CBE ID

0642

Title

Cardiac Rehabilitation Patient Referral From an Inpatient Setting

Project

Management of Acute Events, Chronic Disease, Surgery, and Behavioral Health

Endorsement Status

Endorsed

Is Under Review

No

Next Maintenance Cycle

Spring 2030

Previous Endorsement Cycle

Spring 2025

Initial Endorsement

Tue, 05/04/2010 - 15:18

Steward

American College of Cardiology

1.0 New or Maintenance

Maintenance

1.1 Measure Structure

Single Measure

1.3 Electronic Clinical Quality Measure (eCQM)

No

1.6 Measure Description

Percentage of patients aged 18 years and older admitted to a hospital with a primary diagnosis of an acute myocardial infarction or chronic stable angina or who during hospitalization have undergone coronary artery bypass (CABG) surgery, a percutaneous coronary intervention (PCI), cardiac valve surgery (CVS), or cardiac transplantation who are referred to an early outpatient cardiac rehabilitation/secondary prevention program.

1.7 Measure Type

Process

1.8 Level of Analysis

Facility

1.9 Care Setting

Hospital: Inpatient

1.10 Measure Rationale

Cardiac rehabilitation/secondary prevention programs (CR/SP) improve patient outcomes, including quality of life, function, recurrent myocardial infarction, and mortality and participation can be cost-effective when compared to usual care (Dibben, 2021). Even with the long-standing evidence and clinical recommendations supporting referral to these programs, rates continue to be lower than desired and specific populations may be less likely to receive these referrals. Even with the ongoing efforts of organizations such as the American College of Cardiology, American Heart Association, and Million Hearts initiative, generally low rates are reported such as less than 35% across the U.S. with variation across states and for specific populations, including women and minorities (Ades, 2017; Li, 2018). This measure ensures that those individuals who were hospitalized with an event (i.e., myocardial infarction [MI], chronic stable angina, or who during hospitalization have undergone coronary artery bypass graft surgery [CABG], percutaneous coronary intervention [PCI], cardiac valve surgery, and/or heart transplantation) are referred to one of these programs prior to discharge as the use of systematic referral processes and tools have been shown to increase CR/SP referral (Whitler, 2024).

References:

Ades PA, Keteyian SJ, Wright JS, et al. Increasing Cardiac Rehabilitation Participation From 20% to 70%: A Road Map from the Million Hearts Cardiac Rehabilitation Collaborative. *Mayo Clin Proc*. 2017;92(2):234-242. doi:10.1016/j.mayocp.2016.10.014

Dibben G, Faulkner J, Oldridge N, et al. Exercise-based cardiac rehabilitation for coronary heart disease. *Cochrane Database Syst Rev*. 2021;11(11):CD001800. Published 2021 Nov 6. doi:10.1002/14651858.CD001800.pub4

Li S, Fonarow GC, Mukamal K, et al. Sex and Racial Disparities in Cardiac Rehabilitation Referral at Hospital Discharge and Gaps in Long-Term Mortality. *J Am Heart Assoc*. 2018;7(8):e008088. Published 2018 Apr 6. doi:10.1161/JAHA.117.008088

Whitler C, Varkoly KS, Patel H, et al. Improved Cardiac Rehabilitation Referral Rate Utilizing a Multidisciplinary Quality Improvement Team. *Cureus*. 2024;16(5):e61157. Published 2024 May 27. doi:10.7759/cureus.61157

1.13 Data Dictionary

Attached

1.13a Attach Data Dictionary

PCI_V5.0_DataDictionaryFullSpecifications_.pdf

1.14 Numerator

Number of eligible patients with a qualifying event/diagnosis who were referred to an outpatient Cardiac Rehabilitation/Secondary Prevention (CR/SP) program prior to hospital discharge. (Note: the program may include a traditional CR/SP program based on face-to-face interactions and training sessions or may include other options such as home-based approaches. If alternative CR/SP approaches are used, they should be designed to meet appropriate safety standards and deliver effective, evidence-based services.)

1.14a Numerator Details

Patients who are referred to an outpatient CR/SP program prior to hospital discharge.

A referral is defined as:

- an official communication between the healthcare provider and the patient to recommend and carry out a referral order to an early outpatient cardiac rehabilitation program. This includes:
  - the provision of all necessary information to the patient that will allow the patient to enroll in an early outpatient cardiac rehabilitation program
  - a communication between the healthcare provider or healthcare system and the cardiac rehabilitation program that includes the patient´s enrollment information for the program.
  - A hospital discharge summary or office note may be potentially formatted to include the necessary patient information to communicate to the cardiac rehabilitation program [the patient´s cardiovascular history, testing, and treatments, for instance.]
  - All communications must maintain appropriate confidentiality as outlined by the 1996 Health Insurance Portability and Accountability Act (HIPAA).

1.15 Denominator

Qualifying events include all patients aged 18 years and older hospitalized with primary diagnosis of myocardial infarction (MI), chronic stable angina, or who during hospitalization have undergone coronary artery bypass graft surgery (CABG), percutaneous coronary intervention (PCI), cardiac valve surgery, and/or heart transplantation.

1.15a Denominator Details

Patients who are hospitalized with one of the following qualifying events:

- Primary diagnosis of myocardial infarction (MI)

- Primary diagnosis of chronic stable angina
- Underwent coronary artery bypass graft surgery (CABG), percutaneous coronary intervention (PCI), cardiac valve surgery, and/or heart transplantation during the hospitalization

1.15b Denominator Exclusions

The exclusions for this measure are:

- Patients who expired before discharge.
- Discharge location of “other acute hospital, hospice, or against medical advice”.

