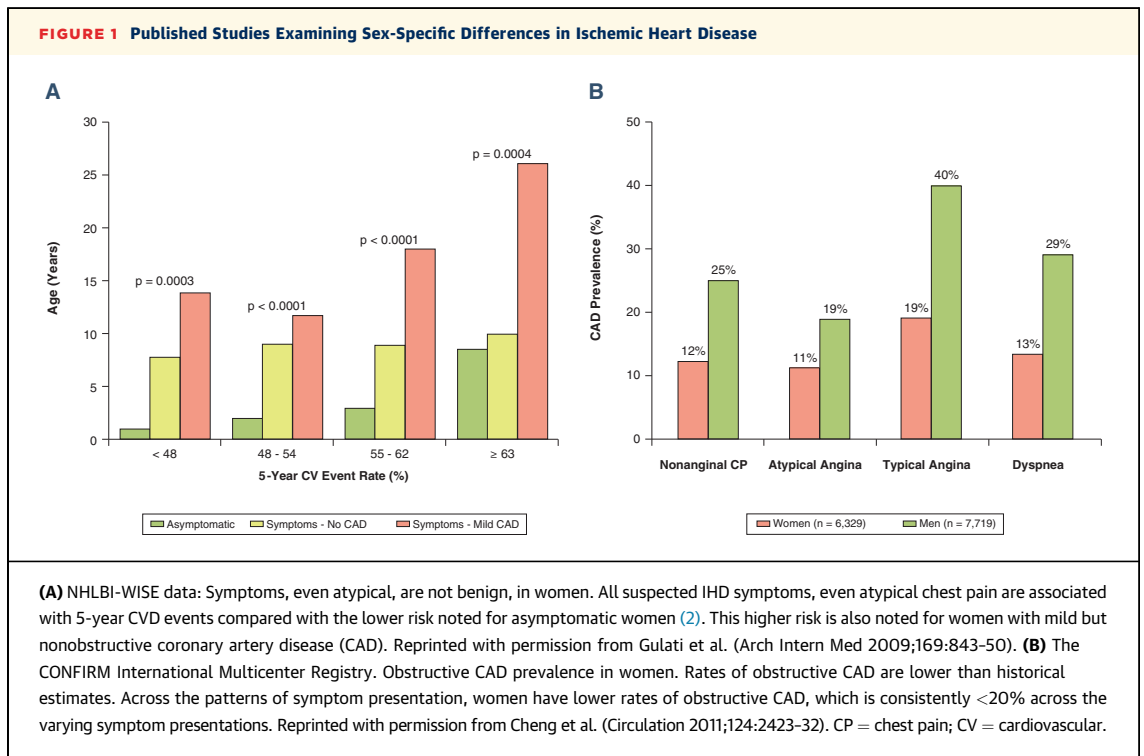


Sex Differences in Cardiovascular Imaging



Leslee J. Shaw, PhD

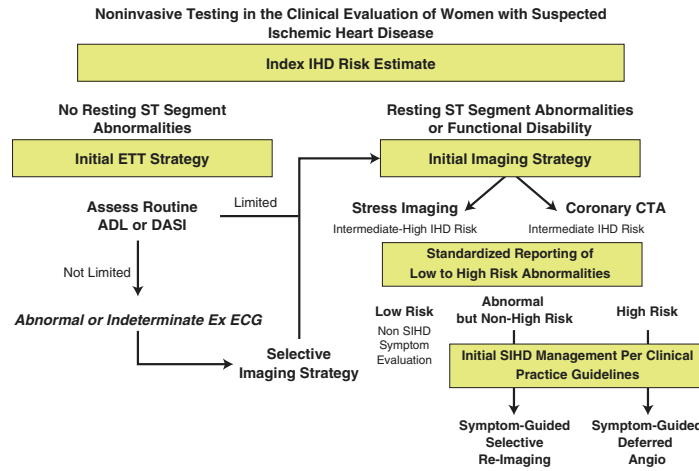
HEART DISEASE IS THE LEADING CAUSE OF DEATH FOR WOMEN IN THE UNITED STATES, RESPONSIBLE for 1 in every 4 women's deaths. Despite increases in awareness over the past decade, only 54% of women recognize that heart disease is their number 1 killer. Almost two-thirds (64%) of women who die suddenly of coronary heart disease have no previous symptoms. By race, heart disease is also the leading cause of death equally for African-American and white women in the United States. Among Hispanic women, heart disease and cancer cause roughly the same number of deaths each year. For American-Indian or Alaska Native and Asian or Pacific Islander women, heart disease is second only to cancer. Women presenting with suspected or with known coronary artery disease are generally older and have higher incidences of diabetes, hypertension, and often a clustering of risk factors. Women also present with more anginal-equivalent or atypical symptoms (1,2). See [Figures 1 to 5](#).



