Decision Memo for Cardiac Rehabilitation (CR) Programs - Chronic Heart Failure (CAG-00437N)

Decision Summary

The Centers for Medicare & Medicaid Services (CMS) has determined that the evidence is sufficient to expand coverage for cardiac rehabilitation services under 42 C.F.R. § 410.49(b)(1)(vii) to beneficiaries with stable, chronic heart failure defined as patients with left ventricular ejection fraction of 35% or less and New York Heart Association (NYHA) class II to IV symptoms despite being on optimal heart failure therapy for at least six weeks. Stable patients are defined as patients who have not had recent (≤6 weeks) or planned (≤6 months) major cardiovascular hospitalizations or procedures.

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Decision Memo

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I. Decision

The Centers for Medicare & Medicaid Services (CMS) has determined that the evidence is sufficient to expand coverage for cardiac rehabilitation services under 42 C.F.R. § 410.49(b)(1)(vii) to beneficiaries with stable, chronic heart failure defined as patients with left ventricular ejection fraction of 35% or less and New York Heart Association (NYHA) class II to IV symptoms despite being on optimal heart failure therapy for at least six weeks. Stable patients are defined as patients who have not had recent (≤6 weeks) or planned (≤6 months) major cardiovascular hospitalizations or procedures.

II. Background

The following acronyms are used throughout this document. For the readers convenience they are listed here in alphabetical order.

AACVPR - American Association of Cardiovascular and Pulmonary Rehabilitation
ACC – American College of Cardiology
AHA - American Heart Association
CHF - chronic heart failure
CMS - Centers for Medicare & Medicaid Services
CR - cardiac rehabilitation
CVD - cardiovascular disease
CV – cardiovascular
ESC – European Society of Cardiology
ET - exercise training
EuroQol – European Quality of Life
EV - exercise volume
DSMB – data safety monitoring board
FDA - Food & Drug Administration
HF - heart failure
HFA - Heart Failure Association
HFSA - Heart Failure Society of America
HR - hazard ratio
HRQoL - health related quality of life
ICR - intensive cardiac rehabilitation
LVEF - left ventricular ejection fraction
MET - metabolic equivalent
MLHF – Minnesota Living with Heart Failure
NCA - national coverage analysis
NCD - national coverage determination
NHLBI – National Heart, Lung, and Blood Institute
NT - normal treatment
NYHA - New York Heart Association
PHI - personal health information
PTCA - percutaneous transluminal coronary angioplasty
QOL - quality of life
RCT - randomized controlled trials
VF - ventricular fibrillation
VO_2 - peak oxygen consumption
VT - ventricular tachycardia

Heart failure (HF), a condition where the heart is unable to pump enough blood throughout the body resulting in symptoms such as shortness of breath on exertion, fatigue and edema, is a common cause of morbidity and mortality in adults 65 years and older. In 2008, 1 in 9 death certificates (281,437 deaths) in the United States mentioned heart failure. HF incidence increases with age, approaching 10 per 1000 population after 65 years of age. (Roger, 2012)

In 2010, 16% of the Medicare population had heart failure (11% in beneficiaries less than 65 years, 17% 65 years and older; CMS Chartbook 2012). It is also the most common reason for hospitalizations (over 800,000 in 2008; Chen, 2011) and 30 day readmissions (over 100,000 per year 2007-2009; Dharmarajan, 2013) in the Medicare population. HF often results from acute myocardial infarction or the chronic effects of hypertension and can be divided into systolic (phase when the heart is contracting) HF and diastolic (phase when the heart is at rest) HF.

Cardiac rehabilitation (CR) was developed in the 1950s from the concept of early mobilization after acute myocardial infarction. (Pashkow, 1993) The standard of care prior to the widespread adoption of CR was bedrest and inactivity after acute myocardial infarction. (Forman, et al., 2000) In the 1970s, cardiac rehabilitation developed into highly structured, physician supervised, electrocardiographically-monitored exercise programs. However, the programs consisted almost solely of exercise alone. (Ades et al., 2000) Foreman et al. (2000) stated that "over subsequent years, CR broadened beyond exercise into a composite of cardiac risk modification. Lipid, blood pressure and stress reductions, smoking cessation, diet change, and weight loss were coupled to goals of exercise training."

The current concept of cardiac rehabilitation includes a specific exercise prescription ["the exercise prescription should include intensity (dose), frequency, duration, and the often forgotten, progression" (Pina, 2010)], behavioral and lifestyle risk factor reduction, health education, and personal counseling.

III. History of Medicare Coverage

Sections 1861(s)(2)(CC) and 1861(eee)(1) of the Social Security Act provide for coverage of items and services furnished under a CR program under part B. Among other things, Medicare regulations define key terms, address the components of a CR program, establish the standards for physician supervision, and limit the maximum number of program sessions that may be furnished. See 42 C.F.R. §410.49. The regulations also describe the cardiac conditions that would enable a beneficiary to obtain CR services. Specifically, coverage is permitted for beneficiaries who have experienced one or more of the following:

- An acute myocardial infarction within the preceding 12 months;
- A coronary artery bypass surgery;
- Current stable angina pectoris;
- Heart valve repair or replacement;
- Percutaneous transluminal coronary angioplasty (PTCA) or coronary stenting; and
- A heart or heart-lung transplant.

The regulations also establish that CMS may add "other cardiac conditions as specified through a national

coverage determination." (42 CFR §410.4(b)(vii).[1]

For Medicare coverage purposes, CR is defined as containing all of these elements: physician prescribed exercise; cardiac risk factor modification, including education, counseling, and behavioral intervention; psychosocial assessment; outcomes assessment. Physician supervision is also a requirement. At the time we issued our final regulations, the evidence was not adequate to conclude that CR was reasonable and necessary for congestive heart failure. (74 Fed. Reg. 61,738, 61,877 November 25, 2009).

A. Current Reconsideration

The American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR), American College of Cardiology (ACC), American Heart Association (AHA), and Heart Failure Society of America (HFSA) submitted a formal request for a NCD to add CHF to the list of approved indications for coverage for CR.

B. Benefit category

Medicare is a defined benefit program. An item or service must fall within a benefit category as a prerequisite to Medicare coverage [§1812 (Scope of Part A); §1832 (Scope of Part B); §1861(s) (Definition of Medical and Other Health Services)]. An item or service must meet one of the statutorily defined benefit categories in the Social Security Act and not otherwise be excluded.

As noted above, Congress specifically authorized coverage of certain items and services furnished by a qualified CR program under Part B of the Medicare program (Sections 1861(s)(2)(CC) and 1861(eee)(1)).

IV. Timeline of Recent Activities

June 04, 2013	CMS initiates this national coverage analysis for consideration of CR for chronic heart failure. The initial 30-day public comment period began with this posting date.

July 04, 2013	The initial 30-day public comment period ended.
November 21, 2013	Proposed Decision Memorandum posted. Second comment period begins.
December 21, 2013	Second comment period ended.

V. FDA

Cardiac rehabilitation services are not subject to FDA regulatory oversight.

VI. General Methodological Principles

When making national coverage determinations under §1862(a)(1)(A), CMS generally evaluates relevant clinical evidence to determine whether or not the evidence is of sufficient quality to support a finding that an item or service falling within a benefit category is reasonable and necessary for the diagnosis or treatment of illness or injury or to improve the functioning of a malformed body member. The critical appraisal of the evidence enables us to determine to what degree we are confident that: 1) the specific assessment questions can be answered conclusively; and 2) the intervention will improve health outcomes for patients. An improved health outcome is one of several considerations in determining whether an item or service is reasonable and necessary.

A detailed account of the methodological principles of study design that the agency utilizes to assess the relevant literature on a therapeutic or diagnostic item or service for specific conditions can be found in Appendix A. In general, features of clinical studies that improve quality and decrease bias include the selection of a clinically relevant cohort, the consistent use of a single good reference standard, the blinding of readers of the index test, and reference test results.

Public comments sometimes cite the published clinical evidence and give CMS useful information. Public comments that give information on unpublished evidence such as the results of individual practitioners or patients are less rigorous and therefore less useful for making a coverage determination. Public comments that contain personal health information (PHI) will be redacted and the PHI will not be made available to the public. CMS uses the initial public comments to inform its proposed decision. CMS responds in detail to the public comments on a proposed decision when issuing the final decision memorandum.