Exceptions include:

- Medical factors (e.g., patient deemed by provider to have a medically unstable, life-threatening condition).
- Health care system factors (e.g., no cardiac rehabilitation/secondary prevention (CR/SP) program available within 60 min of travel time from the patient’s home).

1.15c Denominator Exclusions Details

NCDR distinguishes between absolute “Exclusions” (e.g., death) and relative “Exceptions”, (e.g., contraindications). Patients with exclusions are always automatically removed from the denominator and numerator; exceptions allow clinicians the opportunity to identify an intervention/process/medication as not clinically indicated based on the individual circumstances. Patients are removed from the denominator if they have an exception documented.

Exclusions:
- Patients who expired before discharge.
- Discharge location of “other acute hospital, hospice, or against medical advice”

Exceptions:

Exceptions criteria require documentation of one or more of the following factors that may prohibit cardiac rehabilitation participation:
- Medical factors (e.g., patient deemed by provider to have a medically unstable, life-threatening condition).
- Health care system factors (e.g., no cardiac rehabilitation/secondary prevention (CR/SP) program available within 60 min of travel time from the patient’s home).

Exceptions:
All eligible patients who can participate in even a low intensity exercise program and who have

the cognitive ability to carry out the individualized education and counseling to life-long secondary prevention efforts should be referred to cardiac rehabilitation/secondary prevention programs, because morbidity and mortality benefits extend to nearly all patient populations, regardless of age or co-morbidities. As a result, the exception examples included in the performance measure relate to either the patient's inability unable to actively attend an exercise program (due to physical or practical obstacles) or to cognitive deficits which make them unable to actively participate in exercise or to apply secondary prevention recommendations.

Examples, justification, and data collection issues for exceptions for this measure:

1. Medical factors (e.g., patient deemed by provider to have a medically unstable, life-threatening condition): Medically unstable, life-threatening conditions are contraindications to aerobic exercise and require medical efforts to stabilize and reverse those conditions, rather than efforts directed at secondary prevention of cardiovascular disease. Objective criteria for contraindications to exercise training are included in AHA, ACC, and AACVPR statements and guidelines, which are readily available to practicing clinicians and abstractors. After the condition has been stabilized or reversed, then referral to CR/SP is appropriate. Providers document the specific reason for this exception in clinical notes, summaries and problem lists, which can be abstracted.
2. Health care system factors (e.g., no cardiac rehabilitation program available within 60 minutes of travel time from the patient's home): Although some patients may do so, it is not practical to expect a patient to drive for 2 hours 2 or 3 times per week in order to attend a program that lasts for 1 to 2 hours and research has shown that distance to CR/SP is inversely correlated with attendance We chose 60 minutes (assuming average 30 mph driving speed) based on published data showing that the adjusted odds ratio (OR) to attend CR/SP decreased as the distance from patient zip code to nearest CR/SP facility increased, with the greatest decline between 10.2 (6.5-14.9) miles (OR 0.58) to 31.8 (15.0-231.0) miles (OR 0.29). Although alternative delivery models such as those using telemedicine or home care may be developed in the future to provide CR/SP, currently there is no reimbursement for these programs. Therefore, it is unreasonable to hold the provider responsible to refer a patient to a program that he/she is highly unlikely to attend. Providers can determine availability of CR/SP programs from on-line or local resources and document this exception in the medical record. Abstractors can verify the exceptions by cross-referencing the patient's address with publicly available lists of CR/SP program locations.

1.15d Age Group

Adults (18-64 years), Older Adults (65 years and older)

1.16 Type of Score

Rate/proportion

1.17 Measure Score Interpretation

Better performance = Higher score

1.18 Calculation of Measure Score

1. Determine the discharge date and location.
2. Remove patients whose discharge status is deceased or discharge location is other acute hospital, hospice, or against medical advice
3. Confirm that the patient received one of the qualifying events.
4. If yes, then keep this patient.

5. If eligible for cardiac rehabilitation referral and referral was made, then code “Yes”

   If eligible for cardiac rehabilitation referral and referral was not made but a medical or health system reason was documented, then code “exception.”

   If eligible for cardiac rehabilitation referral and referral was not made, then code “No, not referred”

6. If any “No, not referred” present, then performance not met. Else, performance met.

1.19 Measure Stratification Details

This measure is not stratified.

1.20 Types of Data Sources

Registries

1.21a Data Collection Tool URL(s)

http://example.com

1.25 Data Source Details

National Cardiovascular Data Registry (NCDR®) CathPCI Registry® and and CPMI Registry®

1.26 Minimum Sample Size

No minimum sample size is required.

2.1 Attach Logic Model

0642 EM-Logic-Model.docx

2.2 Evidence of Measure Importance

This clinical quality measure is based on three evidence-based clinical guidelines:

- 2025 ACC/AHA/ACEP/NAEMSP/SCAI guideline for the management of patients with acute coronary syndromes
- 2023 AHA/ACC/ACCP/ASPC/NLA/PCNA guideline for the management of patients with chronic coronary disease
- 2021 ACC/AHA/SCAI guideline for coronary artery revascularization

These guidelines explicitly recommended cardiac rehabilitation referral for patients with a primary diagnosis of an acute myocardial infarction or chronic stable angina or who during hospitalization have undergone coronary artery bypass (CABG) surgery, a percutaneous coronary intervention (PCI), cardiac valve surgery (CVS), or cardiac transplantation. These programs provide an opportunity to decrease morbidity and mortality and improve a patient's functional status and quality of life.

