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ORIGINAL RESEARCH

Treatment Effect of Percutaneous Coronary Intervention in Men Versus Women With ST-Segment–Elevation Myocardial Infarction

Samian Sulaiman, MD;* Akram Kawsara, MD;* Mohamed O. Mohamed, MD, PhD; Harriette G. C. Van Spall, MD, MPH; Nadia Sutton, MD; David R. Holmes, MD; Mamas A. Mamas, MD, PhD; Mohamad Alkhouli, MD

BACKGROUND: Women are less likely to receive primary percutaneous coronary intervention (pPCI) than men. A potential reason is risk aversion because of the worse outcomes with pPCI among women. However, whether pPCI is associated with a comparable mortality benefit in men and women remains unknown.

METHODS AND RESULTS: We selected patients admitted with a principal diagnosis of ST-segment–elevation myocardial infarction in the National Inpatient Sample (2016–2018). We used propensity-score matching to calculate average treatment effects of pPCI for in-hospital mortality, major complications, length of stay, and cost. As a sensitivity analysis, we used logit models followed by a marginal command to calculate the average marginal effect. We included 413 500 weighted hospitalizations (30.7% women, 69.3% men). Women had more comorbidities except smoking and prior sternotomy. Compared with men, women were less likely to undergo angiography (81.0% versus 87.0%; adjusted odds ratio [OR], 0.77; 95% CI, 0.74–0.81; $P<0.001$) or pPCI (74.0% versus 82.0%; adjusted OR, 0.76; 95% CI, 0.73–0.79; $P<0.001$). There were no significant differences in average treatment effects of pPCI on mortality between men (–8.4% [–9.3% to –7.6%], $P<0.001$), and women (–9.5% [–10.8% to –8.3%], $P<0.001$) (P interaction=0.16). This persisted in age-stratified analyses (≥85, 65–84, 45–64, <45 years) and sensitivity analysis, excluding emergent admissions. The average treatment effects of pPCI on major complications were comparable except for acute stroke, leaving against medical advice, and palliative encounter. There were no differences in the average treatment effects of pPCI on length of stay, but the proportional increase in cost with pPCI was higher in women.

CONCLUSIONS: pPCI results in a comparable reduction in in-hospital mortality in men and women. Nonetheless, risk-adjusted rates of pPCI remain lower in women in contemporary US practice.

Key Words: myocardial infarction ■ percutaneous coronary intervention ■ sex differences ■ treatment effect

Disparities in the management of ST-segment–elevation myocardial infarction (STEMI) between men and women are well documented. Women presenting with STEMI are less likely to receive invasive management, primary percutaneous coronary intervention (pPCI), or preventive medication at discharge.[1–10] Reasons for this disparity are multifactorial and include differences in risk profile, symptom complex, and timing of presentation (typically more delayed among women).[11–14] In addition, pPCI is thought to be associated with worse outcomes in women, which may play a role in the lower rates of its provision among them, although data on sex-specific pPCI outcomes are conflicting.[1,9,11–16] However, previous studies documenting worse outcomes of pPCI in women only compared absolute mortality and not the differential

Correspondence to: Mohamad Alkhouli, MD, Mayo Clinic School of Medicine, 200 First Street SW, Rochester, MN 55905. E-mail: alkhouli.mohamad@mayo.edu

*S. Sulaiman and A. Kawsara contributed equally.

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CLINICAL PERSPECTIVE

What Is New?

- This study documents that in the setting of ST-segment–elevation myocardial infarction, women are less likely to undergo primary percutaneous coronary intervention than men, despite both sexes deriving comparable clinical benefit from the procedure.
- This treatment gap persists even after adjustment for differences in demographics and comorbidities between men and women.

What Are the Clinical Implications?

- Efforts are needed to identify effective strategies to bridge this gap.

Nonstandard Abbreviations and Acronyms

AME	average marginal effect
ATE	average treatment effect
NIS	National Inpatient Sample
pPCI	primary percutaneous coronary intervention

treatment effect of pPCI on outcomes in men versus women. The latter approach, referred to as treatment effect, has been recently used to assess whether high-risk patients derive a comparable benefit from a specific cardiovascular intervention (eg, percutaneous coronary intervention [PCI]) than low-risk patients.[17,18] We used a contemporary nationwide database to test the hypothesis that pPCI is associated with a comparable effect on short-term mortality in men and women. Hence, avoiding pPCI in women based on their higher perceived risks is not justified.

