Supplementary Online Content

Supplement 1


**Supplement.** Replacement Supplement With Errors Highlighted (eMethods, eTable 1, eTable 2, eTable 3)

This supplementary material has been provided by the authors to give readers additional information about their work.
Supplementary Materials – Utilization of Cardiac Rehabilitation in Veterans

Includes: eMethods, eTable 1, eTable 2, eTable 3

eMethods

Study participants:

National VA inpatient files were used to identify all patients who were discharged from VA facilities with a qualifying diagnosis of acute myocardial infarction (MI), percutaneous coronary intervention (PCI), and/or coronary artery bypass grafting (CABG) during fiscal years 2007 to 2011 (10/1/06 - 9/30/11). Diagnosis and procedure codes were extracted from the VA Corporate Data Warehouse (CDW) diagnosis and inpatient procedure files as well as from the VA MedSAS diagnosis (INP_PM, INPEXC_XM, INPOBD_PMO) and procedure (INP_PP, INPEXC_XP, INPOBD_PPO, INP_PS, INPEXC_XS, INPPCE-IE, OUTP_SE) files. We used primary ICD-9 diagnosis codes and inpatient procedure codes to define MI (410.xx), PCI (CPT 92973, 92974, 92980-92982, 92984, 92995, 92996, G0290, G0291; ICD-9 00.66, 17.55, 36.0x), and CABG (CPT 33510-33514, 33516-33519, 33521-33523, 33530, 33533-33536, 33572, 35600, 93564, S2205-S2209; ICD-9 36.10-36.16, 36.19, 36.2). Patients were excluded if death, as indicated in the VA vital status file, occurred within 30 days of hospitalization. Demographic information, including marital status, income and race, was derived from OUTP_SF, and height plus weight were extracted from vital signs files. Comorbid conditions were defined based on a single ICD-9 diagnosis code in the inpatient files listed above or based on the same diagnosis code recorded at two separate outpatient visits in the OUTP_SE or CDW outpatient diagnosis file. Medications filled within a year of hospitalization were derived from the CDW rxout_rxoutpatfill file, using drug class CN103 for aspirin, CV100 for beta-blockers, CV800 for Angiotensin Converting Enzyme inhibitors, CV805 for Angiotensin Receptor Blockers and CV350 for statins. Distance to the closest VA facility was calculated
based on patients’ home zip codes which were determined using Planning System Support Group (PSSG) enrollment files. All data files were linked using scrambled social security numbers.

To determine the presence or absence of an on-site cardiac rehabilitation (CR) program at each VA facility, we obtained data from the 2011 Survey of Cardiovascular Specialty Care Services (conducted by the VA Office of Healthcare Analysis and Information Group) that included the question, “Does your facility have a CR program?” Of the 124 VA facilities providing inpatient cardiovascular care, 39 facilities responded affirmatively to having a CR program. In follow-up telephone interviews, 4 of these facilities did not have a CR program, but the presence of an on-site CR program was confirmed at 35 VA facilities.

Outcome assessment:

The primary outcome was the number of unique patients who participated in 1 or more CR sessions within 12 months after hospitalization for MI, PCI, or CABG at a VA medical center. The number of unique patients who participated in VA CR programs from fiscal year 2007-2011 was determined from VA outpatient files (MedSAS OUTP_SE and CDW outpat_vprocedure) based on CPT codes for CR (93797, 93798, G0422, G0423, S9472). Veterans are entitled to receive non-VA health care (paid for by the VA) if an indicated service is not available at a nearby VA facility. The number of patients who participated in non-VA CR programs was determined from non-VA care (fee basis) files and from Centers for Medicare & Medicaid Services (CMS) data (OP_REV and CA_LINE). Files were linked using scrambled social security numbers. Secondary outcomes were the individual rates of participation in VA CR programs and non-VA CR programs.