The following evidence statements are quoted verbatim from the referenced clinical guidelines:

2025 ACC/AHA/ACEP/NAEMSP/SCAI guideline for the management of patients with acute coronary syndromes (ACS)

Patients with ACS should be referred to an outpatient CR program prior to hospital discharge to reduce death, MI, hospital readmissions and improve functional status and QOL. Class of Recommendation: 1 Level of Evidence: A

2023 AHA/ACC/ACCP/ASPC/NLA/PCNA guideline for the management of patients with chronic coronary disease (CCD)

All patients with CCD and appropriate indications*†‡ should be referred to a cardiac rehabilitation program to improve outcomes. Class of Recommendation: 1 Level of Evidence: A*, B-R†, C-LD‡

*After recent MI, PCI, or CABG †With stable angina or after heart transplant ‡After recent spontaneous coronary artery dissection event

2021 ACC/AHA/SCAI guideline for coronary artery revascularization

In patients who have undergone revascularization, a comprehensive cardiac rehabilitation program (home based or center based) should be prescribed either before hospital discharge or during the first outpatient visit to reduce deaths and hospital readmissions and improve quality of life. Class of Recommendation: 1 Level of Evidence: A

References:

Lawton JS, Tamis-Holland JE, Bangalore S, Bates ER, Beckie TM, Bischoff JM, Bittl JA, Cohen MG, DiMaio JM, Don CW, Fremes SE, Gaudino MF, Goldberger ZD, Grant MC, Jaswal JB, Kurlansky PA, Mehran R, Metkus TS Jr, Nnacheta LC, Rao SV, Sellke FW, Sharma G, Yong CM, Zwischenberger BA. 2021 ACC/AHA/SCAI guideline for coronary artery revascularization: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. J Am Coll Cardiol. 2022;79:e21-e129.

Rao SV, O'Donoghue ML, Ruel M, Rab T, Tamis-Holland JE, Alexander JH, Baber U, Baker H, Cohen MG, Cruz-Ruiz M, Davis LL, de Lemos JA, DeWald TA, Elgendy IY, Feldman DN, Goyal A, Isiadinso I, Menon V, Morrow DA, Mukherjee D, Platz E, Promes SB, Sandner S, Sandoval Y, Schunder R, Shah B, Stopyra JP, Talbot AW, Taub PR, Williams MS. 2025 ACC/AHA/ ACEP/NAEMSP/SCAI guideline for the management of patients with acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. JACC. Published online February 27, 2025. https://doi.org/10.1016/j.jacc.2024.11.009

Virani SS, Newby LK, Arnold SV, Bittner V, Brewer LC, Demeter SH, Dixon DL, Fearon WF, Hess B, Johnson HM, Kazi DS, Kolte D, Kumbhani DJ, LoFaso J, Mahtta D, Mark DB, Minissian M, Navar AM, Patel AR, Piano MR, Rodriguez F, Talbot AW, Taqueti VR, Thomas RJ, van Diepen S, Wiggins B, Williams MS. 2023 AHA/ACC/ACCP/ ASPC/NLA/PCNA guideline for the management of patients with chronic coronary disease: a report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines. J Am Coll Cardiol. 2023;82:833-955.

2.4 Performance Gap

CathPCI Registry

We identified 649,444 patients from 1637 hospitals eligible for the CR/SP measure during the 12-month time period between July 1, 2023, and June 30, 2024. This was the most recent 12 months of data at the time of the analyses. Overall, 521,658 (80.3%) patients were referred to outpatient cardiac rehabilitation, whereas 127,786 (19.7%) were not referred.

- Average age of those referred was 67.5 $\pm$ 11.6 years, whereas it was 67.9 $\pm$ 11.5 years among those who were not referred.
- Among those referred to cardiac rehabilitation, 69.4% were men and 30.6% were women. This was similar to those who were not referred: 70.1% men and 29.9% women
- Among those referred, 87.0% were White, 8.9% were Black, 3.4% were Asian, and 0.7% were other. Among those not referred, 83.3% were White, 9.3% were Black, 6.6% were Asian, 0.8% were other.
- There did not appear to be differences in cardiac rehabilitation referral rates by insurance

status.

When examined at the hospital site level, table 3 in the attached document summarizes the mean (minimum, maximum) referral rate for each decile, as well as the number of hospitals and patients in each decile.

CPMI Registry

We identified 113,184 patients from 584 hospitals eligible for the CR/SP measure during the 12-month time period between October 1, 2023, and September 30, 2024. This was the most recent 12 months of data at the time of the analyses. Overall, 100,095 (88.4%) patients were referred to outpatient cardiac rehabilitation, whereas 13,089 (11.6%) were not referred.

- Average age of those referred was 65.2 ± 12.6 years, whereas it was 67.3 ± 13.7 years among those who were not referred.
- Among those referred to cardiac rehabilitation, 68.1% were men and 31.9% were women, whereas it was 60.6% men and 39.4% women among those not referred.
- Among those referred, 85.4% were White, 10.9% were Black, 2.8% were Asian, and 0.9% were other. Among those not referred, 82.1% were White, 14.9% were Black, 2.4% were Asian, 0.6% were other.
- Among those referred for cardiac rehabilitation, patients with private insurance appeared to be more likely to receive a referral whereas patients with Medicaid were less likely.