VII. Evidence

A. Introduction

In this coverage analysis, we considered evidence for CR for patients with CHF. Important health outcomes include mortality, morbidity (including adverse events), and quality of life (QOL). While QOL is an important outcome, it is more difficult to objectively measure and may be subject to potential bias in reported studies. Since CR programs as defined by statute are comprised of multicomponent interventions, variability may develop in the implementation of different programs at different centers, possibly affecting the ability to improve health outcomes. Some standardization of the key components of CR programs may help reduce site-to-site variability and enhance the likelihood of achieving improved health outcomes. We have specifically focused on exercise intervention since it is most important in strengthening the heart. Behavioral risk factor reduction is also extremely important but relevant interventions on risk factor reduction are required by our regulations at 42 C.F.R. § 410.49(b)(2).

B. Literature Search

CMS searched PubMed from 2006 to January 2014, using key words CR, exercise, and chronic or congestive heart failure. We initially focused our search on randomized controlled trials (RCTs) and large prospective observational studies that evaluated adults ≥ 65 years, although these may have excluded a portion of our Medicare beneficiaries. Observational studies with sample sizes less than 50 cases were excluded as they may have inherent biases that substantially limit generalizability. Our review included two evidence-based guidelines, four RCTs, one secondary extended analysis of a RCT, and one consensus statement. Abstracts, presentations, and articles not written in English were also excluded. In addition to our search, the requestors and public commenters submitted several published articles which were reviewed and included as appropriate.

C. Discussion of Evidence Reviewed

1. Question:

a. Is the evidence sufficient to determine that cardiac rehabilitation for Medicare beneficiaries with chronic heart failure improves health outcomes?

b. If the answer to question (a) above is yes, what are the characteristics of the beneficiary's clinical status and the cardiac rehabilitation regimen that predict improved health outcomes?

2. External technology assessment

Ades PA, Keteyian SJ, Balady GJ, Houston-Miller N, Kitzman DW, Mancini DM, Rich MW. Cardiac rehabilitation exercise and self-care for chronic heart failure. JACC Heart Fail 2013;1:540-547.

"Chronic heart failure (CHF) is highly prevalent in older individuals and is a major cause of morbidity, mortality, hospitalizations, and disability. Cardiac rehabilitation (CR) exercise training and CHF self-care counseling have each been shown to improve clinical status and clinical outcomes in CHF. Systematic reviews and meta-analyses of CR exercise training alone (without counseling) have demonstrated consistent improvements in CHF symptoms in addition to reductions in cardiac mortality and number of hospitalizations, although individual trials have been less conclusive of the latter 2 findings. The largest single trial, HF-ACTION (Heart Failure: A Controlled Trial Investigating Outcomes of Exercise Training), showed a reduction in the adjusted risk for the combined endpoint of all-cause mortality or hospitalization (hazard ratio: 0.89, 95% confidence interval: 0.81 to 0.99; p = 0.03). Quality of life and mental depression also improved. CHF-related counseling, whether provided in isolation or in combination with CR exercise training, improves clinical outcomes and reduces CHF-related hospitalizations. We review current evidence on the benefits and risks of CR and self-care counseling in patients with CHF, provide recommendations for patient selection for third-party payers, and discuss the role of CR in promoting self-care and behavioral changes."

Davies EJ, Moxham T, Rees K, Singh S, Coats AJ, Ebrahim S, Lough F, Taylor RS. Exercise based rehabilitation for heart failure. Cochrane Database Syst Rev. 2010 Apr 14;(4):CD003331. doi: 10.1002/14651858.CD003331.pub3.

Davies and colleagues reported the results of a systematic review "to update the previous systematic review which determined the effectiveness of exercise-based interventions on the mortality, hospitalization admissions, morbidity and health-related quality of life for patients with systolic heart failure." Randomized controlled trials (2001-April 2008), either parallel group or cross-over design, on exercise based interventions and comprehensive cardiac rehabilitation with follow up time of at least six months were included. Target population was adults with heart failure based on clinical findings and objective measures such as ejection fraction. Outcomes were all-cause death, deaths due to heart failure, sudden death, hospital admission or readmissions.

The review included 19 trials with 3647 heart failure patients combined. The majority of patients were from the HF-ACTION (n = 2331; O'Connor, 2009). Mean age ranged from 43 to 72 years. Four trials had follow up times greater than 12 months. The authors reported: "There was no significant difference in pooled mortality between groups in the 13 trials with < 1 year follow up. There was evidence of a non-significant trend toward a reduction in pooled mortality with exercise in the four trials with > 1 year follow up. A reduction in the hospitalisation rate was demonstrated with exercise training programmes. Hospitalisations due to systolic heart failure were reduced with exercise and there was a significant improvement in health-related quality of life (HRQoL). The effect of cardiac exercise training on total mortality and HRQoL were independent of the degree of left ventricular dysfunction, type of cardiac rehabilitation, dose of exercise intervention, length of follow up, trial quality, and trial publication date." They concluded: "The previous version of this review [2004] showed that exercise training improved exercise capacity in the short term in patients with mild to moderate heart failure when compared to usual care. This updated review provides evidence that in a similar population of patients, exercise does not

increase the risk of all-cause mortality and may reduce heart failure-related hospital admissions. Exercise training may offer important improvements in patients' health-related quality of life."

3. Internal technology assessment

Austin J, Williams WR, Ross L, Hutchison S. Five-year follow-up findings from a randomized controlled trial of cardiac rehabilitation for heart failure. Eur J Cardiovasc Prev Rehabil. 2008 Apr;15(2):162-7. doi: 10.1097/HJR.0b013e3282f10e87.

Austin and colleagues reported five year follow up results of a randomized controlled trial initially performed "to determine whether a cardiac rehabilitation programme improved on the outcomes of an outpatient heart failure clinic (standard care) for patients, over 60 years of age, with chronic heart failure." Inclusion criteria were LVEF < 40%, NYHA class II – III, and age above 60 years. Patients with significant comorbidity that would prevent entry into the study because of terminal disease or inability to exercise were excluded. Primary outcomes were functional status, quality of life and cost utility. All cause mortality was recorded in the follow up period. From January 2000 to June 2001, 200 patients were randomly assigned to cardiac rehabilitation (n = 100) or clinic based usual care (n = 100). The cardiac rehabilitation program included supervised aerobic endurance training and strengthening, health education, psychological and social support twice a week for eight weeks followed by 16 weeks of community based exercise. Standard care participants received health information and routine monitoring of clinical status ("functional performance, fluid status, cardiac rhythm, laboratory assessment").

Mean age was 72 years at baseline and 75 years at the five year follow up. Men comprised 65% of the study population. Of the 200 patients in the initial study period, 112 were in the five year group. In the initial study period, 12 patients (6%) withdrew and 9 died. Of the 179 patients, seven (4%) withdrew in the follow up period. Over the follow up period, there were 31 deaths in the rehabilitation group and 38 in the standard care group. At six months, the authors reported: "There were significant improvements in MLHF and EuroQol scores, NYHA classification and 6-min walking distance (meters) at 24 weeks between the groups (p = 0.001). The experimental group had fewer admissions (11 vs. 33, p = 0.01) and spent fewer days in hospital (41vs. 187, p = 0.001)." In the follow up period improvements in quality of life were maintained and there was no significant reduction in walking distance in the training group. The authors concluded: "A 24-week CR programme for patients with stable heart failure showed some long-term benefit at 5 years. Differences in the mean values of most of the functional and quality of life measures were evidently to the advantage of the CR group, which also showed a better exercise profile."

Belardinelli R, Georgiou D, Cianci G, Purcaro A. 10-year exercise training in chronic heart failure: a randomized controlled trial. J Am Coll Cardiol. 2012 Oct 16;60(16):1521-8. doi: 10.1016/j.jacc.2012.06.036. Epub 2012 Sep 19.

Belardinelli and colleagues reported the results of a randomized controlled trial "to determine whether a 10-year supervised moderate ET program may produce a sustained improvement in functional capacity and quality of life

in New York Heart Association (NYHA) class II and III CHF [chronic heart failure] patients." Inclusion criteria were heart failure with "clinical stability for 3 months before enrollment, left ventricular ejection fraction (LVEF) of less than 40%, and ability to exercise." Exclusion criteria were "hemodynamically significant valvular heart disease, uncontrolled diabetes mellitus and hypertension, orthopedic or neurological problems, and renal insufficiency (creatinine: > 2.5 mg/dl)." Primary outcomes were peak oxygen consumption (VO_2) and change from baseline in quality of life (Minnesota Living with Heart Failure Questionnaire). All-cause mortality and cardiovascular morbidity, defined as acute heart decompensation requiring hospitalization and adjustment of medications, unstable angina, myocardial infarction, and cardiac revascularization procedures were also considered outcomes. Of the 135 patients enrolled, 123 (91%) completed the protocol (63 in the group randomly assigned to exercise training). The program consisted of "3 sessions per week at the hospital for 2 months, then 2 supervised sessions the rest of the year" under the supervision of a cardiologist and exercise therapist. Patients in the training group also "received counseling on smoking cessation, stress reduction, and diet." The usual care participants received instructions on home physical activity and counseling on nutrition, stress reduction, smoking cessation. Mean age was 59 years. Men comprised 78% of the study population. Mean LVEF was 37% at baseline.