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FIGURE 2 American Heart Association Consensus Statement: Role of Noninvasive Testing in the Clinical Evaluation of Women With Suspected IHD



Women with no resting ST-T wave changes who are capable of routine activities of daily living (ADL) or have an estimated Duke Activity Status Index (DASI) of at least 5 metabolic equivalents are recommended to undergo exercise treadmill testing without imaging. Following the exercise ECG. Women with an abnormal or indeterminate result are referred to imaging. Imaging could include a stress imaging procedure or coronary CTA. Women are referred directly to an initial imaging strategy if they have resting ST segment abnormalities or functional disability. Following the index imaging procedure, standardized reporting should document all low- to high-risk findings, with stable IHD management per guidelines. Reprinted with permission from Mieres et al. (Circulation 2014;130:350-79). Abbreviations as in Figure 1.

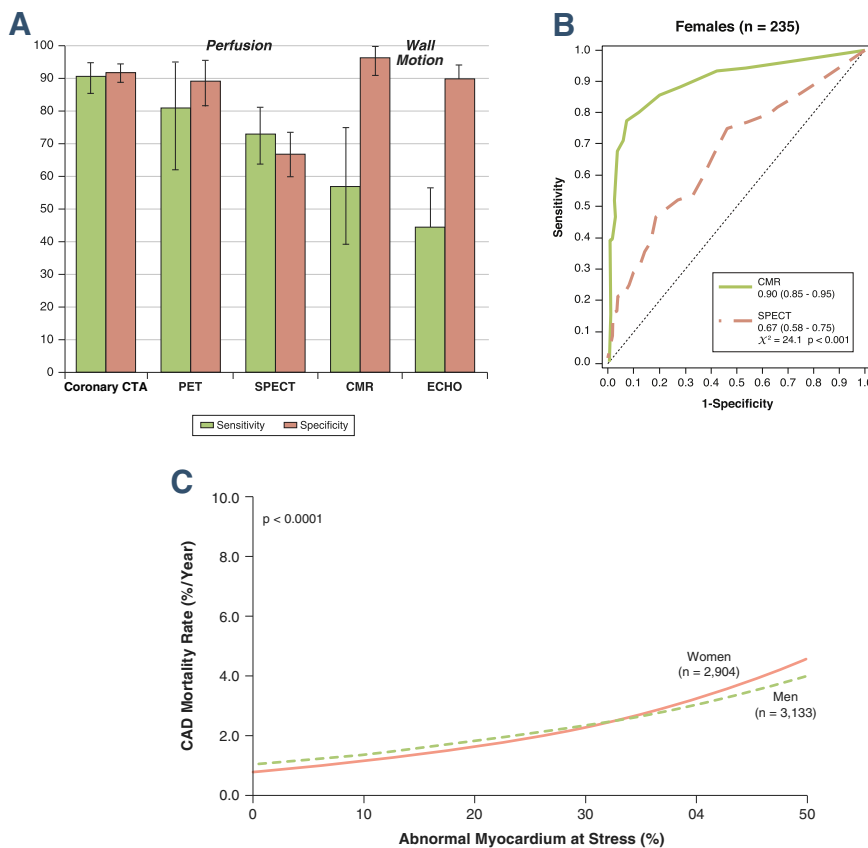
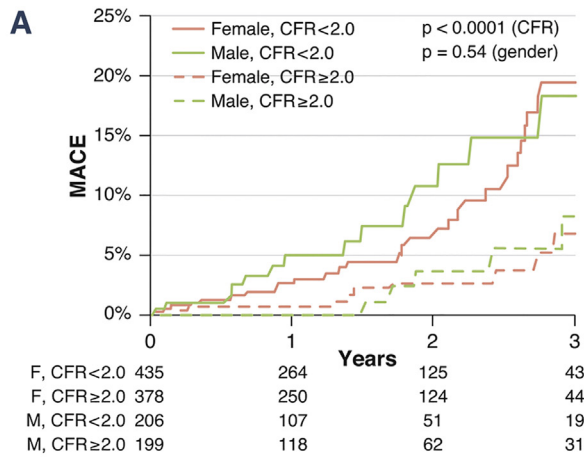