When examined at the hospital site level, table 4 in the attached document summarizes the mean (minimum, maximum) referral rate for each decile, as well as the number of hospitals and patients in each decile.

Table 1. Performance Scores by Decile

Performance Gap

	Overall	Minimum	Decile_1	Decile_2	Decile_3	Decile_4	Decile_5	Decile_6	Decile_7	Decile_8	Decile_9	Decile_10	Maximum
Mean Performance Score	0.803	0	.055	.420	.707	.843	.905	.938	.962	.979	.991	1.00	1.00
N of Entities			163	164	164	163	164	164	163	162	166	164	
N of Persons / Encounters / Episodes			51720	58443	66184	62653	74909	68328	72913	70806	70259	53229	

2.4a Attach Performance Gap Results

CBE #0642 - Tables and Figures_0.pdf

2.6 Meaningfulness to Target Population

This measure was developed with input from a technical expert panel that included patient and caregiver representation. As regaining function and preserving and improving quality of life is the goal of most patients, increasing the rates of referrals to cardiac rehabilitation/secondary prevention programs is easily understood and will help patients in understanding the quality of care provided by facilities and in making decisions about where to receive their care.

3.1 Contributions Towards Closing Care Gaps

Use of this measure can help identify potential referral differences based on patient demographics. In this submission, we found some differences in cardiac rehabilitation referral rates in both the CathPCI and CPMI registries. Given the large sample size, we calculated standardized differences to see if cardiac rehabilitation referral rates differed by patients' demographics and insurance status. A standardized difference of >10% would indicate a significant difference.

CathPCI registry

As seen in table 5 in the attached, we found no differences in cardiac rehabilitation referral rates by patients' age, sex, or insurance status (standardized differences <10%). However, patients with Medicaid insurance were less likely to receive a cardiac rehabilitation referral than other insurance types (standardized difference of 14.9 %).

CPMI registry

As seen in table 6 of the attached, we found significant differences in cardiac rehabilitation referral rates by patients' age, sex, race and insurance status. Younger patients were more likely to be referred than older patients. Men were more likely to be referred for cardiac rehabilitation than women. White patients were more likely to be referred and Black patients were less likely to be referred. Finally, patients with private insurance were more likely to receive a cardiac rehabilitation referral whereas Medicaid patients were less likely to be referred.

These findings underscore potential disparities in cardiac rehabilitation referral rates based on patients' demographics and insurance status.

4.1a Data Structure and Availability

The data elements required to generate this measure are abstracted from a medical record by someone other than person obtaining original information (e.g., chart abstraction for quality measure or registry). All data elements are available in defined fields in electronic clinical data (e.g., clinical registry). This measure uses clinical data from the NCDR CathPCI and CPMI Registries. This measure has been in use for more than 15 years and as a result, while these registries continue to monitor the feasibility and data collection burden of this measure, minimal changes to how the data are collected and reported have been required in recent years. We outline the general process used by any hospital reporting to an NCDR registry below.

Availability:
Participating hospitals report patient demographics, medical history, risk factors, hospital presentation, procedural details, medications, laboratory values and in-hospital outcomes as the key activity of participating in the NCDR registries. All of the required data elements for this measure are routinely generated and acquired during the hospitalization. Electronic extraction of data recorded as part of the procedure expedites data collection. This strategy offers point of care data collection and minimizes time and cost. Institutions can manually report using a free web-based tool or automate the reporting by using certified software developed by third-party vendors.

Sampling:
There is no sampling of patient data allowed within the contractual terms of participation in the NCDR registries. Section 2.b of the NCDR Master Agreement with participants includes 'Participant Responsibilities': "b. Use of ACCF Data Set and ACCF-Approved Software. Participant will submit a data record on each patient who receives medical care and who is eligible for inclusion in the Registries in which Participant is participating under this Agreement." Patients are selected for inclusion by reviewing existing medical records and no direct interaction with the patient is required outside of the normal course of care. There is no discrimination or bias with respect to inclusion on the basis of sex, race, or religion.

4.1b Implementation Costs and Burden

This measure was developed and designed to be used across other organizations and by other measure implementers. The fee and licensing information include below is specific to NCDR program requirements:

The NCDR provides evidence-based solutions for cardiologists and other medical professionals committed to excellence in cardiovascular care. NCDR hospital participants receive confidential benchmark reports that include access to measure macro specifications and micro specifications, the eligible patient population, exclusions, and model variables (when applicable). In addition to hospital sites, NCDR Analytic and Reporting Services provides consenting hospitals' aggregated data reports to interested federal and state regulatory agencies, multi-system provider groups, third-party payers, and other organizations that have an identified quality improvement initiative that supports NCDR-participating facilities. Lastly, the ACCF also allows for licensing of the measure specifications outside of the Registry.

Measures that are aggregated by ACCF and submitted to NQF are intended for public reporting and therefore there is no charge for a standard export package. However, on a case-by-case basis, requests for modifications to the standard export package will be available for a separate charge.