METHODS

Study Data

Our study used the National Inpatient Sample (NIS) (January 1, 2016 to December 31, 2018). The NIS is the largest publicly available all-payer inpatient database in the United States. The annual NIS sample encompasses ~8 million discharges, representing 20% of inpatient stays across different hospital types and geographic regions.[19] National estimates of the US population are calculated using standardized sampling and weighting methods provided by the Agency for Healthcare Research and Quality. The NIS includes detailed information about demographics, inpatient diagnoses and procedures, total costs, primary payers, length of stay, and hospital characteristics and has been used extensively to assess outcomes of STEMI, pPCI, and other cardiovascular interventions.[1,2,20–23] Because data are publicly available and deidentified, this study was deemed exempt from institutional board review approval. The authors of this article cannot share the NIS data directly because the Agency for Healthcare Research and Quality imposes restrictions on data sharing. Please refer to the Data Use Agreement available on www.hcup-us.ahrq.gov for more information.

Study Population

Hospital stays for adults (aged ≥18 years) with a primary diagnosis of STEMI were identified using the *International Classification of Diseases, Tenth Revision, Clinical Modification* (*ICD-10-CM*) codes (Table S1). Patients who were coded to have STEMI as a secondary diagnosis were excluded. We also excluded those who were transferred to another hospital to avoid duplication of records.

Study End Points

We investigated the effect of pPCI on clinical outcomes in men and women. The primary end point was in-hospital mortality. Secondary end points included acute stroke, vascular complications, gastrointestinal bleeding, blood transfusion, mechanical ventilation, palliative care use, home discharge, and transfer to a skilled nursing facility. We also compared the length of stay and cost between men and women with or without pPCI.

Statistical Analysis

Baseline Comparisons

Categorical variables were presented as percentages and compared using the χ^2 test. Continuous variables with a normal distribution (eg, age) were presented as means with a 95% CI and compared using a *t* test. Continuous variables with a skewed distribution (eg, cost) were presented as medians with interquartile range and compared using the Wilcoxon rank sum test. We used quantile linear regression followed by Stata's margins command to predict adjusted medians of the length of stay and costs.[24,25] Total costs were adjusted for inflation using the Consumer Price Index and were calculated in 2018 US dollars. Because the data were missing in <1% for all variables except for race (~4%) and household income (~2%), we deleted missing data and did not impute them using complex statistical methods. We used Stata 15 (StataCorp, College Station, TX) for all analyses.

Risk-Adjusted Differences in Management Patterns

To assess the likelihood of women receiving standard of care treatment (angiography, pPCI), we constructed a multivariate logistic regression model to account for differences in baseline characteristics between men and women. Multiple variables were included in the model: age, race, chronic renal insufficiency, chronic obstructive pulmonary disease, primary payer, household income, hypertension, diabetes, heart failure, atrial fibrillation, peripheral vascular disease, prior stroke, prior sternotomy, conduction disorder, anemia, liver disease, obesity, malignancy, dementia, chronic obstructive pulmonary disease, and elective admission status. The likelihood of undergoing angiography or pPCI among women versus men was presented as an odds ratio [OR] with 95% CI.

Average Treatment Effect

We estimated the average treatment effect (ATE) of PCI in each group using propensity-score matching.[17,26–28] Briefly, we used a logistic regression model to predict each hospitalization's propensity score using the following covariates: age, chronic renal insufficiency, race, insurance (Medicaid/Medicare), household income, hypertension, diabetes, heart failure, atrial fibrillation, vascular disease, prior stroke, prior sternotomy, conduction disorder, anemia, liver disease, obesity, malignancy, dementia, chronic obstructive pulmonary disease, and admission status (Figure S1). Each hospitalization was matched to a single hospitalization from the opposite group (pPCI versus no PCI) whose propensity score is closest. The ATE was computed by taking the average difference in outcomes between each hospitalization and its match. We repeated this method for each clinical outcome. A negative ATE coefficient indicates that pPCI reduces the rate of that outcome and vice versa. We compared the ATE coefficients between men and women using the following formula $Z = (b1 - b2)/(SEb1^2 + SEb2^2)$. Where $b1$ and $b2$ are the ATE coefficients in each group, and $SEb1$ and $SEb2$ are the corresponding standard errors. *P*-value was calculated from the corresponding Z score.