The authors reported significant improvements in peak VO_2, quality of life, hospital readmission and cardiac mortality (hazard ratio = 0.68; 95% CI: 0.30 to 0.82, $p < 0.001$). They concluded: "Moderate supervised ET performed twice weekly for 10 years maintains functional capacity of more than 60% of maximum VO_2 and confers a sustained improvement in quality of life compared with NT patients. These sustained improvements are associated with reduction in major cardiovascular events, including hospitalizations for CHF and cardiac mortality."

Keteyian SJ, Leifer ES, Houston-Miller N, Kraus WE, Brawner CA, O'Connor CM, Whellan DJ, Cooper LS, Fleg JL, Kitzman DW, Cohen-Solal A, Blumenthal JA, Rendall DS, Piña IL; HF-ACTION Investigators. Relation between volume of exercise and clinical outcomes in patients with heart failure. J Am Coll Cardiol. 2012 Nov 6;60(19):1899-905. doi: 10.1016/j.jacc.2012.08.958. Epub 2012 Oct 10.

Keteyian and colleagues reported an analysis of HF-ACTION (O'Connor, 2009) "to elucidate the relation between exercise volume (EV) and clinical outcomes." Of the 2,331 patients in HF-ACTION, 959 patients who were randomly assigned to the exercise training arm and were event-free for at least three months were included in the analysis. Outcomes included all-cause mortality or hospitalization, disease-specific endpoint of CV mortality, HF hospitalization and change in exercise capacity as measured by peak oxygen uptake (VO_2). A metabolic equivalent (product of exercise intensity and the hours of exercise per week. (MET)-h) was used as an indicator of exercise volume. Median age of the patients in the analysis was 59 years (range = 51-67 yrs.) Males comprised 69% of the group. Median ejection fraction was 25% (range = 20-30%). Median duration of follow-up was 28.2 months. The authors found "[a] reverse J-shaped association was observed between exercise volume and adjusted clinical risk." They reported: "On the basis of Cox regression, exercise volume was not a significant linear predictor but was a logarithmic predictor ($p = 0.03$) for all-cause mortality or hospitalization. For cardiovascular mortality or HF hospitalization, exercise volume was a significant ($p = 0.001$) linear and logarithmic predictor. Moderate exercise volumes of 3 to < 5 metabolic equivalent (MET)-h per session and 5 to < 7 MET-h per week were associated with reductions in subsequent risk that exceeded 30%. Exercise volume was positively associated with the change in peak oxygen uptake at 3 months ($r = 0.10$; $p = 0.005$)."

O'Connor CM, Whellan DJ, Lee KL, Keteyian SJ, Cooper LS, Ellis SJ, Leifer ES, Kraus WE, Kitzman DW, Blumenthal JA, Rendall DS, Miller NH, Fleg JL, Schulman KA, McKelvie RS, Zannad F, Piña IL; HF-ACTION Investigators. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA. 2009 Apr 8;301(14):1439-50. doi: 10.1001/jama.2009.454.

O'Connor and colleagues reported the results of an NHLBI funded, multicenter, randomized controlled trial of medically stable patients "to test the efficacy and safety of exercise training among patients with heart failure." Inclusion criteria were LVEF ≤ 35% and NYHA class II-IV despite optimal therapy for at least six weeks. Exclusion criteria included major comorbidities or limitations that could interfere with exercise training, and recent (≤6 weeks) or planned (≤6 months) major cardiovascular events or procedure, performance of regular exercise training, or use of devices that limited the ability to achieve target heart rates. Primary outcome was a composite of all-cause mortality or all-cause hospitalization. Secondary end points included all-cause mortality, the composite of cardiovascular mortality or cardiovascular hospitalization, and the composite of cardiovascular mortality or heart failure hospitalization. A post hoc analysis between the study and control groups was also performed to compare the composite of cardiovascular mortality, heart failure hospitalization, left ventricular assist device implantation, or heart transplantation. Endpoints were adjudicated by a committee blinded to treatment assignment. Cardiovascular adverse events and certain other hospitalizations were collected. The study was designed to have 90% power to detect an 11% reduction in the two year rate of the primary end-point. An independent DSMB was appointed by NHLBI to review the interim results of the study and evaluate patient safety and trial feasibility on a semiannual basis.

From April 2003 to February 2007, 2,331 participants were randomly assigned to exercise training (n = 1159) or usual care (n = 1172). The exercise training program consisted of "structured, group-based, supervised exercise program, with a goal of 3 sessions per week for a total of 36 sessions in 3 months" followed by home based exercise five times per week for 40 minutes. Participants in the usual care group did not receive formal exercise prescriptions. All patients received "detailed self-management educational materials, in the form of a booklet, at the time of enrollment, including information on medications, fluid management, symptom exacerbation, sodium intake, and activity level of 30 minutes (as tolerated) of moderate-intensity activity on most days of the week, consistent with the guidelines from the American College of Cardiology and the American Heart Association."

Median age was 59 years (range 51-68 years). Men comprised 72% of the study population. Median LVEF was 25%. A number of other baseline patient characteristics were summarized and presented for review. Median duration of follow-up was 30.1 months (goal of a minimum of 1 year and a maximum of 4 years). Statistical comparisons of the clinical outcomes were performed according to intention-to-treat. Additional analyses pre-specified in the protocol of the primary and secondary endpoints were performed that adjusted for baseline characteristics "strongly predictive" of these clinical outcomes. This was done as "time-to-event outcomes, adjustment for strong predictors of the outcome enables the analysis to more specifically compare patients of like risk with like risk and thereby increases the statistical power."

Thirty nine patients (1.7%) were lost to follow but had a median follow-up of 14.6 months and 83 patients (4%) withdrew at a median of 6.8 months. At baseline, over 90% of all patients were on an angiotensin-converting-enzyme (ACE) inhibitor or an angiotensin II receptor blocker (ARB), and/or a beta blocker medication. Details of the exercise times were provided. The authors stated "[a]t all time points, approximately 30% or more of the patients in the exercise training group exercised at or above the target exercise minutes per week." Patients with hospitalizations and adverse events were analyzed. Overall the authors reported that the performance of exercise training was well tolerated and safe. A number of patients in the usual care group also exercised based on self-report.

The authors reported: "A total of 759 patients (65%) in the exercise training group died or were hospitalized compared with 796 patients (68%) in the usual care group (hazard ratio [HR], 0.93 [95% confidence interval (CI), 0.84-1.02]; P = .13). There were non-significant reductions in the exercise training group for mortality (189 patients [16%] in the exercise training group vs 198 patients [17%] in the usual care group; HR, 0.96 [95%

CI, 0.79-1.17]; P=.70), cardiovascular mortality or cardiovascular hospitalization (632 [55%] in the exercise training group vs 677 [58%] in the usual care group; HR, 0.92 [95% CI, 0.83-1.03]; P = .14), and cardiovascular mortality or heart failure hospitalization (344 [30%] in the exercise training group vs 393 [34%] in the usual care group; HR, 0.87 [95% CI, 0.75-1.00]; P = .06). In pre-specified supplementary analyses adjusting for highly prognostic baseline characteristics, the HRs were 0.89 (95% CI, 0.81-0.99; P = .03) for all-cause mortality or hospitalization, 0.91 (95% CI, 0.82-1.01; P = .09) for cardiovascular mortality or cardiovascular hospitalization, and 0.85 (95% CI, 0.74-0.99; P=.03) for cardiovascular mortality or heart failure hospitalization." They concluded: "In the protocol-specified primary analysis, exercise training resulted in non-significant reductions in the primary end point of all-cause mortality or hospitalization and in key secondary clinical end points. After adjustment for highly prognostic predictors of the primary end point, exercise training was associated with modest significant reductions for both all-cause mortality or hospitalization and cardiovascular mortality or heart failure hospitalization."

