and the degree of current underutilization. There have been few national campaigns undertaken to improve the awareness of CR and to overcome underutilization, {{4755 British Heart Foundation; 4756 The Canadian Cardiac Rehabilitation Foundation; 4758 Preventive Cardiovascular Nurses Association 2006;}} and to our knowledge, the effectiveness of these campaigns have not been empirically tested. Given the weight of the evidence on the benefits of CR and the knowledge available on how to facilitate universal patient access, it is time for more advocacy in the public and political domains.

The final consideration is financial cost. Although implementation of an automatic referral strategy could have substantial start-up costs—particularly in the case of electronic discharge orders—the cost of maintaining such a system would not be onerous. However, the cost involved in setting up a liaison referral system, through the payment of salary for an allied health professional, could be prohibitive. Many institutions use this liaison model in practice, and, ultimately, it could become widely adopted if the cost-effectiveness of this referral strategy can be established.

Conclusions

The preponderance of evidence indicates that strategies combining automatic and liaison referral to CR programs can significantly increase CR referral and enrollment rates. Automatic prompts in electronic medical records can facilitate overall increases in referral form transmission. To identify and target obstacles to enrollment, discussions between the patient and health-care provider should take place before hospital discharge. These innovative referral strategies could result in approximately 70%{{4285 Higgins, R.O.

2008;4282 Harkness, K. 2005}} of eligible patients enrolling in CR programs. The patient-level factors affecting CR utilization have been well established and we could reasonably expect that approximately 30% of patients will not take advantage of CR services.

Although the evidence in the literature supports the idea that innovative referral strategies improve CR referral, more research is needed particularly with regard to enrollment. It is likely that automatic referral is not the whole answer, but that the addition of other approaches appear useful. There may well be other methods which are even more effective, but which have yet to be studied. However, we hope that this Review will encourage institutions to evaluate their CR referral strategies. Implementation of these referral strategies on a broad scale could translate into substantial public health benefits. We have the potential to make an important impact on secondary prevention of cardiovascular disease simply by promoting access to established care.

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Key Points

- Despite recommendations in clinical practice guidelines, evidence shows that only 15–20% of cardiac patients make use of cardiac rehabilitation services
- The reasons for the disparity between evidence and care are complex but, arguably, the chief explanatory factors are referral failure and lack of provider encouragement
- Innovative referral strategies can substantially increase cardiac rehabilitation referral and enrollment
- Automatic referral methods, such as the AHA's 'Get With the Guidelines' initiative, can appreciably increase referral rates
- The incorporation of a cardiac rehabilitation referral discussion with an allied health-care provider can result in enrollment rates that are double the rates after usual referral
- These innovative cardiac rehabilitation referral strategies should be considered by healthcare providers, administrators and policy-makers, although randomized trials are needed.

Review criteria

Literature searches of Scopus, MEDLINE, CINAHL, PsycINFO, and The Cochrane Library databases were conducted from database inception to January 2009. English language papers or abstracts were included if they were published in a peer-reviewed journal and were from primary or secondary observational or interventional studies in which participants were cardiac patients eligible for cardiac rehabilitation. Search terms used included “coronary artery disease” combined with “cardiac rehabilitation”, “automatic referral”, “referral”, and “consultation” or “program utilization”. Quality assessment was undertaken on full length manuscripts based on US Preventive Services Task Force criteria.

Table 1

Studies evaluating the effect of innovative referral strategies on CR referral rates

