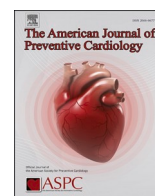


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Short Report

Internal medicine resident education improves cardiac rehabilitation knowledge, attitudes, and referral rates: A pilot study

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ABSTRACT

Background: Referrals to cardiac rehabilitation (CR) remain low despite evidence showing reduction in cardiovascular mortality and hospital readmissions. Resident education and awareness may be an opportunity to address barriers to CR referrals.

Methods: This pilot study involves 20 internal medicine residents rotating at an ambulatory primary care clinic. Voluntary surveys were sent through an online-based survey platform. Following survey completion, residents received a 10-minute scripted lecture and an educational handout outlining CR components, availability, indications, insurance eligibility criteria, and referral process. Surveys were redistributed 2 months post-education to assess changes in mean aggregate knowledge scores and attitude ratings on a 5-point Likert scale. CR referral rates of eligible patients pre- and post-education were obtained through review of electronic medical records.

Results: Sixteen (80%) residents completed both pre and post surveys, and 13 (81%) reported no education on CR in the prior year. There was a significant increase in mean aggregate knowledge scores on CR components (5.1 versus 7.0, $P = 0.001$), insurance coverage (2.4 versus 5.6, $P < 0.001$), and eligible diagnoses (7.1 versus 9.9, $P = 0.03$) following education. Attitudes towards CR also improved following education, particularly in self-reported comfort level with explaining CR to patients (3.69 versus 2.06, $P < 0.001$) and perceived familiarity with CR referral process (4.00 versus 2.18, $P < 0.001$). CR referrals increased from 0% (0 out of 10 eligible patients) to 33% (3 out of 9 eligible patients) over a 2-month period before and after education, respectively ($P = 0.09$).

Conclusions: Internal medicine resident knowledge and attitudes towards CR significantly improved after formal education. Although there was a modest increase in the rates of CR referrals following resident education, this pilot study was not powered to detect statistical significance.

1. Introduction

Cardiac rehabilitation (CR) is a comprehensive medically supervised program that integrates electrocardiogram-monitored exercise training, nutritional counseling, patient education, and health behavior modification to improve cardiovascular outcomes [1]. CR is a class 1A recommendation for patients following acute coronary syndrome, chronic stable angina pectoris, percutaneous coronary intervention, coronary artery bypass grafting, peripheral artery disease, stable heart failure with reduced ejection fraction less than or equal to 35%, valvular replacement, and heart transplantation within the past 12 months based

on the American Heart Association/American College of Cardiology and European Society of Cardiology guidelines [2–6]. The benefits of CR are well-supported, with longstanding evidence showing a 25% to 46% reduction in 5-year cardiovascular mortality [7–9] and a 28% decrease in hospital readmissions from cardiovascular events [10]. Studies have shown that CR participation can significantly improve functional status and quality of life. Despite these known benefits, referrals to CR remain low. In fact, over 80% of eligible patients do not participate in CR in the United States, with the lowest rates being amongst older patients (age 65 or older), women, minority populations, and those with limited fluency in English [11–15]. Studies have shown only 12.2% of Medicare

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beneficiaries with an indication for CR utilized CR [9]. Data also illustrate women were 12% less likely to receive CR referral, and Black, Hispanic, and Asian patients were 20%, 36%, and 50% less likely to receive CR referral, respectively [16].

The Million Hearts Initiative, a national effort led by the Centers for Disease Control and Prevention and the Centers for Medicare and Medicaid Services, has set a goal of 70% participation in CR for eligible patients by 2022 [17]. One strategy to promote CR utilization is reduction of physician barriers to referral through provider education. Literature on the existing knowledge base of internal medicine resident trainees and the role of structured education in bridging potential knowledge gaps or facilitating referrals is lacking. Thus, we sought to determine the effects of internal medical resident education on CR knowledge, attitudes, and referral rates in an outpatient ambulatory care setting. We hypothesized that resident education would improve CR knowledge, attitudes, and referral rates.

2. Methods

2.1. Patient population

This is a pilot study of 20 internal medicine residents rotating through an ambulatory primary care clinic at a tertiary care center. Approximately 20% of the patients seen at this clinic have a history of cardiovascular disease. This study is approved by the Cedars-Sinai Medical Center Institutional Review Board.

2.2. Data collection & analysis

Voluntary surveys were sent to 20 internal medicine residents using Google Forms. Following survey completion, residents received a 10-minute scripted lecture and educational handout based on American Heart Association guidelines. Educational material included CR components, availability, indications, insurance eligibility criteria, and referral process. CR components are defined as services provided by CR. CR coverage is defined as insurance plans that would authorize CR upon CR referral placement. CR eligibility is defined as qualifying Medicare and Medicaid diagnoses for CR referral. CR attitudes are defined as thoughts or feelings towards CR. Surveys were redistributed 2 months following education. Referral rates of eligible patients to CR were obtained through review of electronic medical records of all patients seen by internal medicine resident trainees at a primary care clinic over a 2-month period prior to education and over a 2-month period after education.