To ensure the robustness of our findings, we performed several sensitivity analyses. To account for clustering within hospitals, we used a different method to calculate the treatment effect of pPCI in women versus men (logit model followed by the average marginal effects [AMEs]).[25,29,30] We first fitted a population-averaged logit model using the exchangeable correlation structure and robust variance-covariance estimation in this method.[30] The model was adjusted for the same covariates included in the first propensity-score matching method. We followed this by calculating average marginal effect (Stata's margins command). For every hospitalization, the margins command uses the logit model to predict the probability of the outcome (eg, in-hospital mortality) in 2 scenarios: if the patient had received PCI and did not receive PCI, leaving all other covariates values as is. The average marginal effects are then computed by taking the average difference between these 2 probabilities. We repeated this method for each clinical outcome. A negative marginal effects coefficient indicates that PCI reduces the probability of that outcome and vice versa. We used the above Z equation to compare the AMEs coefficients between the 2 groups. To account for the differences in the pathophysiology of a portion of STEMI cases in women versus men, we (1) performed age-stratified subgroup analyses (>85, 65–84, 45–64, <45 years), and (2) repeated the analysis excluding patients with diagnosis code for coronary dissection and Takotsubo cardiomyopathy, because both are known to be more frequent in women than in men. We also performed another sensitivity analysis excluding patients who had an elective admission and subsequently developed an in-hospital STEMI during the hospitalization. Finally, we also chose irritable bowel syndrome and infectious arthropathies as falsification end points because they are physiologically less likely to be associated with or affected by PCI.

RESULTS

Baseline and Procedural Characteristics

A total of 413 500 weighted STEMI hospitalizations were included in the study, of which 126 885 (30.7%) involved women and 286 530 (69.3%) involved men. Compared with men, women were older (67.6 versus 61.7 years), and more likely to have Medicare/Medicaid insurance (69.0% versus 50.0%), and to be in the lowest quartile for household income (30.0% versus 26.0%) (*P*<0.05 for all). Women also had higher cardiac and noncardiac comorbidities burden except for smoking and prior sternotomy (Table 1). Before risk adjustment, women were less likely to undergo coronary angiography (81.0% versus 87.0%, *P*<0.001), and less likely to receive pPCI (74.0% versus 82.0%, *P*<0.001) (Figure 1) or coronary bypass grafting (3.0% versus 4.7%, *P*<0.001) (Table 2). After adjustment for demographics, socioeconomic, and clinical risk factors, women had lower odds of undergoing angiography (OR 0.78; 95% CI, 0.74–0.82; *P*<0.001), or pPCI (OR 0.76; 95% CI, 0.73–0.79; *P*<0.001) compared with men.

Clinical Outcomes of STEMI in Men and Women

Patients who underwent pPCI were younger and more likely to be treated at teaching or large hospitals in both groups. Although most cardiovascular comorbidities differed modestly between patients who underwent

Table 1. Baseline Characteristics of the Study Cohort

Baseline characteristics	Women, n=126 885	Men, n=286 530
Demographics		
Age, y, mean (95% CI)	67.6 (67.5–67.8)	61.7 (61.6–61.8)
White race	72.0%	71.0%
Medicare/Medicaid insurance	69.0%	50.0%
Lowest quartile household income	30.0%	26.0%
Hospital in southern states	42.0%	41.0%
Teaching hospital	66.0%	67.0%
Large-bed-size hospital	16.0%	15.0%
Clinical risk factors		
Cardiovascular comorbidities		
Smoking	29.0%	33.0%
Hypertension	25.0%	20.0%
Diabetes	40.0%	36.0%
Chronic heart failure	19.0%	14.0%
Atrial fibrillation	16.0%	13.0%
Peripheral vascular disease	6.8%	5.1%
Prior stroke	6.9%	4.3%
Conduction disorders	9.1%	8.1%
Prior sternotomy	3.9%	5.0%
Pulmonary hypertension	3.6%	1.9%
Noncardiovascular comorbidities		
Chronic obstructive lung disease	13.0%	9.2%
Chronic kidney disease	14.0%	12.0%
Anemia	15.0%	8.2%
Liver disease	4.0%	4.3%
Dementia	6.2%	2.1%
Malignancy	4.0%	3.1%
Obesity	18.0%	15.0%