Study Author, Year	Study design, Sample and Location	Referral Type	Source of outcome measure	Referred/total participants (%)
Brown (2009)	Interventional, non-RCT; 72,817 MI, PCI and CABG patients; pre-discharge CR referral; multi-site, USA	Automatic (electronic)	Hospital records	<p>1 No control group, therefore no computation made.</p> <p>2 GWTG pathways use: 40,974/72,817= 56%</p>
Brown (2008)	Interventional, non-RCT; 185,794 established CAD, MI, PCI and CABG patients; pre-discharge CR referral; multi-site, USA	Automatic (electronic)	Hospital records	<p>1 No control group, therefore no computation made.</p> <p>2 GWTG pathways use:</p> <ul style="list-style-type: none"> i. Overall Population (CAD): 70,563/185,794 = 38% ii. MI patients: 48,046/110,905 = 43% iii. MI, PCI, or CABG patients: 66,006/144,281 = 46%
Grace (2007)	Observational, prospective cohort; 661 ACS patients; pre-discharge CR referral; multi-site, Canada	Automatic (electronic)	Patient self-report and CR site verification	<p>1 Usual: 91/265 = 34%</p> <p>2 Automatic Electronic: 162/241 = 67%</p>
LaBresh (2007)	Interventional, one-group pretest posttest; 45,998 CAD and PVD patients; pre-discharge CR referral; multi-site, USA	Automatic (electronic)	Hospital records	<p>1 Baseline: 5353/9067= 59%</p> <p>2 Q1: 5247/7811= 67%</p> <p>3 Q2: 5749/8577= 67%</p> <p>4 Q3: 6008/8629= 70%</p> <p>5 Q4: 5421/7571= 72%</p>
LaBresh (2004)	Interventional, one-group pretest posttest; 1738 CAD patients; pre-discharge CR referral; multi-site, USA	Automatic (electronic)	Hospital records	<p>1 Baseline* = 34%</p> <p>2 4–6 months* = 44%</p> <p>3 10–12 months* = 73%</p>
Mazzini (2008)	Observational, retrospective cohort; 780 MI patients; pre-discharge CR referral; single site, USA	Automatic (electronic)	Hospital records	<p>1 Non-pathways use: 25/66 = 38%</p> <p>2 GWTG pathways use: 392/714 = 55%</p>
Nori (2002)	Interventional, non-RCT; 125 MI patients; pre-discharge CR referral; single site, USA.	Automatic (manual)	Hospital records	<p>1 Absent discharge worksheet = 40/65 = 62%</p> <p>2 Incomplete discharge worksheet = 15/26 = 58%</p>

Study Author, Year	Study design, Sample and Location	Referral Type	Source of outcome measure	Referred/total participants (%)
				3 Completed discharge worksheet = 28/34 = 82%
Grace (2005)	Interventional, non-RCT; 80 female PCI patients; post-discharge CR referral; multi-site, Canada	Liaison	Patient self-report	1 Control Group: 6/36 = 17% 2 Intervention Group: 11/32 = 34%
Kalayi (1999)	Interventional, pretest-posttest, 561 MI patients; pre-discharge CR referral; single site, UK	Automatic (manual, electronic) & Liaison	Hospital records	1 Baseline: Automatic Manual: 194/298 = 65% 2 Follow-up: Automatic Electronic & Liaison: 208/263 = 79%
Mehta (2000)	Interventional, non-RCT; 497 MI patients; pre-discharge CR referral; single-site; USA	Automatic (electronic) & Liaison	Hospital records	1 No control group, therefore no computation made. 2 Critical Pathway patients = 345/497 = 69% • No PET use: 146/232 = 63% • PET use: 199/243 = 82%
Grace (2008) [†]	Observational, prospective cohort; 202 CAD patients; pre-discharge CR referral; multi-site; Canada	Automatic (manual, electronic) & Liaison	Patient self-report	1 Usual Referral: 18/40 = 45% 2 Automatic Manual: 40/47 = 85% 3 Liaison by allied health: 28/40 = 70% 4 Automatic Electronic: 52/75 = 69%

CAD, Coronary Artery Disease; MI, Myocardial Infarction; ACS, Acute Coronary Syndrome; PCI, Percutaneous Coronary Intervention; CABG, Coronary Artery Bypass Grafting; SA, Stable Angina; PVD, Peripheral Vascular Disease; RCT, Randomized Controlled Trial; CR, Cardiac Rehabilitation; USA, United States of America; UK, United Kingdom; OR, Odds ratio; CI, Confidence Interval; PET, Patient Education Tool

* Numerator and denominator data not available

[†] Updated preliminary results are presented in the discussion

Table 2

Studies evaluating the effect of innovative referral strategies on CR enrollment rates

