# Cardiac rehabilitation in African Americans: Evidence for poorer outcomes compared with whites, especially in women and diabetic participants

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**Background** Cardiac rehabilitation (CR) improves coronary artery disease risk factors and mortality. Outcomes after CR in African Americans (AAs) compared with whites have not been studied extensively.

**Methods** A total of 1,096 patients (169 AAs, 927 whites) were enrolled in a 36-session CR program for ischemic heart disease or postcardiac surgery. The program consisted of exercise, lifestyle modification, and pharmacotherapy.

**Results** After CR, quality of life, blood pressure, and low-density lipoprotein cholesterol improved significantly in both AAs and whites, although to a lesser degree in AAs. Whites also had significant improvements in weight and triglyceride concentrations. Overall, mean peak exercise capacity, measured in metabolic equivalents (METs), improved by only 1.6 (95% CI 1.3–1.8) in AAs compared with 2.4 (2.3-2.6) in CCs ($P < .001$ for AAs vs CCs). African American women had the least improvement in METs, but changes were still significant (1.1 [CI 0.9-1.4]). The subgroup with the least improvement in METs was AA diabetic patients (1.4 (CI 1.1-1.7]).

**Conclusion** African Americans derive a significant benefit from CR, but not to the same degree as whites, based on changes in risk factors and in exercise capacity. Within both ethnic groups, both women and diabetic patients appeared to have markedly less improvement. (Am Heart J 2015;169:102-7.)

## Background

The benefits of cardiac rehabilitation (CR) after treatment of coronary artery disease include improvements in quality of life, cardiac risk factors such as blood pressure and lipid profiles, and peak exercise capacity, with resulting positive impacts on long-term mortality.[1-3] Previous studies have focused mostly on white populations, whereas examinations of CR outcomes in African American (AA) populations are sparse.[4-6] The goal of the current study was to compare outcomes after CR in AAs with those of whites. (See Fig. 1.)

## Methods

### Patient population

A total of 1,096 patients (169 AAs, 927 whites) were enrolled between 2004 and 2012 into the CR program at Wake Forest Baptist Medical Center after treatment of coronary artery disease, including percutaneous coronary intervention and coronary artery bypass graft surgery. *Coronary artery disease* was defined by clinical criteria and/or cardiac catheterization or echocardiography.

### Intervention

The CR program consisted of 3 outpatient sessions per week for 12 weeks of physical exercise and health and nutrition education. An exercise physiologist created an individualized exercise plan for each participant based on history, comorbidities, physical fitness, and clinical status according to the American College of Sports Medicine Guidelines for Exercise Testing and Prescription.[7] Exercise lasted 30 to 40 minutes and consisted of 5-minute warm-up and cool-down activity, upper and lower body training modalities including walking on a track, cycle ergometry, treadmills, stair climbers, and light resistance exercises. Level of activity was increased gradually by 0.5 to 1.0 metabolic equivalents (METs) as tolerated, to a rating of perceived exertion of 11 to 14 on a 6-20 Borg scale.[7] Heart rates were obtained at the highest level of exercise during each modality by telemetry.

### Study measures

At each visit, staff record participants' weight, systolic (SBP) and diastolic blood pressures (DBP), resting heart

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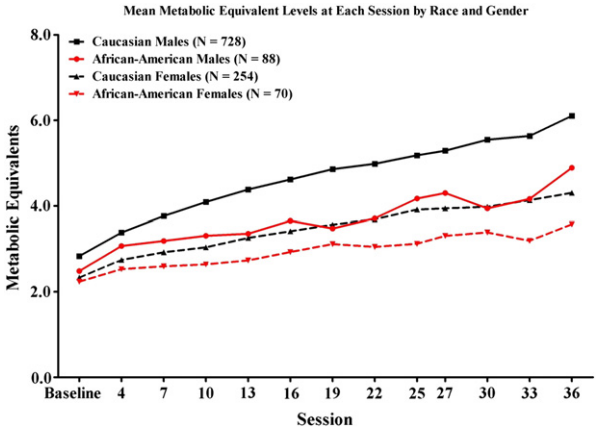
**Fig. 1**




Levels of MET in white men, AA men, white women, and AA women by session of CR. Levels of MET rose less in AA women than in all other groups.

rate, and MET level. Steady-state MET levels were recorded at each session and obtained either automatically from exercise devices or using a standardized MET formula.[8] Levels of MET (documented by the supervising exercise physiologist or nurse) were the highest level of exertion for the patient for that session and were recorded at the first and subsequent sessions in the same manner.