4.1c Confidentiality

Each NCDR institution signs a Participant Agreement with the American College of Cardiology Foundation ("ACCF") including a Business Associate Agreement and Data Use Agreement. The NCDR requires the collection of protected health information as such term is defined by the Health Insurance Portability and Accountability Act of 1996 as amended ("HIPAA"). Submission of Protected Health Information is considered permissible as a healthcare operations disclosure not requiring a HIPAA authorization from individuals. Consistent with the requirements of HIPAA, ACCF has designed a comprehensive security program that protects the confidentiality, integrity and availability of protected health information through the implementation of administrative, physical, and technical safeguards. ACCF's security program was designed using the NIST Cybersecurity Framework. ACCF periodically conducts an independent control assessment to confirm alignment with the HIPAA Security Rule and NIST Cybersecurity Framework. This measure does not include a patient survey. There is no added procedural risk to patients through involvement in the NCDR and no testing, time, risk, or procedures beyond those required for routine care are imposed.

4.3 Feasibility Informed Final Measure

This measure has been in use for more than 15 years and as a result, while these registries continue to monitor the feasibility and data collection burden of this measure, minimal changes to how the data are collected and reported have been required in recent years.

4.4 Proprietary Information

Proprietary measure or components with fees

4.4a Fees, Licensing, or Other Requirements

External uses who choose to use a performance measure must sign a licensing agreement with the ACCF. Depending on the circumstance ACCF may charge a licensing fee for such license.

5.1.1 Data Used for Testing

The following datasets were used:

- CathPCI registry during the 12-month period between July 1, 2023, and June 30, 2024.
- CPMI registry during the 12-month period between October 1, 2023, and September 30, 2024.

5.1.1a Dates of Testing Data

Field not required Spring 2025

5.1.2 Differences in Data

We report measure reliability statistics for the CR/SP measure separately for each dataset.

5.1.3 Characteristics of Measured Entities

U.S. hospitals identified from the ACCF CathPCI and the AHA CPMI registries were analyzed. We sought a variety of hospitals, based on varied geographical locations, community sizes, and hospital types/sizes.

CathPCI Registry:

The CathPCI Registry is an in-patient registry that collects information on patients who have been undergone PCI at a hospital. Testing results are included from 649,444 patients from 1637 inpatient centers participating in the ACCF CathPCI Registry between July 1, 2023 and June 30, 2024.

CPMI Registry:

The CPMI Registry is an in-patient registry of ACCF and AHA that collects information on patients who have been admitted to a participating in-patient center due to a myocardial infarction. Testing results are included from 113,184 patients from 584 inpatient centers participating between October 1, 2023 and September 30, 2024.

5.1.4 Characteristics of Units of the Eligible Population

CathPCI Registry

Of the 649,444 patients eligible for the CR/SP measure during the 12-month time period between July 1, 2023, and June 30, 2024:

- Mean age was 67.6 years, with a standard deviation of 11.6 years
- Sex: 451,348 (69.5%) were men and 198,096 (30.5%) were women
- Race was available for 619,930 patients. Of these, 535,071 (86.3%) were White, 55,780 (9.0%) were Black, 25,131 (4.1%) were Asian, and 3948 (0.6%) were other.
- Approximately half of patients had Medicare insurance.

As seen in table 7 of the attached, 521,658 (80.3%) patients were referred to outpatient cardiac rehabilitation, whereas 127,786 (19.7%) were not referred.

- Average age of those referred was 67.5 ± 11.6 years, whereas it was 67.9 ± 11.5 years among those who were not referred.
- Among those referred to cardiac rehabilitation, 69.4% were men and 30.6% were women. This was similar to those who were not referred: 70.1% men and 29.9% women
- Among those referred, 87.0% were White, 8.9% were Black, 3.4% were Asian, and 0.7% were other. Among those not referred, 83.3% were White, 9.3% were Black, 6.6% were Asian, 0.8% were other.
- There did not appear to be differences in cardiac rehabilitation referral rates by insurance status.

CPMI Registry

Of the 113,184 patients eligible for the CR/SP measure during the 12-month time period between October 1, 2023, and September 30, 2024:

- Mean age was 65.4 years, with a standard deviation of 12.7 years and was similar between those referred and not referred for cardiac rehabilitation.
- Sex: 76,129 (67.3%) were men and 37,055 (32.7%) were women. Rates were similar for men and women referred for cardiac rehabilitation.
- Race was available for 109,048 patients. Of these, 92,670 (85.0%) were White, 12,375 (11.3%) were Black, 3016 (2.8%) were Asian, and 987 (0.9%) were other. Rates of cardiac rehabilitation referral were higher for White patients and lower for Asian patients.
- Approximately 45% were insured by Medicare.

As seen in table 8 of the attached, 100,095 (88.4%) patients were referred to outpatient cardiac rehabilitation, whereas 13,089 (11.6%) were not referred.

- Average age of those referred was 65.2 ± 12.6 years, whereas it was 67.3 ± 13.7 years among those who were not referred.
- Among those referred to cardiac rehabilitation, 68.1% were men and 31.9% were women, whereas it was 60.6% men and 39.4% women among those not referred.
- Among those referred, 85.4% were White, 10.9% were Black, 2.8% were Asian, and 0.9% were other. Among those not referred, 82.1% were White, 14.9% were Black, 2.4% were Asian, 0.6% were other.
- Among those referred for cardiac rehabilitation, patients with private insurance appeared to be more likely to receive a referral whereas patients with Medicaid were less likely.