Witham MD, Fulton RL, Greig CA, Johnston DW, Lang CC, van der Pol M, Boyers D, Struthers AD, McMurdo ME. Efficacy and cost of an exercise program for functionally impaired older patients with heart failure: a randomized controlled trial. Circ Heart Fail. 2012 Mar 1;5(2):209-16. doi: 10.1161/CIRCHEARTFAILURE.111.963132. Epub 2012 Jan 23.

Witham and colleagues reported the results of a randomized controlled trial performed in the United Kingdom to test "whether an exercise program tailored to the needs of these patients could improve exercise capacity and quality of life or reduce costs to the National Health Service." Inclusion criteria were age ≥ 70 years, NYHA class II and III, LV systolic dysfunction and signs and symptoms of CHF. Exclusion criteria included aortic stenosis, sustained VT or VF, unstable angina and atrial fibrillation. Primary outcome was six minute walk distance at 24 weeks. Secondary outcomes included physical function, quality of life (Minnesota Living With Heart Failure questionnaire), health status (Functional Limitations Profile), and daily activity. A total of 107 individuals were randomly assigned (intervention group n = 53; usual care group n = 54). The intervention program consisted of twice weekly exercise classes for eight weeks in an outpatient group setting delivered by a physiotherapist, followed by 16 weeks of home exercise (asked to perform at least twice a week). Functional aerobic exercise and strength training were included. The usual care group received a booklet with general advice on diet, exercise and lifestyle. Mean age was 80 years. Men comprised 67% of the study population. Dropout rate was 19% ("close to the predicted dropout rate of 20%". Exercise program attendance was 77%.

The authors reported no significant difference between groups for the primary outcome and quality of life at 24 weeks. They concluded that "[t]his exercise intervention did not improve exercise capacity or quality of life in older patients with heart failure."

4. Medicare Evidence Development & Coverage Advisory Committee (MEDCAC)

The MEDCAC was not convened for this review.

5. Evidence-based guidelines

Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE Jr, Drazner MH, Fonarow GC, Geraci SA, Horwich T, Januzzi JL, Johnson MR, Kasper EK, Levy WC, Masoudi FA, McBride PE, McMurray JJV, Mitchell JE, Peterson PN, Riegel B, Sam F, Stevenson LW, Tang WHW, Tsai EJ, Wilkoff BL. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013 June;62:e147–239.

The American College of Cardiology and the American Heart Association released joint evidence based guidelines. On exercise training:

"CLASS I
1. Exercise training (or regular physical activity) is recommended as safe and effective for patients with HF who are able to participate to improve functional status (404–407).
(Level of Evidence: A)

CLASS IIa
1. Cardiac rehabilitation can be useful in clinically stable patients with HF to improve functional capacity, exercise duration, HRQOL, and mortality (404,406–411).
(Level of Evidence: B)"

"Exercise training in patients with HF is safe and has numerous benefits. Meta-analyses show that cardiac rehabilitation reduces mortality; improves functional capacity, exercise duration, and HRQOL; and reduces hospitalizations. Other benefits include improved endothelial function, blunted catecholamine spillover, increased peripheral oxygen extraction, and reduced hospital admission.

Many RCTs of exercise training in HF have been conducted, but the statistical power of most was low. A major trial of exercise and HF randomly assigned 2331 patients (mean EF, 25%; ischemic etiology, 52%) to either exercise training for 3 months or usual care. In unadjusted analyses, there was no significant difference at the end of the study in either total mortality or hospitalizations. When adjusted for coronary heart disease risk factors, there was an 11% reduction in all-cause mortality, cardiovascular disease mortality, or hospitalizations ($P<0.03$) in the exercise training group. A meta-analysis demonstrated improved peak oxygen consumption and decreased all-cause mortality with exercise."

McMurray JJ, Adamopoulos S, Anker SD, Auricchio A, Böhm M, Dickstein K, Falk V, Filippatos G, Fonseca C, Gomez-Sanchez MA, Jaarsma T, Køber L, Lip GY, Maggioni AP, Parkhomenko A, Pieske BM, Popescu BA, Rønnevik

PK, Rutten FH, Schwitter J, Seferovic P, Stepinska J, Trindade PT, Voors AA, Zannad F, Zeiher A; Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology, Bax JJ, Baumgartner H, Ceconi C, Dean V, Deaton C, Fagard R, Funck-Brentano C, Hasdai D, Hoes A, Kirchhof P, Knuuti J, Kolh P, McDonagh T, Moulin C, Popescu BA, Reiner Z, Sechtem U, Sirnes PA, Tendera M, Torbicki A, Vahanian A, Windecker S, McDonagh T, Sechtem U, Bonet LA, Avraamides P, Ben Lamin HA, Brignole M, Coca A, Cowburn P, Dargie H, Elliott P, Flachskampf FA, Guida GF, Hardman S, Iung B, Merkely B, Mueller C, Nanas JN, Nielsen OW, Orn S, Parissis JT, Ponikowski P; ESC Committee for Practice Guidelines. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC. Eur J Heart Fail. 2012 Aug;14(8):803-69. doi: 10.1093/eurjhf/hfs105. Erratum in Eur J Heart Fail. 2013 Mar;15(3):361-2.

The European Society of Cardiology and the Heart Failure Association provided this statement in the management of patients with heart failure, specifically stating for exercise training: "Collectively, the evidence suggests that physical training is beneficial in HF, although typical elderly patients were not enrolled in many studies and the optimum exercise 'prescription' is uncertain. Furthermore, the single large trial showed a borderline treatment effect that was only obtained with a very intensive intervention that may not be practical to deliver in every centre. Exercise training is discussed in more detail in a recent Heart Failure Association consensus paper." (Piepoli, 2011) The authors reported: "It is recommended that regular aerobic exercise is encouraged in patients with heart failure to improve functional capacity and symptoms". [Class I ("Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective."), Level A ("Data derived from multiple randomized clinical trials or meta-analyses.")]

6. Consensus statement

Piepoli MF, Conraads V, Corrà U, Dickstein K, Francis DP, Jaarsma T, McMurray J, Pieske B, Piotrowicz E, Schmid JP, Anker SD, Solal AC, Filippatos GS, Hoes AW, Gielen S, Giannuzzi P, Ponikowski PP. Exercise training in heart failure: from theory to practice. A consensus document of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation. Eur J Heart Fail. 2011 Apr;13(4):347-57. doi: 10.1093/eurjhf/hfr017.

Piepoli and colleagues presented consensus guidelines of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation, specifically noting for exercise training: "The European Society of Cardiology heart failure guidelines firmly recommend regular physical activity and structured exercise training (ET), but this recommendation is still poorly implemented in daily clinical practice outside specialized centres and in the real world of heart failure clinics. In reality, exercise intolerance can be successfully tackled by applying ET. We need to encourage the mindset that breathlessness may be evidence of signaling between the periphery and central haemodynamic performance and regular physical activity may ultimately bring about favourable changes in myocardial function, symptoms, functional capacity, and increased hospitalization-free life span and probably survival. In this position paper, we provide practical advice for the application of exercise in heart failure and how to overcome traditional barriers, based on the current scientific and clinical knowledge supporting the beneficial effect of this intervention."

7. Public Comments

Initial 30-day comment period – (06/04/2013 – 07/04/2013)

During the initial 30-day comment period, CMS received 182 public comments. A summary of these comments can be found in the proposed decision memorandum and the complete text of these comments is available on the CMS website at View Public Comments http://www.cms.gov/medicare-coverage-database/details/nca-view-public-comments.aspx?NCAId=270.

Final 30-day comment period – (11/21/2013 - 12/21/2013)

Public Comments on the Proposed Decision Memorandum

CMS received 83 comments on the proposed decision. Of the 83 comments, 79 supported expanded coverage of CR for HF but some commenters sought changes to the description of the eligible patients, one advocated for non-coverage, and three had unclear positions on coverage. Fifty-three were identified as being from providers, five from professional societies, four from industry, and twenty-one did not identify their affiliation.

There were four comments from seven national provider organizations, which included the American Academy of Physical Medicine and Rehabilitation (AAPM&R), American Association of Heart Failure Nurses (AAHFN), American Association of Cardiovascular & Pulmonary Rehabilitation (AACVPR), the American College of Cardiology (ACC), the American Heart Association (AHA), the Heart Failure Society of America (HFSA), and the American Physical Therapy Association (APTA).

Ten commenters cited references. All references were reviewed for relevance to the scope of the NCA and a list of these references is provided in Appendix B. The references that were determined to be relevant to the scope of the NCA are incorporated into the review and included in the bibliography.

