A nomogram of exercise capacity for age predicted mortality in women with cardiovascular symptoms


Clinical impact ratings: GIM/FP/GP ★★★★★✩ Cardiology ★★★★★✩✩✩ Geriatrics ★★★★★✩✩✩

Question
In women with cardiovascular symptoms and in asymptomatic women, does the percentage of predicted exercise capacity for age predict all-cause and cardiac mortality?

Methods
Design: 2 cohort studies, 1 for derivation of a nomogram (St. James Women Take Heart Project [SJWTHP]) and 1 for validation (Economics of Noninvasive Diagnosis Study [ENDS]).

Setting: Metropolitan Chicago (SJWTHP) and 6 medical centers in the United States (ENDS).

Patients: The derivation cohort included 5721 women ≥ 35 years of age (mean age 52 y) with the ability to walk on a treadmill at a moderate pace, weight ≤ 148 kg, and blood pressure < 170/110 mm Hg. Exclusion criteria included pregnancy, typical angina symptoms, history of cardiac disease, and incomplete data on cardiac risk factors. The validation cohort included 4471 women (mean age 61 y) with cardiovascular symptoms. Women who were recently hospitalized for unstable angina, myocardial infarction, or coronary revascularization were excluded.

Description of prediction guide: For all participants, exercise capacity (measured in metabolic equivalents [METs]) was estimated based on the speed and grade of a treadmill according to the Bruce protocol. Through use of the derivation cohort, a linear regression of exercise capacity on age was calculated as MET = 14.7 – 0.13 × age. For a given age, the percentage of predicted exercise capacity was obtained from (observed METs + age-predicted METs) × 100. A nomogram to determine the percentage of predicted exercise capacity for age was constructed using the linear regression equation for the derivation cohort. The association between exercise capacity and mortality was assessed using Cox proportional-hazards models.

Outcome: All-cause and cardiac mortality.

Main results
In both derivation and validation cohorts, the rates of all-cause and cardiac mortality were greater in women with exercise capacity < 85% of the age-predicted value than in women with exercise capacity ≥ 85% of the age-predicted value (Table). Both rates were also greater in women whose exercise capacity was less than that predicted for age than in women whose exercise capacity exceeded the age-predicted value by more than 3 METs (Table).

Conclusions
In women with cardiovascular symptoms and asymptomatic women, the percentage of predicted exercise capacity for age predicted all-cause and cardiac mortality.

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Associations between exercise capacity and all-cause and cardiac mortality in women*

<table>
<thead>
<tr>
<th>Exercise capacity</th>
<th>All-cause mortality Hazard ratios (95%)</th>
<th>Cardiac mortality Hazard ratios (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 85% of predicted value for age†</td>
<td>2.03 (1.51 to 2.71)</td>
<td>2.44 (1.46 to 4.09)</td>
</tr>
<tr>
<td>≥ 85% of predicted value</td>
<td>2.37 (1.90 to 2.97)</td>
<td>2.02 (1.43 to 2.85)</td>
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<tr>
<td>Observed minus predicted value &lt; 0 vs &gt; 3 METs</td>
<td>2.63 (1.33 to 5.19)</td>
<td>3.80 (2.26 to 6.38)</td>
</tr>
<tr>
<td>≥ 0 vs &lt; 3 METs</td>
<td>3.28 (2.47 to 4.35)</td>
<td>4.27 (1.03 to 17.6)</td>
</tr>
</tbody>
</table>

*METs = metabolic equivalents; †Defined in Glossary.

The study by Gulati and colleagues provides important information about predicting age-adjusted exercise capacity in women. Moreover, it reemphasizes the prognostic importance of functional status, specifically the percentage of predicted exercise capacity. Beyond these results, the implications are less clear.

Previous studies have shown independent prognostic significance of exercise capacity in suspected coronary heart disease (1), and this has led guidelines to call for exercise as the preferred provocative stimulus for stress testing and exercise capacity as a key variable for prognostication. The study by Gulati and colleagues further calls into question the asymptomatic women, the ability to walk on a treadmill at a moderate pace, thus almost certainly overestimating exercise capacity compared with a truly representative sample. Surprisingly, Gulati and colleagues did not report what proportion of the asymptomatic sample achieved predicted exercise capacity, thus we have little information about the comparability of the samples. The authors did not provide adequate information on how well the predictive model discriminates risk. The exercise capacity threshold of 85% of the age-predicted value, and more important, categories according to an absolute difference in expected compared with observed METs, provide some information. But we need to know the relation between capacity as a continuous measure and outcome, since that would provide the most useful predictive value. Exercise capacity data are routinely collected during exercise stress testing, and further prospective quantification is warranted.

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Reference