5.2.1 Level(s) of Reliability Testing Conducted

Accountable entity level (i.e., measure score) (e.g., signal-to-noise analysis)

5.2.2 Method(s) of Reliability Testing

Signal-to-Noise Ratio Reliability Assessment:

We performed signal-to-noise analyses for the CR/SP measure. For the signal-to-noise analysis, we followed the methodology as outlined in a Rand Corporation technical report by John L Adams. The document is available at the following URL (https://www.rand.org/content/dam/rand/pubs/technical_reports/2009/RAND_...).

Reliability of the computed measure score was measured as the ratio of signal to noise. The signal in this case is the proportion of the variability in measured performance that can be explained by real differences in physician performance. Reliability at the level of the specific physician is given by:

Reliability = Variance (physician-to-physician) / [Variance (physician-to-physician) + Variance (physician- specific-error]

Reliability is the ratio of the physician-to-physician variance divided by the sum of the physician-to- physician variance plus the error variance specific to a physician. A reliability of zero implies that all the variability in a measure is attributable to measurement error. A reliability of one implies that all the variability is attributable to real differences in physician performance.

This approach uses a beta-binomial model that assumes the hospital's score is a binomial random variable conditional on the hospital's true value that comes from a beta distribution. The beta distribution is a very flexible distribution on the interval from 0 to 1 and can have any distribution within the interval and can be skewed left or right or even U-shaped. It is the most common distribution for probabilities on the 0-1 interval. The beta-binomial model assumes the physician performance score is a binomial random variable conditional on the physician's true value that comes from the beta distribution. The beta distribution is usually defined by two parameters, alpha and beta. Alpha and beta can be thought of as intermediate calculations to get to the needed variance estimates.

5.2.3 Reliability Testing Results

Signal-to-noise ratio results from CathPCI Registry

As seen in table 9 of the attached, was high reliability across the hospitals, with a median (10^{th}, 90^{th} percentile) reliability of 0.998 (0.989, 1.00).

Signal-to-noise ratio results from CPMI Registry

As seen in table 10 of the attached, there was high reliability across the hospitals, with a median (10^{th}, 90^{th} percentile) reliability of 0.931 (0.653, 0.998.

5.2.3a Attach Additional Reliability Testing Results

CBE #0642 - Tables and Figures_1.pdf

5.2.4 Interpretation of Reliability Results

Signal to Noise Analyses:

The signal to noise ratio analysis measures the confidence levels in differentiating performance between hospitals.

- In the signal-to-noise analyses in the ACCF CathPCI registry, the median signal-to-noise ratio was 0.998 which suggests that almost all the variability is attributable to real differences, since a reliability of one implies that all the variability is attributable to real differences in physician performance.
- This was also the case for the CPMI registry, in which the median signal-to-noise ratio was 0.988.

Table 2. Accountable Entity Level Reliability Testing Results by Denominator, Target Population Size

Accountable Entity-Level Reliability Testing Results

	Overall	Minimum	Decile_1	Decile_2	Decile_3	Decile_4	Decile_5	Decile_6	Decile_7	Decile_8	Decile_9	Decile_10	Maximum
Reliability	0.995	0.906	0.974	0.991	0.995	0.997	0.998	0.999	0.999	1.00	1.00	1.00	1.00
Mean Performance Score	0.780		.055	.420	.707	.843	.905	.938	.962	.979	.991	1.00	
N of Entities			163	164	164	163	164	164	163	164	157	171	
N of Persons / Encounters / Episodes			15748	31703	48905	62328	713389	75952	90307	99357	108906	44849	

5.3.1 Level(s) of Validity Testing Conducted

Accountable entity level (i.e., measure score) (e.g., criterion validity)

5.3.2 Type of Accountable Entity Level Validity Testing Conducted

Systematic assessment of face validity of the measure’s performance score as an indicator of quality or resource use

5.3.3 Method(s) of Validity Testing

Predictive Validity

The ACC sought to assess the predictive validity of this measure using a comparator measure; however, we were unable to identify a suitable measure with available data as long-term outcome data were not available within the CathPCI or CPMI registries to examine the association between cardiac rehabilitation referral and readmissions, quality of life, or survival.

To provide evidence for the predictive validity for cardiac rehabilitation as a critical secondary prevention intervention, we reviewed three recent systematic reviews and meta-analyses of randomized trials on the efficacy of cardiac rehabilitation programs for secondary prevention in coronary artery disease, particularly in patients who had experienced myocardial infarction (MI) or had undergone coronary artery bypass grafting (CABG) or percutaneous coronary intervention

(PCI) (Mahmood, 2024; Nemani, 2023; Dibben, 2023). Evidence from these systematic reviews and meta-analyses reveals that participation in cardiac rehabilitation after these events reduces cardiovascular mortality (RR of 0.74 [95% CI: 0.64-0.86]), hospital readmissions (RR of 0.77 [95% CI: 0.67-0.89])), and recurrent myocardial infarction (RR of 0.82 [95% CI: 0.70-0.96])), thereby reducing the burden of recurrent cardiac events. (Dibben, 2023).

In terms of functional outcomes, cardiac rehabilitation improves exercise capacity and physical performance, with marked improvements in VO_2max, metabolic equivalents (METs), and six-minute walk test (6MWT) distance after participation. These improvements in physical capacity correlate with better overall patient mobility, increased independence, and enhanced quality of life (QOL) (Nemani, 2023). Additionally, cardiac rehabilitation has demonstrated beneficial effects on key physiological markers, including left ventricular ejection fraction (LVEF) and ventricular volumes (LVEDD, LVESV), contributing to improved cardiac function and reduced heart failure risk (Nemani, 2023).