Comment:
Commenters noted that HF-ACTION enrolled stable patients with chronic heart failure and did not include patients with acute events [“recent (≤6 weeks) or planned (≤6 months) major cardiovascular events or procedures]. The commenters recommended that the language in the final decision be modified to emphasize that patients must be stable.

Response:
CMS agrees with this comment and has clarified this issue in the decision, analysis section, and in Appendix C. The coverage expansion is intended solely for patients with stable, chronic HF as guided by the inclusion and exclusion criteria of HF-ACTION. We are adding the following language to the NCD based on the public comments: Stable patients are defined as patients who have not had recent (≤6 weeks) or planned (≤6 months) major cardiovascular hospitalizations or procedures.

Comment:
Commenters noted that CR should be used cautiously in patients with NYHA Class IV heart failure since very few Class IV patients (23/2331) were included in HF-ACTION.

Response:
CMS agrees with this comment and has noted this concern in the analysis section. We strongly recommend that physicians consider the potential risks and benefits of CR for patients with NYHA Class IV heart failure since the evidence is limited.

Comment:
Commenters asked that coverage be extended to patients with preserved ejection heart failure (preserved or normal left ventricular ejection fraction), as well as to consider those with left ventricular ejection fraction of 40%.

Response:
The definition of symptomatic chronic heart failure traditionally has included a metric of reduced left ventricular ejection fraction. While the condition of preserved ejection heart failure is gaining recognition, the evidence base for CR in this population is not as well established as for CR in patients with chronic heart failure and reduced left ventricular ejection fraction. In our prior consideration, we noted the lack of a large randomized controlled trial on CR in patients with HF. HF-ACTION was completed and demonstrated improvements in adjusted mortality for patients with reduced ejection fraction HF as required to be added as a condition. There is no corresponding trial of CR in patients with preserved ejection fraction HF that evaluated health outcomes. Patients with preserved ejection fraction HF are different pathophysiologically since there appears to be little correlation between the objective measure of ejection fraction and symptoms of HF. Given this difference the results of HF-ACTION are not applicable to this subset of HF patients. The lack of evidence remains on CR in the subset of patients with preserved or normal ejection fraction heart failure. The observational studies noted by commenters have evaluated intermediate outcomes such as peak oxygen consumption. While initially promising, the effects on health outcomes in these patients need to be determined by rigorous clinical trials.

Since HF-ACTION was the largest randomized trial on exercise in patients with chronic HF and included a criterion on reduced ejection fraction, the eligibility criteria for Medicare coverage were created to correspond to the population in this trial so that the benefits of CR in terms of health outcomes could be optimized. CMS accepts the comment from the AACVPR, and we will consider further expansion for this patient population when the needed additional research and large randomized controlled trials on CR in stable chronic HF patients with preserved ejection fraction confidently determine benefits and harms.

Comment:
Commenters noted that CR provides an opportunity to integrate lifestyle interventions and behavioral risk factor reduction in treating eligible patients.

Response:
CMS agrees with this comment. CR is a comprehensive approach that includes physician prescribed exercise; cardiac risk factor modification, including education, counseling, and behavioral intervention; psychosocial assessment; outcomes assessment.

Comment:
One commenter asked that we change the language describing CR from "physician prescribed" to "provider prescribed" so that advanced practice nurses could order CR.

Response:
We are not able to accept this comment. Cardiac rehabilitation is a statutorily defined benefit. A cardiac rehabilitation program "means a physician-supervised program," see § 1861(eee)(1) of the Social Security Act and "physician-prescribed exercise" is one of the required items listed in § 1861(eee)(3). We have defined "physician-prescribed exercise" in our regulation at 42 C.F.R. § 410.49 and we may not revise that definition through the NCD process.

Comment:
Commenters asked that home based exercise should be covered.

Response:
Cardiac rehabilitation is a statutorily defined benefit and is defined as a physician supervised program. As noted in our regulations (42 C.F.R. § 410.49(b)(3), CR services must be furnished in a physician's office or a hospital outpatient setting.

Comment:
One commenter asked if the eligible heart failure patient would have ongoing CR without a time limit.

Response:

The limitations for CR sessions and time limits are contained at 42 C.F.R. § 410.49(f). Specifically, the number of sessions are limited to a maximum of 2 1-hour sessions per day for up to 36 sessions over a period of 36 weeks. An additional 36 sessions may be approved by the Medicare contractor under section 1862(a)(1)(A) of the Social Security Act.

Comment:
One commenter stated that exercise is good for heart failure but there is no need for a formal expensive program with monitoring.

Response:
We disagree with the commenter's suggestion that there is no need for a formal CR program with monitoring by a physician for patients with heart failure as described in our decision. Congress has included CR as a benefit within the scope of the Medicare program with certain limitations. By this NCD, we are expanding coverage for this benefit to new patient population where medical and scientific evidence demonstrates a medical benefit. The vast majority of the public commenters, and the medical evidence, supports this expansion.

VIII. CMS Analysis

NCDs are determinations by the Secretary with respect to whether or not a particular item or service is covered nationally by Medicare (§1862(l) of the Act). In order to be covered by Medicare, an item or service must fall within one or more benefit categories contained within Part A or Part B, and must not be otherwise excluded from coverage. Moreover, section 1862(a)(1) of the Social Security Act states, with limited exceptions, no payment may be made under Part A or Part B for any expenses incurred for items or services, which are not reasonable and necessary for the diagnosis or treatment of illness or injury or to improve the functioning of a malformed body member (§1862(a)(1)(A)).

Sections 1861(s)(2)(CC) and 1861(eee)(1) of the Social Security Act provide for coverage of items and services furnished under a qualifying CR program under part B. Among other things, Medicare regulations define key terms, address the components of a CR program, establish the standards for physician supervision, and limit the maximum number of program sessions that may be furnished. See 42 C.F.R. §410.49. The regulations also describe the cardiac conditions that would enable a beneficiary to obtain CR services. Specifically, coverage is permitted for beneficiaries who have experienced one or more of the following:

- An acute myocardial infarction within the preceding 12 months;
- A coronary artery bypass surgery;
- Current stable angina pectoris;
- Heart valve repair or replacement;
- Percutaneous transluminal coronary angioplasty (PTCA) or coronary stenting; and
- A heart or heart-lung transplant.

The regulations also establish that CMS may add "other cardiac conditions as specified through a national coverage determination." (42 CFR §410.49(b)(1)(vii))

As noted earlier, our review of the evidence sought the answer to the question below. We have repeated it here for the convenience of the reader.

Question a. Is the evidence sufficient to determine that cardiac rehabilitation for Medicare beneficiaries with chronic heart failure improves health outcomes?

In 2009, we noted the lack of evidence on the effect of cardiac rehabilitation on health outcomes in Medicare beneficiaries with chronic heart failure. At that time, we were aware of an ongoing trial, the HF-ACTION trial, a collaborative effort that involved NHLBI (O'Connor, 2009). Since then, the trial was completed and several reports on HF-ACTION, as well as additional evidence, have been published in the peer reviewed literature. Main results as reported by O'Connor and colleagues (2009) showed "[a]fter adjustment for highly prognostic predictors of the primary end point, exercise training was associated with modest significant reductions for both all-cause mortality or hospitalization and cardiovascular mortality or heart failure hospitalization." Two smaller but longer term studies (Austin, 2008; Belardinelli, 2012) provided supporting evidence on the benefits of exercise. One small study of older adults (mean age = 80 years; Witham, 2012) did not show improvements from exercise intervention at 24 weeks. In this particular study, it is possible that the small number of patients and high dropout rate (19%) influenced the ability to detect a significant small to moderate benefit. In addition, optimal medical therapy was emphasized in HF-ACTION while others studies may not have specifically addressed concomitant medical therapy.

There is wide support for CR in both U.S. and European guidelines. The evidence based recommendation by the ACC/AHA ("Exercise training is beneficial as an adjunctive approach to improve clinical status in ambulatory patients with current or prior symptoms of HF and reduced LVEF. (Level of Evidence: B)"; Hunt, 2005) and the ESC ("Collectively, the evidence suggests that physical training is beneficial in HF, although typical elderly patients were not enrolled in many studies and the optimum exercise 'prescription' is uncertain.") support the benefit of exercise in chronic heart failure. It is important to highlight that exercise may be safely performed by patients with heart failure. The Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation consensus document stated: "We need to encourage the mindset that breathlessness may be evidence of signalling between the periphery and central haemodynamic performance and regular physical activity may ultimately bring about favourable changes in myocardial function, symptoms, functional capacity, and increased hospitalization-free life span and probably survival." (Piepoli, 2011)

While we have focused in this review on exercise intervention, cardiac rehabilitation programs include other interventions required to address additional important risk factors that are behavioral such as diet and tobacco use. It is well recognized that these cardiac risk factor reduction interventions have been shown in clinical trials to improve health outcomes in a broad population. Screening and treatment of hypertension, appropriate use of aspirin, multicomponent interventions on diet and obesity are recommended in general for patients with cardiovascular disease and are specific Medicare benefits (please see NCDs on Intensive Behavioral Therapy for Cardiovascular Disease http://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=348 and Intensive Behavioral Therapy for Obesity http://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=353).