Blood pressure was measured in the sitting position after resting for 5 minutes by a registered nurse using a standardized cuff. Stages of hypertension were based on the JNC 7 report,[9] with normal blood pressure defined as SBP <120 mm Hg and DBP <80 mm Hg; prehypertension, as SBP 120-139 mm Hg or DBP 80-89 mm Hg; and hypertension, as a SBP >140 mm Hg or DBP >90 mm Hg.

Our goals for lipid concentrations were based on Adult Treatment Panel III guidelines[10] as follows: low-density lipoprotein (LDL) <100 mg/dL, high-density lipoprotein (HDL) >40 mg/dL, and triglycerides <150 mg/dL. Pre- and post-CR lipid profiles were checked within 1 month of starting and finishing CR, respectively. The presence of diabetes and chronic obstructive pulmonary disease was documented by medical record review and/or with standard diagnostic criteria.[11,12] Left ventricular function was measured by standard echocardiographic techniques.[13] Quality of life score was calculated before and after CR using the Ferrans and Powers Quality of Life Index Cardiac Version IV questionnaire.[14]

All clinical data were taken from patient records, and the study was approved by the Wake Forest Baptist Medical Center Institutional Review Board. No extramural funding was used to support this work. The authors are solely responsible for the design and conduct of this study, all study analyses, the drafting and editing of the manuscript, and its final contents.

**Table I.** Baseline patient characteristics by race

| Characteristic | AA (n = 169) | white (n = 927) |
|---|---|---|
| Demographics | | |
| Age (y) | 59.4 ± 11.2 | 62.9 ± 11.2* |
| Male gender | 92 (54%) | 700 (76%)* |
| Median household income, $1000 | 36.1 ± 8.9 | 44.6 ± 8.5* |
| Insured | 156 (92%) | 904 (98%)* |
| Private | 68 (40%) | 427 (46%) |
| Government | 73 (43%) | 381 (41%) |
| Other/Unknown | 15 (9%) | 96 (10%) |
| Unemployed | 53 (31%) | 125 (13%)* |
| Highest education level completed | | |
| Some high school | 2 (1%) | 5 (1%) |
| High school graduate | 36 (21%) | 248 (27%) |
| College graduate | 31 (18%) | 241 (26%)* |
| Postgraduate degree | 9 (5%) | 109 (12%)* |
| Not reported | 91 (54%) | 324 (35%)* |
| Medical history | | |
| Quality of life | 21.2 ± 5.0 | 22.4 ± 4.5* |
| Current smoker | 20 (12%) | 86 (9%) |
| Lung disease | 71 (42%) | 285 (31%)* |
| Hypertension | 151 (89%) | 726 (78%)* |
| SBP (mm Hg) | 127.7 ± 22.2 | 121.2 ± 18.2* |
| DBP (mm Hg) | 75.1 ± 11.7 | 69.5 ± 9.5* |
| Resting heart rate (beats/min) | 80.1 ± 15.1 | 74.6 ± 13.7* |
| Hyperlipidemia | 134 (79%) | 745 (80%) |
| Diabetes mellitus | 68 (40%) | 265 (29%)* |
| Glucose (mg/dL) | 105.6 ± 27.4 | 106.6 ± 31.7 |
| Ejection fraction (%) | 44.9 ± 13.9 | 49.4 ± 11.7* |
| Multivessel disease | 94 (56%) | 675 (73%)* |
| Body mass index (kg/m$^2$) | 30.0 ± 7.5 | 28.9 ± 5.6 |
| Weight (lb) | 194.5 ± 44.7 | 194.6 ± 42.3 |
| Waist circumference (inches) | 40.3 ± 6.0 | 40.9 ± 5.2 |
| Medications | | |
| β-Blocker | 152 (90%) | 839 (91%) |
| ACE inhibitor | 124 (73%) | 600 (65%)* |
| Statin | 150 (89%) | 836 (90%) |
| Baseline METs | 2.4 ± 0.7 | 2.7 ± 0.9* |

Variables expressed as frequency (percent) or mean ± SD.
* $P < .05$ vs AAs.

## Statistical methods

Descriptive statistics (frequency and percent for categorical factors, and mean and SD for continuous factors) were calculated and compared at baseline for statistical significance using $\chi^2$ or Fisher exact tests for categorical variables and Student $t$ test for continuous variables. Absolute deltas in CR metrics were calculated as mean (95% CI) of postrehabilitation minus baseline levels and compared using analysis of variance with $F$ testing. Multivariable linear regression models were constructed with increase in METs from baseline to peak as the dependent variable. Independent predictors were selected for inclusion using a backward selection methodology. All potentially significant univariate predictors of exercise capacity ($P < .10$) were included in the model, and least significant covariates were removed individually until all