Data analysis:

We compared the characteristics of patients who participated in CR vs. those who did not participate in CR using t-tests for continuous variables and chi-square tests for dichotomous or
categorical variables. Percentages and medians with interquartile ranges were reported for categorical
and continuous variables respectively. We calculated the proportion of eligible patients who
participated in CR at facilities with vs. without an onsite CR program. We used multivariable logarithmic
regression to determine factors independently associated with CR participation. Analyses were
performed using SAS (version 9.4; SAS Institute Inc, Cary, NC).
### eTable 1. Patient Participation in Cardiac Rehabilitation (CR) by Qualifying Diagnosis (10/06-9/11)

<table>
<thead>
<tr>
<th></th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospitalized</td>
</tr>
<tr>
<td>Total</td>
<td>88 826</td>
</tr>
<tr>
<td>MI only</td>
<td>17 271</td>
</tr>
<tr>
<td>PCI only</td>
<td>34 083</td>
</tr>
<tr>
<td>CABG only</td>
<td>19 097</td>
</tr>
<tr>
<td>MI + PCI</td>
<td>13 103</td>
</tr>
<tr>
<td>MI + CABG</td>
<td>28 687</td>
</tr>
<tr>
<td>PCI + CABG</td>
<td>16 287</td>
</tr>
<tr>
<td>MI + PCI + CABG</td>
<td>777</td>
</tr>
<tr>
<td>All MI</td>
<td>34 018</td>
</tr>
<tr>
<td>All PCI</td>
<td>49 591</td>
</tr>
<tr>
<td>All CABG</td>
<td>24 369</td>
</tr>
</tbody>
</table>