Since chronic heart failure often results from coronary artery disease and hypertension, evidence on behavioral interventions in the treatment of these conditions provide additional supportive evidence. With the accumulated evidence that supports the benefits of the individual components of cardiac rehabilitation programs, the evidence is sufficient to determine that participation in these multicomponent programs improves health outcomes for Medicare beneficiaries with stable, chronic heart failure. Commenters and professional societies were supportive of this expansion while noting that the evidence was established for stable patients but not for patients with acute or decompensated heart failure. Providers and patients should also recognize the importance of the individual's ability to participate in exercise training and dedication and willingness to change before enrolling in CR programs since ultimately the potential benefits that may be gained are dependent on the individual's engagement and commitment to the rigorous interventions.

Question b. If the answer to question (a) above is yes, what are the characteristics of the beneficiary's clinical status and the cardiac rehabilitation regimen that predict improved health outcomes?

Patient Criteria

In recent years, the criteria to identify patients who may benefit from CR have been better substantiated. As with most interventions, patient criteria are important to maximize the likelihood of improving health outcomes for a specific population. HF-ACTION, (O'Connor, 2009) a well-designed randomized controlled trial, provided the evidence on important health outcomes that was missing in our 2006 analysis. While there is some variation in the patient selection criteria in the studies reviewed, we believe the HF-ACTION study was the most well designed study and provided the best evidence of benefit. Therefore, we have determined that the HF-ACTION patient selection criteria are the most appropriate for Medicare beneficiaries with chronic heart failure defined as patients with left ventricular ejection fraction of 35% or less and New York Heart Association (NYHA) class II to IV symptoms on optimal heart failure therapy for at least six weeks.

We note that HF-ACTION excluded patients with "major comorbidities or limitations that could interfere with exercise training" and those who had "recent (≤ 6 weeks) or planned (≤ 6 months) major cardiovascular events or procedures." We have used hospitalizations in place of events since acute major events such as myocardial infarctions and strokes will lead to hospitalizations. These inclusion and exclusion criteria may not be an exhaustive list but do serve as a guide for clinical judgment. In addition, HF-ACTION enrolled very few patients (23/2331) with NYHA Class IV heart failure and provided only limited evidence on these patients. Therefore, we encourage CR programs to consider whether those patients who meet the above criteria but have NYHA Class IV heart failure, major comorbidities or limitations that would prevent the safe and efficient completion of exercise training should be excluded from participation, when establishing the individualized treatment plans required by 42 C.F.R. § 410.49(b)(2)(v).

Disparities

Heart failure events occur more frequently in older beneficiaries regardless of gender and ethnicity. Roger and

colleagues reported: "The annual rates per 1000 population of new HF events for white men are 15.2 for those 65 to 74 years of age, 31.7 for those 75 to 84 years of age, and 65.2 for those 85 years of age. For white women in the same age groups, the rates are 8.2, 19.8, and 45.6, respectively. For black men, the rates are 16.9, 25.5, and 50.6,* and for black women, the estimated rates are 14.2, 25.5, and 44.0,*respectively (CHS, NHLBI)." (*Unreliable estimate.) As with research studies in general, women comprised a relatively small percentage of the populations in most studies reviewed (28% in HF-ACTION; O'Connor, 2009). We encourage women to take part, as appropriate and necessary, in cardiac rehabilitation programs. Minorities were adequately represented especially in HF-ACTION where race of 38% of the participants was reported as African American (33%) or other (5%).

Summary

In 2009, CMS found there was little evidence in the existing literature that supported CR, specifically the exercise component, improving health outcomes in Medicare beneficiaries with chronic HF. After the completion of the HF-ACTION trial (O'Connor, 2009), the additional evidence established that exercise intervention is beneficial and can be safely performed by selected patients with chronic HF.

As the criteria to identify patients who may benefit from CR have been better substantiated, the likelihood of improving health outcomes for a specific population has increased. CR programs focus not only on exercise intervention, but also on reducing behavioral risk factors such as promoting healthy diet and reducing tobacco use. CR improves symptoms of chronic HF, decreases mortality, and reduces hospitalization. We conclude that the evidence that supports the clinical benefits of the individual components of CR programs is sufficient to determine that participation in these programs improves health outcomes for Medicare beneficiaries with chronic HF.

IX. Conclusion

The CMS has determined that the evidence is sufficient to expand coverage for cardiac rehabilitation services under 42 C.F.R. § 410.49(b)(1)(vii) to beneficiaries with stable, chronic heart failure defined as patients with left ventricular ejection fraction of 35% or less and New York Heart Association (NYHA) class II to IV symptoms despite being on optimal heart failure therapy for at least six weeks. Stable patients are defined as patients who have not had recent (≤ 6 weeks) or planned (≤ 6 months) major cardiovascular hospitalizations or procedures.

Appendix A General Methodological Principles of Study Design

When making national coverage determinations, CMS evaluates relevant clinical evidence to determine whether or not the evidence is of sufficient quality to support a finding that an item or service falling within a benefit category is reasonable and necessary for the diagnosis or treatment of illness or injury or to improve the functioning of a malformed body member. The critical appraisal of the evidence enables us to determine whether: 1) the specific assessment questions can be answered conclusively; and 2) the intervention will improve health outcomes for patients. An improved health outcome is one of several considerations in determining whether an item or service is reasonable and necessary.

CMS divides the assessment of clinical evidence into three stages: 1) the quality of the individual studies; 2) the relevance of findings from individual studies to the Medicare population; and 3) overarching conclusions that can be drawn from the body of the evidence on the direction and magnitude of the intervention's risks and benefits.

The issues presented here represent a broad discussion of the issues we consider when reviewing clinical evidence. However, it should be noted that each coverage determination has unique methodological aspects.

1. Assessing Individual Studies

Methodologists have developed criteria to determine weaknesses and strengths of clinical research. Strength of evidence generally refers to: 1) the scientific validity underlying study findings regarding causal relationships between health care interventions and health outcomes; and 2) the reduction of bias. In general, some of the methodological attributes associated with stronger evidence include those listed below:

- Use of randomization (allocation of patients to either intervention or control group) in order to minimize bias.
- Use of contemporaneous control groups (rather than historical controls) in order to ensure comparability between the intervention and control groups.
- Prospective (rather than retrospective) studies to ensure a more thorough and systematical assessment of factors related to outcomes.
- Larger sample sizes in studies to help ensure adequate numbers of patients are enrolled to demonstrate both statistically significant as well as clinically significant outcomes that can be extrapolated to the Medicare population. Sample size should be large enough to make chance an unlikely explanation for what was found.
- Masking (blinding) to ensure patients and investigators do not know to which group patients were assigned (intervention or control). This is important especially in subjective outcomes, such as pain or quality of life, where enthusiasm and psychological factors may lead to an improved perceived outcome by either the patient or assessor.

Regardless of whether the design of a study is a randomized controlled trial, a non-randomized controlled trial, a cohort study or a case-control study, the primary criterion for methodological strength or quality is the extent to which differences between intervention and control groups can be attributed to the intervention studied. This is known as internal validity. Various types of bias can undermine internal validity. These include:

- Different characteristics between patients participating and those theoretically eligible for study but not participating (selection bias)
- Co-interventions or provision of care apart from the intervention under evaluation (confounding)
- Differential assessment of outcome (detection bias)
- Occurrence and reporting of patients who do not complete the study (attrition bias)

In principle, rankings of research design have been based on the ability of each study design category to minimize these biases. A randomized controlled trial minimizes systematic bias (in theory) by selecting a sample of participants from a particular population and allocating them randomly to the intervention and control groups. Thus, randomized controlled studies have been typically assigned the greatest strength, followed by non-randomized clinical trials and controlled observational studies. The following is a representative list of study designs (some of which have alternative names) ranked from most to least methodologically rigorous in their potential ability to minimize systematic bias:

- Randomized controlled trials
- Non-randomized controlled trials
- Prospective cohort studies
- Retrospective case control studies
- Cross-sectional studies
- Surveillance studies (e.g., using registries or surveys)
- Consecutive case series
- Single case reports

When there are merely associations but not causal relationships between a study's variables and outcomes, it is important not to draw causal inferences. Confounding refers to independent variables that systematically vary with the causal variable. This distorts measurement of the outcome of interest because its effect size is mixed with the effects of other extraneous factors. For observational, and in some cases randomized controlled trials, the method in which confounding factors are handled (either through stratification or appropriate statistical modeling) are of particular concern. For example, in order to interpret and generalize conclusions to our population of Medicare patients, it may be necessary for studies to match or stratify their intervention and control groups by patient age or co-morbidities.