FIGURE 3 Imaging Trials and Registries Examining Diagnostic and Prognostic Accuracy

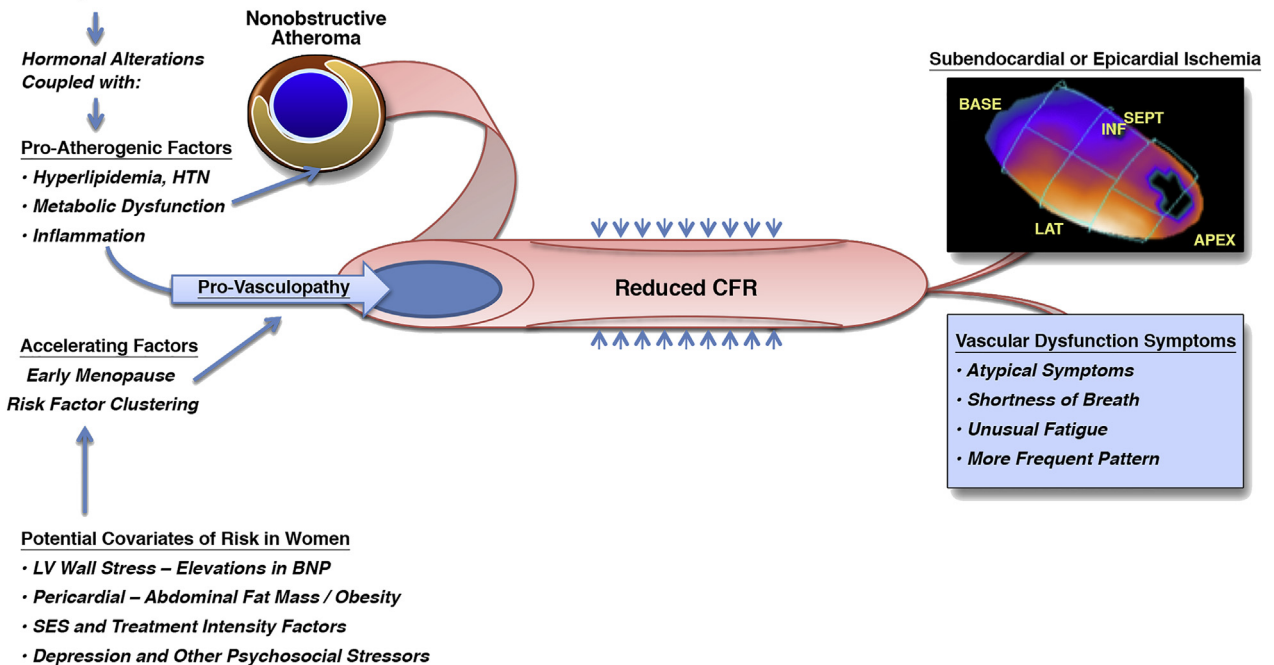
(A) Evaluation of Integrated CAD Imaging in IHD trial (N = 475). Coronary CTA has the highest diagnostic accuracy when compared with invasive angiography. Of the functional imaging procedures, PET imaging has the highest diagnostic accuracy, with diminished sensitivity noted for CMR and echocardiography wall motion imaging. Reprinted with permission from Neglia et al. (Circ Cardiovasc Imaging 2015;8:e002179). **(B)** CE-MARC trial (N = 752) compared CMR with stress myocardial perfusion SPECT imaging. The receiver operating characteristics curves reveal a substantially higher diagnostic accuracy for women with CMR compared with SPECT imaging; a pattern emulated from the main trial results. Reprinted with permission from Greenwood et al. (Circulation 2014;129:1129-38). **(C)** PET Prognosis Registry. Predicted CAD mortality in 2,904 women and 3,133 men undergoing stress myocardial perfusion PET, reports similar annualized mortality rate for women and men by the % abnormal myocardium at stress. Reprinted with permission from Kay et al. (J Am Coll Cardiol 2013;62:1866-76). *% Myocardium = Summed Stress Score/(17 × 4). CTA = computed tomographic angiography; ECHO = echocardiogram; other abbreviations as in Figures 1 and 2.

