Gender Disparities in the Utilization of Myocardial Perfusion Imaging
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BACKGROUND
- Myocardial perfusion imaging (MPI) is recommended by the American Heart Association/American College of Cardiology for the evaluation and diagnosis of patients with coronary artery disease.
- MPI is commonly used non-invasive imaging modality where stress to the myocardium is achieved with the use of exercise or pharmacologically.
- Gender disparities in receiving cardiac stress tests and exercise stress test have been identified in the United States population-based studies.2,4
- To date, no studies have examined whether disparities exist in the utilization of pharmacologic stress tests in the United States.

STUDY OBJECTIVE AND HYPOTHESIS
- Study objective: To assess whether disparities exist in the utilization of MPI in relation to gender and other sociodemographic factors in the United States ambulatory care setting.
- Study hypothesis: Women are less likely to receive MPI procedures than men when other sociodemographic factors are controlled.

METHODOLOGY

Data Source
- Cross-sectional physician survey data from the 2004 National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS)
- NAMCS and NHAMCS are national probability sample annual surveys of United States private, non-hospital-based clinics physicians and hospital-based outpatient/emergency departments of nonfederal short-stay hospital physicians, respectively.

Patient Selection
- Orders of pharmacologic MPI tests were determined using the International Classification of Diseases, 9th Revision procedure code (ICD-9) 84.44.
- For patients with orders for pharmacologic MPI tests, characteristics including gender, age, ethnicity, and payment type were extracted.
- We included all orders from the NAMCS database (private clinics). However, orders placed by emergency department physicians were excluded from the NHAMCS database, thus, only leaving the outpatient department orders and limiting our analysis to the ambulatory care setting.

Statistical Analysis
- Utilization rates for pharmacologic MPI tests use (tests/100,000 visits) by gender and other characteristics were calculated at a national level.
- Logistic regression analyses (with proportional sample weights applied) were conducted for the overall identified population and for a subgroup including females only.
- Odds ratios (OR) and 95% confidence intervals (CI) were calculated with the level of significance set at 0.05.

RESULTS
Overall Pharmacologic MPI Test Ordering
- In the United States in 2004, 2.9 million and 228.0 million pharmacologic MPI procedures were ordered by office-based physicians and hospital outpatient departments, respectively.
  - The mean age (±SD) of the office-based ambulatory patients was 61.6±12.9 years, 54.1% were males, and 78.7% were White.
  - The mean age (±SD) of patients in the hospital outpatient setting was 55.4±17.7 years, 60.4% were males, and 80.4% were White.
- Utilization rates (test/100,000 visits) differed by gender (420 in men vs. 250 in women) for office visits, and 415 in men vs. 175 in women for hospital outpatient department visits and by other characteristics (Figure 1).

Factors Associated with Pharmacologic MPI Test Ordering among All Identified Patients
- Logistic regression analyses revealed that while controlling for other sociodemographic factors, women were significantly less likely than men to have the procedure ordered during both office and hospital outpatient department visits (both p<0.05). OR 0.63 (95% CI 0.41-0.97) and OR 0.54 (95% CI 0.32-0.91), respectively (Table 1).
- During office visits, age was also significantly associated with the test orders: those within the 45-64 and 65-74 age groups were 5.4 and 5.5 fold more likely to have a pharmacologic MPI test order, respectively, than those of 25-44 years of age (both p<0.05).
- In addition, patients with “Other” insurance type (self-pay, no charge/charity, and other unknown) were significantly less likely to have the order compared to patients with private insurance in both office-based and hospital outpatient settings (both p<0.05) (Table 1).

Factors Associated with Pharmacologic MPI Test Ordering in Women
- A subgroup analysis was further conducted among women only to determine factors associated with pharmacologic MPI test ordering among this subgroup of patients.
- Logistic regression analyses revealed that while controlling for other factors, age was the only factor significantly associated with the test orders during office visits (p<0.001): women of 45-64 years of age were 6.2 times more likely to have the procedure ordered compared to the women of 25-44 years of age.

DISCUSSION AND CONCLUSIONS
- This study was the first to our knowledge to examine disparities in the utilization of the pharmacologic MPI tests. Findings from this study can help identify the potentially underserved populations using a nationally representative sample.
- In this nationally-representative physician survey database, a larger proportion of the MPI test orders was placed by office-based vs. hospital outpatient physicians.
- MPI tests were ordered less frequently for women regardless of age, race, ethnicity, and payment type in both non-hospital office- and hospital outpatient-based settings.
- Of other studied characteristics, age was also significantly associated with the MPI test ordering by the non-hospital office physicians, but not by the hospital outpatient departments.
- Age was a determinant of the MPI test ordering among women in the non-hospital private office setting only; none of other studied sociodemographic characteristics predicted MPI test ordering in women in either setting.
- Our findings are consistent with the overall trend seen in the literature: the averaged rate of yearly increase (over 8 years) in the use of imaging stress tests was about 1.5 times higher in non-black men than in women or black men in one cross-sectional years5; similarly, men were significantly more likely than women to receive an exercise stress test across all age strata in another study (all p<0.005).6
- Our study has certain limitations:
  - Data extracted from the datasets refer to the tests ordered and may not accurately reflect the number of tests actually conducted.
  - No patients’ clinical characteristics were included in this analysis. The impact of inherent gender differences on the disease presentation and manifestations need to be considered.
  - Understanding why gender disparities exist requires further research into clinical and socioeconomic factors.
  - A study using different data source is warranted to confirm whether these disparities remain with regard to the tests received.

REFERENCES

Table 1. Sociodemographic factors associated with pharmacologic stress test ordering (all patients)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Male (%)</th>
<th>Ref</th>
<th>Male (%)</th>
<th>OR (95% CI)</th>
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<tr>
<td>Race and Ethnicity</td>
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<td>White</td>
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<td>338/513</td>
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<td>Black/African American</td>
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<td>Hispanic</td>
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<td>0.82 (0.43-1.61)</td>
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<td>Other</td>
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<td>0.61 (0.22-1.69)</td>
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<td>Age</td>
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<tr>
<td>&lt;25</td>
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<td>25-44</td>
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<td>228/372</td>
<td>1.39 (0.64-3.03)</td>
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<td>45-64</td>
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<td>0.63 (0.41-0.97)</td>
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<td>65-74</td>
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<td>SCHIP</td>
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<td>0.61 (0.22-1.69)</td>
</tr>
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</table>

Data extracted from the datasets refer to the tests ordered and may not accurately reflect the number of tests actually conducted. Abbreviations: SCHIP=State Children’s Health Insurance Program.