Methodological strength is, therefore, a multidimensional concept that relates to the design, implementation and analysis of a clinical study. In addition, thorough documentation of the conduct of the research, particularly study's selection criteria, rate of attrition and process for data collection, is essential for CMS to adequately assess the evidence.

2. Generalizability of Clinical Evidence to the Medicare Population

The applicability of the results of a study to other populations, settings, treatment regimens, and outcomes assessed is known as external validity. Even well-designed and well-conducted trials may not supply the evidence needed if the results of a study are not applicable to the Medicare population. Evidence that provides accurate information about a population or setting not well represented in the Medicare program would be considered but would suffer from limited generalizability.

The extent to which the results of a trial are applicable to other circumstances is often a matter of judgment that depends on specific study characteristics, primarily the patient population studied (age, sex, severity of disease, and presence of co-morbidities) and the care setting (primary to tertiary level of care, as well as the experience and specialization of the care provider). Additional relevant variables are treatment regimens (dosage, timing, and route of administration), co-interventions or concomitant therapies, and type of outcome and length of follow

-up.

The level of care and the experience of the providers in the study are other crucial elements in assessing a study's external validity. Trial participants in an academic medical center may receive more or different attention than is typically available in non-tertiary settings. For example, an investigator's lengthy and detailed explanations of the potential benefits of the intervention and/or the use of new equipment provided to the academic center by the study sponsor may raise doubts about the applicability of study findings to community practice.

Given the evidence available in the research literature, some degree of generalization about an intervention's potential benefits and harms is invariably required in making coverage decisions for the Medicare population. Conditions that assist us in making reasonable generalizations are biologic plausibility, similarities between the populations studied and Medicare patients (age, sex, ethnicity and clinical presentation), and similarities of the intervention studied to those that would be routinely available in community practice.

A study's selected outcomes are an important consideration in generalizing available clinical evidence to Medicare coverage determinations because one of the goals of our determination process is to assess health outcomes. We are interested in the results of changed patient management not just altered management. These outcomes include resultant risks and benefits such as increased or decreased morbidity and mortality. In order to make this determination, it is often necessary to evaluate whether the strength of the evidence is adequate to draw conclusions about the direction and magnitude of each individual outcome relevant to the intervention under study. In addition, it is important that an intervention's benefits are clinically significant and durable, rather than marginal or short-lived.

If key health outcomes have not been studied or the direction of clinical effect is inconclusive, we may also evaluate the strength and adequacy of indirect evidence linking intermediate or surrogate outcomes to our outcomes of interest.

3. Assessing the Relative Magnitude of Risks and Benefits

Generally, an intervention is not reasonable and necessary if its risks outweigh its benefits. Health outcomes are one of several considerations in determining whether an item or service is reasonable and necessary. For most determinations, CMS evaluates whether reported benefits translate into improved health outcomes. CMS places greater emphasis on health outcomes actually experienced by patients, such as quality of life, functional status, duration of disability, morbidity and mortality, and less emphasis on outcomes that patients do not directly experience, such as intermediate outcomes, surrogate outcomes, and laboratory or radiographic responses. The direction, magnitude, and consistency of the risks and benefits across studies are also important considerations. Based on the analysis of the strength of the evidence, CMS assesses the relative magnitude of an intervention or technology's benefits and risk of harm to Medicare beneficiaries.

Appendix B

Additional Articles Submitted by the Requestor that Were Reviewed

Curtis LH, Whellan DJ, Hammill BG, et al. Incidence and prevalence of heart failure in elderly persons, 1994-2003. Arch Intern Med. 2008;168(4):418-24.

Downing J, Balady GJ. The role of exercise training in heart failure. J Am Coll Cardiol. 2011;58(6):561-9.

Flynn KE, Piña IL, Whellan DJ, et al. HF-ACTION Investigators. Effects of exercise training on health status in patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA. 2009;301:1451-9.

Hunt SA, Abraham WT, Chin MH, et al. 2009 focused update incorporated into the ACC/AHA 2005 guidelines for the diagnosis and management of heart failure in adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2009;53:e1-90.

Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:e147–239.

Articles That Were Submitted by the Requestor or Commenters That Were Reviewed and Excluded from Analysis

Alves AJ, Ribeiro F, Goldhammer E, et al. Exercise training improves diastolic function in heart failure patients. Med Science Sports Exerc 2012;44:776-85.

Babu AS, Maiya AG, George MM, Padmakumar R, Guddattu V. Effects of Combined Early In-Patient Cardiac Rehabilitation and Structured Home-based Program on Function among Patients with Congestive Heart Failure: A

Randomized Controlled Trial. Heart Views. 2011;12(3):99-103.

Bernheim SM, Grady JN, Lin Z, et al. National patterns of risk-standardized mortality and readmission for acute myocardial infarction and heart failure. Update on publicly reported outcomes measures based on the 2010 release. Circ Cardiovasc Qual Outcomes. 2010;3(5):459-467.

Bhatia RS, Tu JV, Lee DS, et al. Outcome of heart failure with preserved ejection fraction in a population-based study. N Engl J Med 2006;355:260-9.

Chaudhry SI, McAvay G, Chen S, et al. Risk Factors for hospital admission among older persons with newly diagnosed heart failure: findings from the Cardiovascular Health Study. J Am Coll Cardiol. 2013;61(6):635-42.

Dracup K, Evangelista LS, Hamilton MA, et al. Effects of a home-based exercise program on clinical outcomes in heart failure. Am Heart J. 2007;154(5):877-83. Epub 2007 Sep 12

Duncan PW, Sullivan KJ, Behrman AL, et al. Body-weight supported treadmill rehabilitation after stroke. N Engl J Med 2011;364:2026-2036.

Edelmann F, Gelbrich G, Düngen HD, et al. Exercise training improves exercise capacity and diastolic function in patients with heart failure with preserved ejection fraction: results of the Ex-DHF (Exercise training in Diastolic Heart Failure) pilot study. J Am Coll Cardiol 2011;58:1780-91.

Gary RA, Sueta CA, Dougherty M, et al. Home-based exercise improves functional performance and quality of life in women with diastolic heart failure. Heart Lung 2004;33:210-18.

Hammill BG, Curtis LH, Schulman KA, Whellan DJ. Relationship between cardiac rehabilitation and long-term risks of death and myocardial infarction among elderly Medicare beneficiaries. Circulation. 2010;121(1):63-70. Epub 2009 Dec 21.

Heidenreich PA, Trogdon JG, Khaviou OA, et al. Forecasting the future of cardiovascular disease in the United States. Circulation. 2011;123:944-944.

Lavie CJ, Milani RV. Cardiac rehabilitation and exercise training in secondary coronary heart disease prevention. Prog Cardiovasc Dis. 2011;53:397 – 403.

Lien CT, Gillespie ND, Struthers AD, McMurdo ME. Heart failure in frail elderly patients: diagnostic difficulties, co-morbidities, polypharmacy and treatment dilemmas Eur J Heart Fail. 2002;4(1):91-8.

Kitzman DW, Brubaker PH, Morgan TM, Stewart KP, Little WC: Exercise training in older patients with heart failure and preserved ejection fraction: a randomized, controlled, single-blind trial. Circ Heart Fail 2010;3(6):659-667.

Kitzman DW, Little WC, Brubaker PH, Anderson RT, Hundley WG, Marburger CT, Brosnihan B, Morgan TM, Stewart KP: Pathophysiological characterization of isolated diastolic heart failure in comparison to systolic heart failure. JAMA 2002;288(17):2144-2150.

Krumholz HM, Merrill AR, Schone EM, et al. Patterns of hospital performance in acute myocardial infarction and heart failure 30-day mortality and readmissions. Circ Cardiovasc Qual Outcomes. 2009;2(5);407-413.