Knowledge questions consisted of multiple correct and incorrect possibilities and were adapted from a survey used in a prior study of cardiology fellowship trainees [18]. Survey questions were replicated with the exception of demographic questions, which were adjusted to account for the difference in level of training. There was a total of 5 knowledge questions with multiple possible answers: 1 question testing internal medicine resident trainees' understanding of CR components, 3 questions on insurance coverage and eligible diagnoses for CR, and 1 question assessing internal medicine resident trainees' knowledge of CR benefits. Surveys were scored by assigning 1 point for each correct answer and calculating a total score in each knowledge category. Points were not awarded or deducted for incorrect answers. Total possible scores, defined as the best score achievable, were computed for each knowledge category. A higher score represented increased knowledge. A 5-point Likert scale was utilized to assess attitudes towards CR (1 = disagree, 2 = somewhat disagree, 3 = neither agree or disagree, 4 = somewhat agree, 5 = agree).

Mean aggregate knowledge scores and attitude ratings pre- and post-education were analyzed using paired t-tests and reported as means \pm standard deviations. Shapiro-Wilk test was used to test data normality. Referral rates of eligible patients 2 months pre- and post- education were analyzed using Fisher's exact test. Statistical analyses were performed

using Microsoft Excel version 16.54 (Microsoft corporation, Redmond, WA, USA) and SPSS version 24.0 (IBM Corporation, Armonk, NY, USA).

3. Results

3.1. Participant characteristics

Sixteen residents (80%) completed pre- and post-education surveys. Nine (56%) residents were post-graduate year one, 4 (25%) were post-graduate year two, and 3 (19%) were post-graduate year three. Two (13%) residents intend to practice general medicine following training, 5 (31%) residents intend to pursue a career in cardiology, and 9 (56%) residents plan to pursue another subspecialty. Thirteen (81%) residents reported no education on CR within the past year on the pre-survey.

3.2. Outcomes

There was a significant increase in aggregate knowledge scores post-education with respect to CR components (5.1 ± 2.1 versus 7.0 ± 1.4 , $P = 0.001$), insurance coverage (2.4 ± 1.8 versus 5.6 ± 0.7 , $P < 0.001$), and eligibility (7.1 ± 4.8 versus 9.9 ± 3.4 , $P = 0.03$) (Fig. 1). Knowledge scores on eligibility improved the most (39%), followed by CR components (37%), and insurance coverage (33%). Attitudes towards CR also improved after education, particularly in self-reported comfort level with explaining CR to patients (3.69 versus 2.06, $P < 0.001$) and perceived familiarity with CR referral process (4.00 versus 2.18, $P < 0.001$). Residents disagreed on lacking time to refer patients to CR, were not skeptical of CR benefits, did not feel that patient comorbidities hindered CR participation, did not feel they were less likely to refer older patients, did not think that CR referral was another provider's responsibility, did not agree that CR referral was inconvenient, did not assume that patients were unlikely to attend CR, and did not believe that CR was cost ineffective. These perceptions were comparable before and after education (Table 1).

CR referrals increased from 0% (0 out of 10 eligible patients) to 33% (3 out of 9 eligible patients) over a 2-month period before and after education, respectively ($P = 0.09$). Three separate residents entered the 3 referrals, of which, one was in post-graduate year 1 and the other two were in post-graduate year 2 of training. Of these 3 residents, 1 resident was interested in pursuing cardiology fellowship, while the other 2 were pursuing other subspecialties. The referred patients ranged in age from 36 to 79 years old and 67% were female. Of the 3 patients referred to CR, 1 identified as non-Hispanic white, 1 as Hispanic white, and 1 as non-Hispanic black. The indications for these 3 referrals were percutaneous coronary intervention, heart failure with reduced ejection fraction, and peripheral arterial disease, respectively. Among the 6 eligible patients not referred, ages ranged from 53 to 74 years old and 67% were male. Two identified as non-Hispanic white, 2 as Hispanic, 1 as non-Hispanic black, and 1 as Asian. Three of these 6 patients had percutaneous coronary intervention, 2 had heart failure with reduced ejection fraction, and 1 had stable angina.

4. Discussion

This study investigated changes in CR knowledge scores, attitude ratings, and referral rates following education of internal medicine residents. While prior studies have identified physician referrals as a major barrier to CR, data on the role of resident trainee education on improving referral rates is lacking [19–21]. To our knowledge, this is the first study exploring the impact of education on CR referral rates among internal medicine resident trainees with a description of knowledge or attitudes before and after structured CR education.