FIGURE 4 Added Prognostic Value of PET Quantification of Coronary Flow Reserve

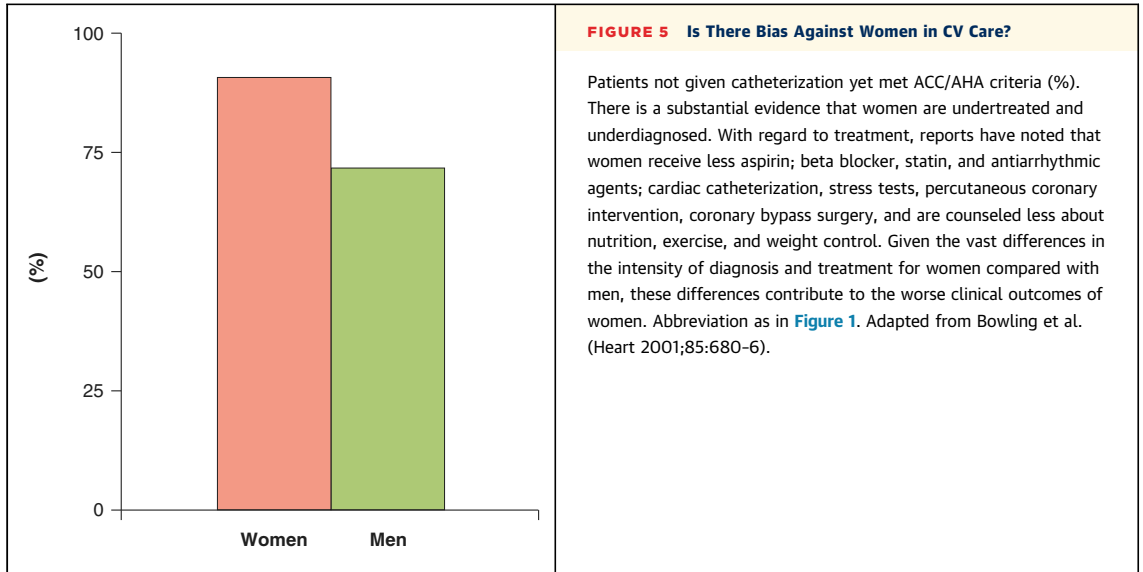


B
Sex-Specific Precursors

- PCOS
- Hypoestrogenemia
- Menopause



PET quantification of myocardial blood flow. (A) This figure reports the cumulative incidence of major adverse cardiac events (MACE) among women and men based on coronary flow reserve (CFR) findings. Higher risk status was noted for women and men with CFR measures <math>< 2.0</math>. Reprinted with permission from Murthy et al. (Circulation 2014;129:2518-27). (B) Hypothetical model of female-specific angina. Mild but nonobstructive CAD resulting in reduced CFR and MI. The model hypothesizes that the varying etiology of reduced epicardial CFR or coronary microvascular dysfunction results in a varying symptom presentation including more atypical or ischemic-equivalent symptoms. Reprinted with permission from Shaw et al. (J Am Coll Cardiol 2009;54:1561-75). BNP = brain natriuretic peptide; HTN = hypertension; LV = left ventricular; PCOS = polycystic ovary syndrome; SES = socioeconomic status; other abbreviations as in Figures 1 to 3.



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