Psychosocially, cardiac rehabilitation participation significantly enhanced mental health and health-related quality of life (HRQoL). This multifaceted impact—spanning physical, psychological, and social domains—directly correlates with reduced hospitalization rates, fewer recurrent cardiac events, and improved long-term recovery.

In summary, the benefits of participation in cardiac rehabilitation programs for secondary prevention is not limited to clinical markers but extends to improvements in patient well-being. These positive outcomes strongly support the integration of cardiac rehabilitation referral while the patient is hospitalized during their index admission as routine clinical practice for all eligible patients with cardiovascular disease, with standardized protocols ensuring comprehensive and evidence-based care.

Face and Content Validity

Validity Survey of Experts: After the measure was fully specified during the original measure development process, members of 3 existing committees, one at the ACC, one at AHA and one joint ACC/AHA, with expertise in general cardiology, cardiac rehabilitation, quality improvement, outcomes research, and performance measurement, who were not involved in development of the measure, were asked to review the measure specifications and rate their agreement with the following statement:

"The scores obtained from the measure as specified will provide an accurate reflection of quality and can be used to distinguish good and poor quality." The respondents recorded their rating on a scale of 1-5, where 1= Strongly Disagree; 3=Neither Agree nor Disagree; 5= Strongly Agree

To determine the content/context validity of the measures, a process using a Delphi peer review was utilized.

C. Identification of Statistically Significant & Meaningful Differences in Performance:

In CathPCI and CPMI Registries, performance rates were assessed by decile, to allow for assessment of differences between “low” and “high” performing centers.

Dibben GO, Faulkner J, Oldridge N, et al. Exercise-based cardiac rehabilitation for coronary heart disease: a meta-analysis. *Eur Heart J*. 2023;44(6):452-469. doi:10.1093/eurheartj/ehac747

Mahmood A, Ray R, Bin Salam SST, et al. The Effectiveness of Cardiac Rehabilitation Programs in Improving Cardiovascular Outcomes: Systematic Review and Meta-Analysis. *Cureus*. 2024;16(10):e72450. Published 2024 Oct 26. doi:10.7759/cureus.72450

Nemani RRS, Gade BS, Panchumarthi D, Bathula BVSR, Pendli G, Panjiyar BK. Role of Cardiac Rehabilitation in Improving Outcomes After Myocardial Infarction. *Cureus*. 2023;15(12):e50886. Published 2023 Dec 21. doi:10.7759/cureus.50886

5.3.4 Validity Testing Results

Predictive Validity

We did not identify any measures that were suitable for comparison with this measure. Our review of available evidence supporting the integration of cardiac rehabilitation referral while the patient is hospitalized during their index admission as routine clinical practice for all eligible CVD patients is discussed under 5.3.3.

Face and Content Validity from Survey of Experts:

There were 27 individuals who completed the survey. Results of the survey were as follows:

-Average score: 4.83 (5 = Strongly Agree)

-93% of respondents either agree or strongly agree that the outpatient measure can accurately distinguish good and poor quality.

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Identification of Statistically Significant & Meaningful Differences in Performance

1. **CathPCI Registry (Table 11 in the attached)**

Overall, 521,658 (80.3%) patients were referred to outpatient cardiac rehabilitation, whereas 127,786 (19.7%) were not referred. Site-level rates of referral for cardiac rehabilitation varied widely, from 0% to 100%.

2. CPMI Registry (Table 12 in the attached)

Overall, 100,095 (88.4%) patients were referred to outpatient cardiac rehabilitation, whereas 13,089 (11.6%) were not referred. Site-level rates of referral for cardiac rehabilitation varied widely, from 0% to 100%.

5.3.5 Interpretation of Validity Results

Predictive Validity

Cardiac rehabilitation as secondary prevention for coronary artery disease reduces the risk of cardiovascular mortality, recurrent myocardial infarction, and rehospitalizations. Moreover, cardiac rehabilitation improves functional exercise capacity, quality of life and mental health.

Face validity:

As noted above, our interpretation is that face and content validity has been established for this measure.

Identification of Statistically Significant & Meaningful Differences in Performance:

There is wide variation in performance for this measure, as reflected in the data from the two registries. Use of this measure allows for identification of the variation in delivery of cardiac rehabilitation referral, which is important because it provides data from which centers can identify improve upon identified gaps in care.

5.4.1 Methods Used to Address Risk Factors

No risk adjustment or stratification

6.1.1 Current Status

In use

6.1.3 Current Use(s)

Payment Program, Quality Improvement with Benchmarking (external benchmarking to multiple organizations), Quality Improvement (Internal to the specific organization)

6.1.3 Program Details

Name of the program and sponsor
CathPCI Registry®
URL of the program
https://cvquality.acc.org/NCDR-Home/registries/hospital-registries/cathpci-regi...
Purpose of the program
The CathPCI Registry® assesses the characteristics, treatments and outcomes of cardiac disease patients who receive diagnostic catheterization and/or percutaneous coronary intervention (PCI) procedures.
Geographic area and percentage of accountable entities and patients included
Geographic area is an estimated 90% of all US based cardiac cath labs. CathPCI Registry specific participants are around 1,800. Total patient records are over 22 million
Applicable level of analysis and care setting

Facility level of analysis and in-hospital care setting.