MI = Myocardial Infarction

CABG = Coronary Artery Bypass Grafting

PCI = Percutaneous Coronary Intervention
eTable 2a. Patient characteristics associated with participation in cardiac rehabilitation following hospitalization for ischemic heart disease (10/1/06-9/30/11) at 35 VA medical centers with an on-site CR program.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants</th>
<th>Non-participants</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=4771</td>
<td>N=25,923</td>
<td></td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>64.9 ± 8.8</td>
<td>66.8 ± 10.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male sex (%)</td>
<td>4697 (98.5%)</td>
<td>25,522 (98.5%)</td>
<td>0.86</td>
</tr>
<tr>
<td>Race – White (%)</td>
<td>3621 (75.9%)</td>
<td>19,622 (75.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Non white (%)</td>
<td>955 (20.8%)</td>
<td>5172 (26.4%)</td>
<td></td>
</tr>
<tr>
<td>Not disclosed (%)</td>
<td>195 (4.1%)</td>
<td>1129 (4.4%)</td>
<td></td>
</tr>
<tr>
<td>Married (%)</td>
<td>2583 (54.1%)</td>
<td>12,595 (48.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Income ($) &lt;9,000 (%)</td>
<td>623 (13.3%)</td>
<td>3515 (13.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>9,000-16,999 (%)</td>
<td>1382 (29.4%)</td>
<td>8,229 (32.2%)</td>
<td></td>
</tr>
<tr>
<td>17,000-33,000 (%)</td>
<td>1717 (36.6%)</td>
<td>9,357 (36.7%)</td>
<td></td>
</tr>
<tr>
<td>&gt;33,000 (%)</td>
<td>971 (20.7%)</td>
<td>4,428 (17.3%)</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.4 ± 5.8</td>
<td>29.5 ± 6.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Distance from VA facility &lt;11 miles (%)</td>
<td>1399 (31.6%)</td>
<td>6,425 (26.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>11-31 miles (%)</td>
<td>1064 (24.0%)</td>
<td>5,432 (22.3%)</td>
<td></td>
</tr>
<tr>
<td>&gt;31 miles (%)</td>
<td>1965 (44.4%)</td>
<td>12,552 (51.4%)</td>
<td></td>
</tr>
<tr>
<td><strong>Medical History</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>4387 (92.0%)</td>
<td>23,849 (92.0%)</td>
<td>0.91</td>
</tr>
<tr>
<td>Hyperlipidemia (%)</td>
<td>4521 (94.8%)</td>
<td>23,359 (90.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>2546 (53.4%)</td>
<td>13,451 (51.9%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Heart Failure (%)</td>
<td>1439 (30.2%)</td>
<td>8,880 (34.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stroke (%)</td>
<td>758 (15.9%)</td>
<td>5,004 (19.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Condition</td>
<td>Group 1</td>
<td>Group 2</td>
<td>p-value</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Peripheral Vascular Disease (%)</td>
<td>1311 (27.5%)</td>
<td>8062 (31.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>COPD (%)</td>
<td>1295 (27.1%)</td>
<td>8062 (31.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chronic Kidney Disease (%)</td>
<td>903 (18.9%)</td>
<td>5827 (22.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Depression (%)</td>
<td>1586 (33.2%)</td>
<td>8076 (31.2%)</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>Medications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin (%)</td>
<td>3614 (75.7%)</td>
<td>18 648 (71.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Beta-blocker (%)</td>
<td>4557 (95.5%)</td>
<td>23 413 (90.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ACE/ARB (%)</td>
<td>3670 (76.9%)</td>
<td>19 280 (74.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Statin (%)</td>
<td>4644 (97.3%)</td>
<td>23 908 (92.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Primary CR Indication</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>943 (19.8%)</td>
<td>9618 (37.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PCI</td>
<td>1043 (21.9%)</td>
<td>11 053 (42.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CABG</td>
<td>2785 (58.4%)</td>
<td>5252 (20.3%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
eTable 3. Patient characteristics associated with participation in cardiac rehabilitation following hospitalization for ischemic heart disease (10/1/06-9/30/11) at 89 VA medical centers without an on-site CR program.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants</th>
<th>Non-participants</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=4352</td>
<td>N=53 780</td>
<td></td>
</tr>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>63.9 ± 8.5</td>
<td>66.0 ± 10.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male sex (%)</td>
<td>4279 (98.3%)</td>
<td>52 861 (98.3%)</td>
<td>0.94</td>
</tr>
<tr>
<td>Race – White (%)</td>
<td>3505 (84.3%)</td>
<td>41 511 (81.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Non white (%)</td>
<td>655 (15.1%)</td>
<td>9615 (17.9%)</td>
<td></td>
</tr>
<tr>
<td>Not disclosed (%)</td>
<td>192 (4.4%)</td>
<td>2654 (4.9%)</td>
<td></td>
</tr>
<tr>
<td>Married (%)</td>
<td>2423 (55.7%)</td>
<td>27 587 (51.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Income ($) &lt;9,000 (%)</td>
<td>539 (12.5%)</td>
<td>7033 (13.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>9,000-16,999 (%)</td>
<td>1297 (30.2%)</td>
<td>17 499 (33.0%)</td>
<td></td>
</tr>
<tr>
<td>17,000-33,000 (%)</td>
<td>1657 (38.5%)</td>
<td>20 048 (37.9%)</td>
<td></td>
</tr>
<tr>
<td>&gt;33,000 (%)</td>
<td>807 (18.8%)</td>
<td>8383 (15.8%)</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.7 ± 5.9</td>
<td>29.6 ± 5.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Distance from VA facility &lt;11 miles (%)</td>
<td>336 (8.2%)</td>
<td>2118 (4.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>11-31 miles (%)</td>
<td>318 (7.8%)</td>
<td>2544 (5.0%)</td>
<td></td>
</tr>
<tr>
<td>&gt;31 miles (%)</td>
<td>3446 (84.0%)</td>
<td>46 424 (90.9%)</td>
<td></td>
</tr>
<tr>
<td>Medical History</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>4069 (93.5%)</td>
<td>49 663 (92.3%)</td>
<td>0.006</td>
</tr>
<tr>
<td>Hyperlipidemia (%)</td>
<td>4151 (95.4%)</td>
<td>48 709 (90.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>2432 (55.9%)</td>
<td>28 576 (53.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart Failure (%)</td>
<td>1276 (29.3%)</td>
<td>18 118 (33.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Condition</td>
<td>Prevalence 1</td>
<td>Prevalence 2</td>
<td>p-value</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>Stroke (%)</td>
<td>647 (14.9%)</td>
<td>9832 (18.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Peripheral Vascular Disease (%)</td>
<td>1095 (25.2%)</td>
<td>16218 (30.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>COPD (%)</td>
<td>1292 (34.0%)</td>
<td>18485 (34.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chronic Kidney Disease (%)</td>
<td>813 (18.7%)</td>
<td>11559 (21.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Depression (%)</td>
<td>1581 (36.3%)</td>
<td>17632 (32.8%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Medications**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Prevalence 1</th>
<th>Prevalence 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin (%)</td>
<td>3190 (73.3%)</td>
<td>38917 (72.4%)</td>
<td>0.18</td>
</tr>
<tr>
<td>Beta-blocker (%)</td>
<td>4195 (96.4%)</td>
<td>49095 (91.3%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ACE/ARB (%)</td>
<td>3346 (76.9%)</td>
<td>40378 (75.1%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Statin (%)</td>
<td>4231 (97.2%)</td>
<td>50114 (93.2%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Primary CR Indication**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Prevalence 1</th>
<th>Prevalence 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI</td>
<td>1068 (24.5%)</td>
<td>18745 (34.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PCI</td>
<td>967 (22.2%)</td>
<td>21020 (39.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CABG</td>
<td>2317 (53.2%)</td>
<td>14015 (26.1%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>