Nilsson BB, Westheim A, Risberg MA.Long-term effects of a group-based high-intensity aerobic interval-training program in patients with chronic heart failure. Am J Cardiol. 2008 Nov 1;102(9):1220-4. doi: 10.1016/j.amjcard.2008.06.046. Epub 2008 Aug 29.

Pack QR, Mansour M, Barboza JS, et al. An early appointment to outpatient cardiac rehabilitation at hospital discharge improves attendance at orientation: a randomized, single-blind, controlled trial. Circulation. 2013;127:349-355.

Piepoli MF, Davos C, Francis DP, Coats AJ; ExTraMATCH Collaborative. Exercise training meta-analysis of trials in patients with chronic heart failure (ExTraMATCH). BMJ. 2004;328:189.

Redfield MM, Jacobsen SJ, Burnett JC Jr, et al. Burden of systolic and diastolic ventricular dysfunction in the community: appreciating the scope of the heart failure epidemic. JAMA 2003;289:194-202.

Smart N, Marwick TH. Exercise training for patients with heart failure: a systematic review of factors that improve mortality and morbidity. Am J Med. 2004;116:693-706.

Suaya JA, Stason WB, Ades PA, Normand SL, Shepard DS. Cardiac rehabilitation and survival in older coronary patients. J Am Coll Cardiol. 2009;54(1):25-33.

Taylor RS, Davies EJ, Dalal HM, et al. Effects of exercise training for heart failure with preserved ejection fraction: a systematic review and meta-analysis of comparative studies. Intl J Cardiology 2012;162:6-13.

van Tol BA, Huijsmans RJ, Kroon DW, Schothorst M, Kwakkel G. Effects of exercise training on cardiac performance, exercise capacity and quality of life in patients with heart failure: a meta-analysis. Eur J Heart Fail. 2006;8(8):841-50.

Appendix C

We are including the preliminary language for the national coverage determination (NCD) which will be effective immediately. The language is subject to formal revisions and formatting changes prior to the release of the final NCD in the NCD Manual.

Medicare National Coverage Determinations Manual
Chapter 1, Part 1 (Sections 10-80)

20.10.1 – Cardiac Rehabilitations Programs for Chronic Heart Failure
(Rev.)

A. General

Items and services furnished under a Cardiac Rehabilitation (CR) program may be covered under Medicare Part B, section 1861(s)(2)(CCC) and 1861(eee)(1) of the Social Security Act. Among other things, Medicare regulations define key terms, address the components of a CR program, establish the standards for physician supervision, and limit the maximum number of program sessions that may be furnished. See 42 CFR. § 410.49. The regulations also describe the cardiac conditions that would enable a beneficiary to obtain CR services. Specifically, coverage is permitted for beneficiaries who have experienced one or more of the following:

- *Acute myocardial infarction within the preceding 12 months.*
- *Coronary artery bypass surgery.*
- *Current stable angina pectoris.*
- *Heart valve repair or replacement.*
- *Percutaneous transluminal coronary angioplasty (PTCA) or coronary stenting.*
- *Heart or heart-lung transplant.*

The Centers for Medicare & Medicaid Services (CMS) may add "other cardiac conditions as specified through a national coverage determination" (NCD) (42 CFR § 410.49(b)(1)(vii).

B. Nationally Covered Indications

Effective for dates of service on and after {DATE}, CMS has determined that the evidence is sufficient to expand coverage for cardiac rehabilitation services under 42 CFR § 410.49(b)(1)(vii) to beneficiaries with stable, chronic heart failure defined as patients with left ventricular ejection fraction of 35% or less and New York Heart Association class II through IV symptoms despite being on optimal heart failure therapy for at least 6 weeks. Stable patients are defined as patients who have not had recent (≤6 weeks) or planned (≤6 months) major cardiovascular hospitalizations or procedures. (See section A above for indications covered under 42 CFR § 410.49(b)(1)(vii).

C. Nationally Non-Covered Indications

Any cardiac indication not specifically identified in 42 CFR § 410.49(b)(1)(vii), or identified as covered in this or any other NCD is considered non-covered.

D. Other

N/A.

(This NCD last reviewed XXXX.)

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[1] There is a separate part B benefit for "intensive cardiac rehabilitation" or ICR. Items and services furnished under the ICR benefit are covered based on different statutes. See 1861(s)(2)(DD) and 1861(eee)(4). The statute establishes specific criteria with respect to the beneficiaries who may obtain ICR services and the Secretary was not given the discretion to extend coverage for additional cardiac patients for those services. See 1861(eee)(4)(B); 42 C.F.R. 410.49(b)(vii).

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Bibliography

Ades PA, Keteyian SJ, Balady GJ, et al. Cardiac rehabilitation exercise and self-care for chronic heart failure. JACC Heart Fail 2013;1:540-547.

Ades PA, Pashkow FJ, Fletcher G, et al. A controlled trial of cardiac rehabilitation in the home setting using electrocardiographic and voice transtelephonic monitoring. Am Heart J. 2000;139(3):543-8.

Austin J, Williams WR, Ross L, Hutchison S. Five-year follow-up findings from a randomized controlled trial of cardiac rehabilitation for heart failure. Eur J Cardiovasc Prev Rehabil. 2008;15(2):162-7.

Austin J, Williams R, Ross L, Moseley L, Hutchison S. Randomised controlled trial of cardiac rehabilitation in elderly patients with heart failure. Eur J Heart Fail. 2005; 7(3):411-7.

Belardinelli R, Georgiou D, Cianci G, Purcaro A. 10-year exercise training in chronic heart failure: a randomized controlled trial. J Am Coll Cardiol. 2012;60(16):1521-8.

Chen J, Normand SL, Wang Y, Krumholz HM. National and regional trends in heart failure hospitalization and mortality rates for Medicare beneficiaries, 1998-2008. JAMA. 2011;306(15):1669-78.

Davies EJ, Moxham T, Rees K, et al. Exercise based rehabilitation for heart failure. Cochrane Database Syst Rev. 2010;(4):CD003331

Dharmarajan K, Hsieh AF, Lin Z, et al. Diagnoses and timing of 30-day readmissions after hospitalization for heart failure, acute myocardial infarction, or pneumonia. JAMA. 2013;309(4):355-63.

Forman DE, Farquhar W. Cardiac rehabilitation and secondary prevention programs for elderly cardiac patients. Clin Geriatr Med. 2000;16(3):619-29.

Hunt SA, Abraham ET, Chin MH, et al. ACC/AHA 2005 guideline update for the diagnosis and management of chronic heart failure in the adult: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Update the 2001 Guidelines for the Evaluation and Management of Heart Failure). J Am Coll Cardiol. 2005;46(6):e1-82. American College of Cardiology Web Site. Available at http://www.acc.org/clinical/guidelines/failure//index.pdf

Hunt SA, Abraham WT, Chin MH, et al. 2009 Focused update incorporated into the ACC/AHA 2005 guidelines for the diagnosis and management of heart failure in adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2009;119:e391– e479.

Keteyian SJ, Leifer ES, Houston-Miller N; et al. HF-ACTION Investigators. Relation between volume of exercise and clinical outcomes in patients with heart failure. J Am Coll Cardiol. 2012;60(19):1899-905.

McMurray JJ, Adamopoulos S, Anker SD, et al.; ESC Committee for Practice Guidelines. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC. Eur J Heart Fail. 2012;14(8):803-69.

O'Connor CM, Whellan DJ, Lee KL, et al.; HF-ACTION Investigators. Efficacy and safety of exercise training in

patients with chronic heart failure: HF-ACTION randomized controlled trial. JAMA. 2009;301(14):1439-50.

Pashkow FJ. Issues in contemporary cardiac rehabilitation: a historical perspective. J Am Coll Cardiol. 1993;21(3):822-34.

Piepoli MF, Conraads V, Corrà U, et al. Exercise training in heart failure: from theory to practice. A consensus document of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation. Eur J Heart Fail. 2011;13(4):347-57.

Roger VL, Go AS, Lloyd-Jones Meet, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics -2012 update: a report from the American Heart Association. Circulation. 2012;125:e2-e220.

Whellan DJ, O'Connor CM, Lee KL, et al. HF-ACTION Trial Investigators. Heart failure and a controlled trial investigating outcomes of exercise training (HF-ACTION): design and rationale. Am Heart J. 2007;153(2):201-11.

Witham MD, Fulton RL, Greig CA, et al. Efficacy and cost of an exercise program for functionally impaired older patients with heart failure: a randomized controlled trial. Circ Heart Fail. 2012;5(2):209-16.

Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:e147–239.

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