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Name of the program and sponsor
CPMI Registry®
URL of the program
https://cvquality.acc.org/NCDR-Home/registries/hospital-registries/chest-pain-m...
Purpose of the program
The CPMI Registry® is a risk-adjusted outcomes-based quality improvement that focuses on the processes of care for high-risk STEMI/NSTEMI patients and those with unstable angina or low-risk chest pain.
Geographic area and percentage of accountable entities and patients included
CPMI participation spans across 43 states and 1 US territory with the highest concentration in the Midwest and East Coast regions. CPMI registry specific participants are approximately 700. Total patient records are over 2 million.
Applicable level of analysis and care setting

Facility level of analysis and in-hospital care setting.

,
Name of the program and sponsor
The Bundled Payments for Care Improvement (BPCI) initiative
URL of the program

https://www.cms.gov/priorities/innovation/innovation-models/bundled-payments
Purpose of the program
Voluntary value-based payment model from the CMS Innovation Center to assess and improve the quality of care provided during a clinical episode, focusing on patient experience, access to care, and provider engagement
Geographic area and percentage of accountable entities and patients included
In 2024 across 47 of 50 states, about 1 in 5 (21.7%) eligible U.S. hospitals participated in BPCI Advanced, more than 1 in 4 (28.5%) eligible clinicians triggered a BPCI episode, and 1 in 5 (18.9%) hospitalizations/outpatient procedures were under BCPI
Applicable level of analysis and care setting

Facility level of analysis and in-hospital care setting.

6.2.1 Actions of Measured Entities to Improve Performance

Performance results are provided as part of quarterly performance report, which includes a rolling 4 quarters of data. These reports provide a detailed analysis of an individual institution´s performance in comparison with the entire registry population from participating hospitals across the nation. Reports include an executive summary dashboard, at-a-glance assessments, and patient level drill-downs. Registry participants also have access to an outcome report companion guide which provides common definitions and detailed metric specifications to assist with interpretation of performance rates. This information along with the other process and outcome measures included in the CathPCI and CPMI registries enables participants to identify interventions that will lead to improvement In cardiac rehabilitation referral rates.

There are a number of methods used to educate and provide general support to registry participants.

These include the following:

- Registry Site Manager Calls are available for all NCDR participants. RSM calls are provided as a source of communication between NCDR and participants to provide a live chat Q and A session on a continuous basis.
- New User Calls are available for NCDR participants and are intended for assisting new users with their questions.
- NCDR Annual Conference

The NCDR Annual Conference is a well-attended and energetic two-day program at which participants from across the country come together to hear about new NCDR and registry-specific updates. During informative general sessions, attendees can learn about topics such as transcatheter therapies, the NCDR dashboard, risk models, data quality and validation, and value-based purchasing. Attendees also receive registry updates and participate in advanced case studies covering such topics as Appropriate Use Criteria and outcomes report interpretation.

- Release notes (for outcomes reports)
- Clinical Support

The NCDR Product Support and Clinical Quality Consultant Teams are available to assist participating sites with questions Monday through Friday, 9:00 a.m. - 5:00 p.m. ET.

6.2.2 Feedback on Measure Performance

Health care facilities, physicians, data abstractors, registry steering committee members, and other stakeholders routinely provide feedback to the Registry support team via email or phone (i.e., SalesForce). Additional opportunities for detailed measure discussion can occur on bi-monthly registry site manager calls or annually at the in-person NCDR Quality Summit conference where registry management and physician leadership will explore the measure in detailed followed by an open Q&A session.

Feedback varies from detailed comments on the measure criteria, reflections, and general questions about how end-point decisions were made. When stakeholders fully understand the measure, they have expressed it is valuable in helping to guide their quality-of-care improvement efforts.

Because this measure has been in use for more than 15 years, hospitals continue to monitor their performance on this measure but feedback or questions on the specifications and reporting have been minimal given the limited number of changes made to the measure in recent years.

6.2.3 Consideration of Measure Feedback

Any criticism of the observational data on performance are escalated to the applicable ACC team(s) (i.e., Registry management, Science leadership, Data Analytic Center) for consideration. If the feedback represents an opportunity for measure improvement, the Data Analytic Center is engaged to provide data insights. These data are reviewed by the Senior NCDR Leadership & Science Leadership team which may lead to updates. If an adjustment is needed the change is approved and cascades to the various teams and implemented. The opportunity for these types of refinements is always available.

6.2.4 Progress on Improvement

CathPCI registry

As seen in figure 1 of the attached, in the CathPCI registry, rates of referrals increased from 67.5% in Q2 2018 to 81.4% in Q4 2022. This is an increase absolute rate of 13.9% (or a 20.6% relative increase) over 25 calendar quarters.

CPMI registry

As seen in figure 2 of the attached, in the CPMI registry, over 23 quarters between Q1 2019 and Q3 2024, rates of cardiac rehabilitation referral have increased from 83.2% to 88.8%, an absolute increase of 5.6% and a relative increase of 6.7%. The slower increase in the CPMI registry may suggest the beginning of a “ceiling effect” since their cardiac rehabilitation referral rates began at a higher rate at baseline.

6.2.5 Unexpected Findings

Because this is a well-established measure, we believe that the potential for unexpected findings are minimal but will continue to monitor any feedback that is received.

7.1 Supplemental Attachment

CBE #0642 - Tables and Figures.pdf

Developer POC email

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Measure Developer POC

Kathryn Goodwin
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The measure developer is different from the measure steward

No

Steward Address

Kathryn Goodwin
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Steward Organization

American College of Cardiology

Steward Organization URL

https://www.acc.org/

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