pPCI versus those who did not, noncardiovascular comorbidities were more frequent among patients who did not undergo pPCI (Table 3). Patients who underwent pPCI had lower in-hospital mortality than those not treated with pPCI in both men and women cohorts. Among women, mortality was 6.5% with pPCI versus 20.0% without pPCI (P<0.001). Among men, mortality was 4.5% with pPCI versus 16.0% without pPCI (P<0.001) (Figure 2). Major complications were more common in the no-pPCI subgroups in both cohorts (Table 4). Women, but not men, who underwent pPCI had an increased risk of vascular complications (Table 4). Patients who had pPCI were more likely to be discharged home than a skilled nursing facility in both

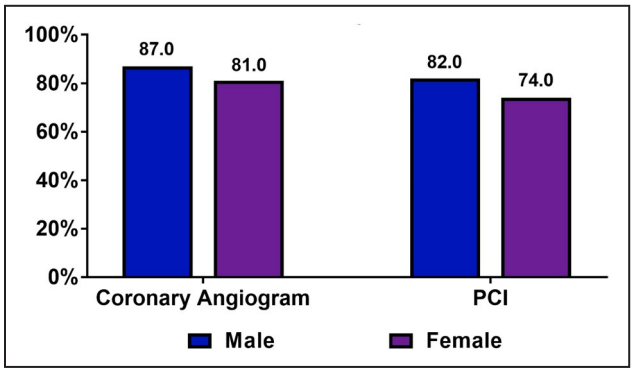

Figure 1. Rates of coronary angiography and primary percutaneous coronary interventions (PCI) among men and women admitted with ST-segment–elevation myocardial infarction.

groups. These differences persisted in age-stratified analyses (Tables S2 through S5).

Average Treatment Effects of pPCI

There were no significant differences in the ATEs of pPCI on the primary end point (in-hospital mortality) between men (–8.4% [–9.3% to –7.6%], P<0.001), and women (–9.5% [–10.8% to –8.3%], P<0.001) (P-interaction=0.16). The treatment effects of pPCI on acute kidney injury, new dialysis requirements, vascular complications, gastrointestinal bleeding, mechanical ventilation, and discharge disposition were comparable between men and women, as shown in Table 5. However, the impact of pPCI on acute stroke and the palliative encounter was lower in women than in men (Table 5). The impact of pPCI on leaving against medical advice was higher in women than in men (Table 5). These treatment effects are investigated in subgroup analyses stratified by age (>85, 65–84, 45–64, <45 years) (Tables S6 through S9). There were no differences in the impact of pPCI on risk-adjusted length of stay between men and women. However, the

Table 2. Management of ST-Segment–Elevation Myocardial Infarction in Men Versus Women

Management pattern	Women, n=126 885	Men, n=286 530
Coronary angiography	81.0%	87.0%
Coronary intervention	74.0%	82.0%
Single vessel intervention	63.0%	69.0%
Multivessel intervention	11.0%	13.0%
Bare-metal stent	7.3%	8.2%
Coronary bypass grafting	3.0%	4.7%
Mechanical support, any	8.2%	10.0%
Intra-aortic balloon pump	6.5%	7.5%
Other mechanical support	1.8%	2.5%

Table 3. Baseline Characteristics of the Study Cohorts Stratified by Sex and Use of pPCI