Study, Author, Year	Study design, Sample and Location	Referral Type	Source of outcome measure	Referred/total participants (%)
Grace (2007)	Observational, prospective cohort; 661 ACS patients; pre-discharge CR referral; multi-site, Canada	Automatic (electronic)	Patient self-report and CR site verification	1 Usual: 84/265 = 32% 2 Automatic Electronic: 124/241 = 52%
Grace (2004)	Observational, cross sectional comparison study; 501 CAD patients; pre-discharge CR referral; single site, Canada	Automatic (electronic)	CR site chart records and a CR provincial registry	1 Automatic (electronic): 215/501 = 43% 2 Usual referral—Province: 9796/35581 = 22% 3 Usual referral—Region: 1448/2682 = 16%
Mazzini (2008)	Observational, retrospective cohort; 780 MI inpatients; pre-discharge CR referral; single site, USA	Automatic (electronic)	Hospital records	1 Non-pathways use: 4/66 = 6% 2 GWTG pathways use: 135/714 = 19%
Mosca (1998)	Interventional, pretest-posttest study; 199 MI patients; pre-discharge CR referral; single site, USA.	Automatic (electronic)	Hospital records	1 Baseline pretest rates not provided. 2 Critical Pathway patients: 108/199 = 54%
Carroll (2007)	RCT; 247 post-MI and CABG patients; post-discharge CR referral; multi-site, USA	Liaison	Patient self-report	Data is reported post-intervention @ 6-month follow-up. 1 Standard Care Group: 29/126 = 23% 2 Treatment Group: 42/121 = 35%
Jolly (1999)	Cluster RCT; 502 MI and angina patients and outpatients; pre-discharge CR referral; multi-site, UK.	Liaison	Patient self-report	1 Control group: 70/297 = 24% 2 Intervention group: 109/262 = 42%
Leibowitz (2004)	Interventional, non-RCT; 5418 CAD patients; pre-discharge CR referral; single site, Israel	Liaison	CR site chart records	1 No control group, therefore no computation made. 2 Liaison intervention group: 1734/5418 = 32%
Pasquali (2001)	Interventional, One-group pretest posttest; 100 post-CABG patients; post-discharge CR referral; single site, USA	Liaison	Patient self-report	1 Prior to the intervention: 31/100 = 31% 2 After the intervention: 56/100 = 56%
Harkness (2005)	Observational, retrospective cohort; 3536 CABG patients; pre-discharge CR referral; single site, Canada	Automatic (manual) & Liaison	Hospital records	1 Control Group (pre-intervention): 1144/2285 = 50%

Study, Author, Year	Study design, Sample and Location	Referral Type	Source of outcome measure	Referred/total participants (%)
				<p>2 Experimental Group (post-intervention): 977/1251 = 78%</p>
Higgins (2008)	Observational, prospective cohort; 170 CABG patients; pre-discharge CR referral; single site, Australia	Automatic (manual) & Liaison	Patient self-report and CR site verification	<p>1 No control group, therefore no computation made.</p> <p>2 Automatic/Liaison: 123/170 = 72%</p>
Smith. (2006)	Observational, retrospective cohort, 3536 CABG patients, pre-discharge CR referral; single site, Canada	Automatic (manual) & Liaison	Hospital records	<p>1 No control group, therefore no computation made.</p> <p>2 Automatic (Care Map) and Liaison: 2121/3536 = 60%</p>
Suskin (2007)	RCT; 548 ACS, PCI, CABG patients, pre-discharge CR referral; single site, Canada	Automatic (Care Map) & Other	CR site chart records	<p>1 Usual Care Group = 159/273 = 58%</p> <p>2 Endorsement Group = 160/275 = 58%</p>
Wyer (2001)	RCT; 87 MI patients; post-discharge CR referral; single sit, UK	Liaison & Other	Clinician (nurse) report & CR site chart records	<p>1 Control Group: 26/44 = 59%</p> <p>2 Experimental Group: 37/43 = 86%</p>

CAD, Coronary Artery Disease; MI, Myocardial Infarction; ACS, Acute Coronary Syndrome; UA, Unstable Angina; PCI, Percutaneous Coronary Intervention; CABG, Coronary Artery Bypass Grafting; PVD, Peripheral Vascular Disease; RCT, Randomized Controlled Trial; CR, Cardiac Rehabilitation; USA, United States of America; UK, United Kingdom; MD