After CR education, there was a significant increase in knowledge of CR components, coverage, and eligibility following education. Resident attitude ratings also improved after education, particularly in self-reported comfort level explaining CR and perceived familiarity with

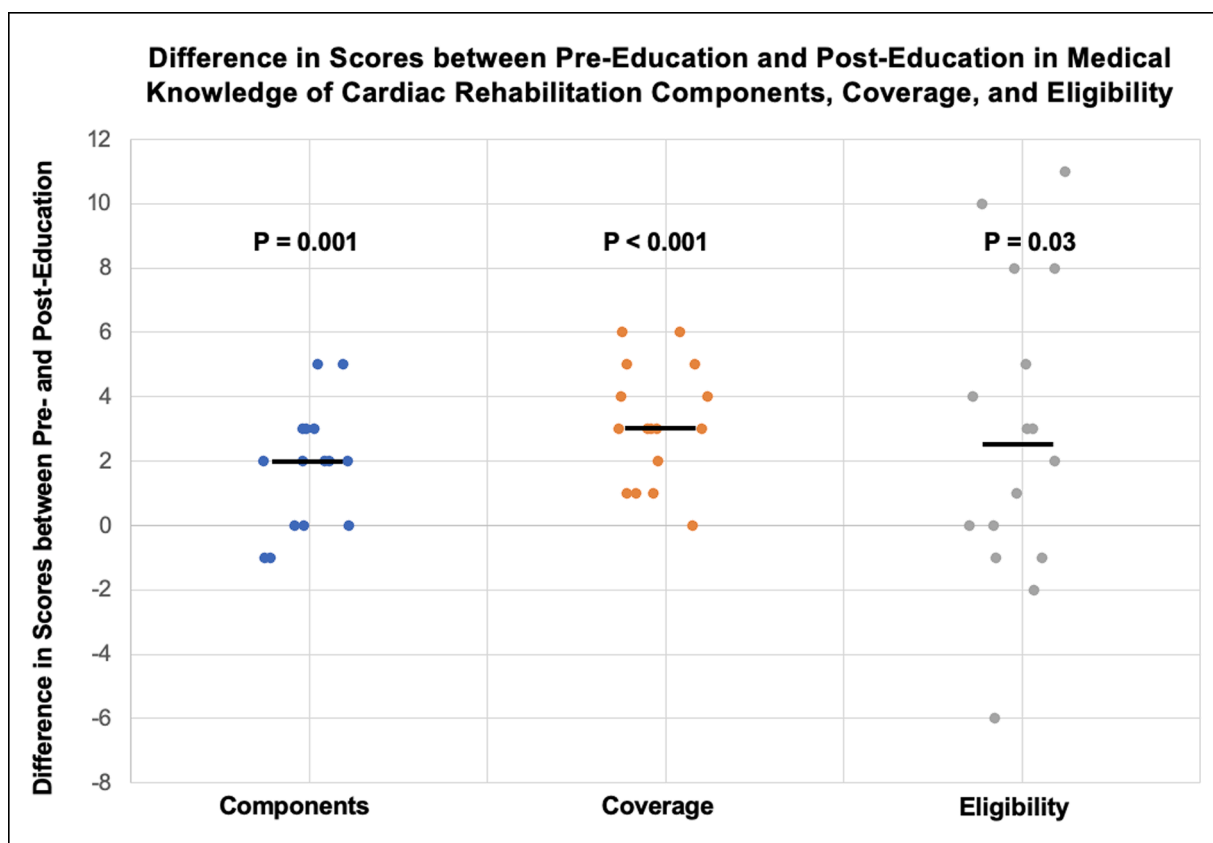


Fig. 1. Changes in knowledge scores following education. The dot-plot demonstrates the differences in scores pre-and post-education with the central line showing the median for the data. There was a significant increase in aggregate knowledge scores post-education with respect to cardiac rehabilitation components ($P = 0.001$), insurance coverage ($P < 0.0001$), and eligible diagnoses ($P = 0.03$).

Table 1

Resident attitude on cardiac rehabilitation pre- and post-education. Attitudes towards CR improved after education, particularly in self-reported comfort level with explaining CR to patients ($P < 0.001$) and perceived familiarity with CR referral process ($P < 0.001$). A 5-point Likert scale was utilized to assess attitudes towards CR (1 = disagree, 2 = somewhat disagree, 3 = neither agree or disagree, 4 = somewhat agree, 5 = agree).