Baseline characteristics	Women, n=126 885		Men, n=286 530	
	No pPCI, 26%	pPCI, 74%	No pPCI, 18%	pPCI, 82%
Demographics				
Age, y	72.5 (72.1–72.9)	65.9 (65.7–66.2)	64.9 (64.6–65.2)	61.0 (60.8–61.1)
White race	70.5%	72.6%	68.4%	71.6%
Medicare/Medicaid insurance	77.2%	65.9%	61.3%	47.0%
Lowest quartile income	29.7%	29.4%	28.9%	25.5%
Hospital in Southern states	38.8%	42.6%	40.9%	41.6%
Teaching hospital	61.8%	68.1%	66.2%	67.7%
Large-bed-size hospital	19.3%	14.6%	16.5%	14.6%
Cardiovascular comorbidities				
Smoking	16.8%	33.0%	25.4%	34.2%
Hypertension	32.8%	22.2%	30.3%	18.1%
Diabetes	38.7%	40.5%	41.5%	34.8%
Chronic heart failure	28.2%	15.1%	24.1%	11.9%
Atrial fibrillation	22.8%	13.3%	20.7%	11.4%
Peripheral vascular disease	8.7%	6.2%	8.4%	4.4%
Prior stroke	8.7%	6.3%	6.7%	3.8%
Conduction disorders	9.6%	8.9%	10.0%	7.7%
Prior sternotomy	6.4%	3.0%	9.7%	4.0%
Pulmonary hypertension	5.8%	2.9%	3.5%	1.6%
Noncardiovascular comorbidities				
Chronic obstructive lung disease	16.2%	12.4%	13.3%	8.3%
Chronic kidney disease	21.6%	11.9%	20.3%	10.0%
Anemia	19.4%	13.7%	14.4%	6.8%
Liver disease	4.7%	3.8%	6.0%	3.9%
Dementia	13.8%	3.5%	5.2%	1.4%
Malignancy	6.3%	3.2%	5.6%	2.5%
Obesity	13.0%	19.5%	14.1%	15.4%

pPCI indicates primary percutaneous coronary intervention.

proportional increase in cost associated with pPCI was higher in women than in men (Table 6).

Sensitivity Analyses

1. Using the AMEs methodology, which accounts for within-hospital clustering of hospitalizations, the AMEs of pPCI on in-hospital mortality were –10% (–11% to –9%) in women versus –7.9% (–8.6% to –7.2%) in men (*P*=0.001), suggesting a modestly higher magnitude of benefit for pPCI in women versus men. The AMEs of pPCI on other outcomes are listed in Table 7.
2. The ATE of pPCI on in-hospital mortality remained nonsignificantly different between men and women in age-stratified subgroups (>85, 65–84, 45–64, <45 years) (Table S6–S9).
3. The ATEs of pPCI also remained similar in men and women in additional analyses, excluding patients with elective admissions and subsequent STEMI. However, the ATEs of pPCI were higher in women than men after excluding those with coronary dissection and Takotsubo cardiomyopathy (Tables S10 through S13).

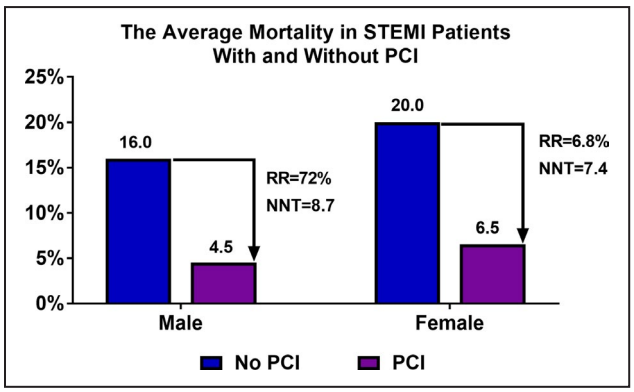

Figure 2. In-hospital mortality among men and women admitted with ST-segment–elevation myocardial infarction (STEMI) stratified by the use of primary percutaneous coronary intervention (PCI).
NNT indicates number needed to treat; and RR, relative risk.