Attitude	Pre-Education (Mean ± SD)	Post-Education (Mean ± SD)	P-value
Lack time	2.31 ± 1.30	1.88 ± 1.02	0.22
Unsure of qualifying diagnosis	4.31 ± 0.70	1.94 ± 0.93	<
Unsure of insurance coverage	4.63 ± 0.50	1.94 ± 0.93	<
Skeptical of benefits	1.25 ± 0.45	1.31 ± 0.60	0.67
Comorbidities hinder participation	2.25 ± 1.29	1.69 ± 1.08	0.10
Other provider's responsibility	1.75 ± 0.93	1.44 ± 0.73	0.26
Less likely to refer older patients	1.94 ± 1.00	1.56 ± 0.81	0.27
Inconvenient to refer	1.81 ± 0.98	1.50 ± 0.73	0.31
Patient unlikely to attend	2.88 ± 1.31	2.75 ± 1.39	0.80
Not cost-effective	1.94 ± 0.85	1.44 ± 0.73	0.10
Sometimes forget	4.25 ± 0.77	3.50 ± 0.89	0.01
Unfamiliar with referral process	4.00 ± 1.15	2.18 ± 1.11	<
Uncomfortable explaining CR	3.69 ± 1.30	2.06 ± 1.06	<

the referral process. Although not powered to detect a significant difference, resident education on CR led to a 33% increase in CR referrals.

These findings suggest that structured resident education on CR is

effective in addressing physician knowledge gaps and has a role in changing referral habits in trainees. A previous study of cardiology fellowship trainees had similar findings of low CR knowledge scores and poor understanding of the physician referral processes [18]. Further, the majority of the internal medicine residents reported that they did not receive any formal education on CR over the past 1 year during their residency training. This suggests that CR is underemphasized in the curriculum of trainees and hence may contribute to the lack of CR knowledge and awareness amongst physicians.

This study also helped elucidate attitudes towards CR amongst internal medicine resident trainees. Resident trainees disagreed that patient-oriented factors were barriers to CR referrals. Resident trainees endorsed having unfamiliarity with the referral process, discomfort explaining CR, and forgetfulness to place referrals. Following education, resident trainees displayed significant changes in the aforementioned sentiments. Improvements in self-reported comfort levels and familiarity are particularly important as increased physician knowledge of CR benefits and indications may lead to stronger recommendations to patients, consequently leading to higher CR participation. In fact, a recent study demonstrated that the strength of physician recommendation for CR is a major positive predictor for CR participation [22]. Physicians practicing general internal medicine have an important role in providing comprehensive cardiac care and may have more frequent patient follow-up, allowing for more opportunities to engage patients and encourage patient enrollment. In addition, internal medicine resident trainees did not feel CR referrals were the responsibility of another provider, which refutes the possibility they were deferring to cardiologists to refer their patients to CR. Overall, this study demonstrates the feasibility of training internal medicine residents about CR, which may serve as one solution to addressing its widespread underutilization.

This study should be interpreted in the context of several limitations.

First, our study is a pilot study and thus was not powered to detect statistical significance. Secondly, as this is a small single-center study at a tertiary academic center, our findings may not be generalizable to other institutions. Impact of specialty on measured outcomes is unknown as trainees from primary-care specialties beyond internal medicine were absent from the study. In addition, while we gathered data on referral rates, CR enrollment or participation rates were not tracked. As resident physicians were only followed for 2 months following education, it remains unknown if the improvement in referral rates will be sustained. Larger, multi-center, observational studies with longer follow-up are needed to validate our findings.

The strength of this study is that it demonstrated the feasibility of using structured education to improve CR knowledge, attitudes, and referrals amongst internal medicine resident trainees. This study also demonstrated that online-based survey platforms can be used to assess the impact of structured education in addressing CR knowledge gaps and attitudes. One suggestion for future studies is to implement and investigate the impact of a nationwide training curriculum through a partnered organization, such as the American Heart Association.

5. Conclusion

Internal medicine resident knowledge and attitudes towards CR significantly improved after formal education. Although there was a modest increase in the rates of CR referrals following resident education, this pilot study was not powered to detect statistical significance. Further investigations are needed to determine the role of resident education in improving CR referrals.

6. Author contributions

Concept and design: M.W., N.T., and C.L.S.

Acquisition, analysis, or interpretation of data: M.W. and N.T.

Drafting of the manuscript: M.W. and N.T.

Critical revision of the manuscript for important intellectual content:

C.N.B, J.W., and C.L.S.

Declaration of Competing Interest

Dr. C. Noel Bairey Merz serves as Board of Director for iRhythm, fees paid through CSMC from Abbott Diagnostics and Sanofi. Dr. Janet Wei served on an advisory board for Abbott Vascular. All other authors have no disclosures to report.

Disclosure Statement

Dr. Bairey Merz has received an honorarium from Abbott Diagnostics and serves as a board director for iRhythm. Dr. Wei is on the advisory board for Abbott Vascular. All other authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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