Table 4. Comparison of Unadjusted Rates of Death and Major Complications Between Men and Women Stratified by pPCI Status

Clinical outcomes	Women, n=126 885		Men, n=286 530	
	No pPCI, 26%	pPCI, 74%	No pPCI, 18%	pPCI, 82%
In-hospital mortality	20.0%	6.5%	16.0%	4.5%
Acute stroke	1.7%	0.9%	1.4%	0.6%
Acute kidney injury	23.0%	13.0%	25.0%	14.0%
New dialysis requirement	0.8%	0.4%	0.8%	0.4%
Vascular complications	0.8%	1.4%	0.8%	0.7%
Gastrointestinal bleeding	2.8%	1.8%	2.6%	1.4%
Blood transfusion	6.5%	4.7%	6.4%	2.8%
Mechanical ventilation	14.0%	9.8%	17.0%	8.9%
Palliative care encounter	13.0%	2.4%	7.4%	1.6%
Left against medical advice	0.9%	0.5%	1.7%	0.9%
Home discharge	49.0%	82.0%	58.0%	88.0%
Nonhome discharge	29.0%	11.0%	25.0%	6.8%

pPCI indicates primary percutaneous coronary intervention.

4. Finally, there were no differences in the selected falsification end points between men and women (Table S14).

DISCUSSION

The salient finding of this study is that although the estimated average treatment effect of pPCI on in-hospital morbidity and mortality is similar in men and women admitted with STEMI, women remain much less likely to receive this standard of care treatment.

Sex differences in the management of myocardial infarction are well described in the literature. In STEMI, several prior studies have documented that women are less likely to receive standard of care treatments, including pPCI.[1–10] Our study encompasses a large cohort of patients admitted in 2016 to 2018 and shows that significant sex differences in the management of STEMI persist in contemporary US practice. The absolute difference in the usage rate of pPCI between men and women was 8%. Hypothetically, this disparity could be attributed to differences in risk profile between women and men presenting with STEMI. However, even after adjusting for age, demographics, and clinical risk factors, women remained 25% less likely to undergo angiography or receive pPCI than men. A potential reason for the lower revascularization rates among women with pPCI is the notion that

Table 5. ATE of Primary Percutaneous Coronary Intervention in Men and Women Using Propensity-Score Matching

Clinical outcomes	Women, n=126 885		Men, n=286 530		
	ATE (95% CI)	*P* value	ATE (95% CI)	*P* value	*P* value*
In-hospital mortality	−9.5% (−10.8% to −8.3%)	<0.001	−8.4% (−9.3% to −7.6%)	<0.001	0.16
Acute stroke	0.5% (−0.8% to 1.8%)	0.447	−1.5% (−2.4% to −0.6%)	0.004	0.01
Acute kidney injury	−0.6% (−1.1% to 0.0%)	0.034	−0.3% (−0.6% to −0.1%)	0.001	0.43
New dialysis requirement	−3.5% (−4.8% to −2.3%)	<0.001	−3.9% (−4.8% to −3.0%)	<0.001	0.61
Vascular complications	−0.1% (−0.4% to 0.1%)	0.363	0.0% (−0.2% to 0.1%)	0.948	0.63
Gastrointestinal bleeding	0.4% (0.0% to 0.8%)	0.055	0.1% (−0.1% to 0.3%)	0.677	0.16
Blood transfusion	−0.2% (−0.7% to 0.3%)	0.401	−0.5% (−0.8% to −0.1%)	0.043	0.39
Mechanical ventilation	−1.2% (−2.0% to −0.3%)	0.010	−2.1% (−2.6% to −1.5%)	<0.001	0.07
Palliative care encounter	−3.8% (−5.1% to −2.5%)	<0.001	−5.9% (−6.8% to −5.0%)	<0.001	0.01
Left against medical advice	−6.5% (−7.4% to −5.6%)	<0.001	−3.6% (−4.1% to −3.1%)	<0.001	<0.001
Home discharge	−0.5% (−0.9% to −0.1%)	0.017	−1.0% (−1.3% to −0.6%)	<0.001	0.12
Nonhome discharge	25.0% (23.2% to 26.8%)	<0.001	24.3% (23.1% to 25.5%)	<0.001	0.49

ATE indicates average treatment effect.
*Comparing ATEs between both groups.

Table 6. Adjusted Length of Stay and Hospital Costs for Men and Women With ST-Segment–Elevation Myocardial Infarction

Resource use	Women, n=126 885			Men, n=286 530		
	No PCI	PCI	*P* value	No PCI	PCI	*P* value
Length of stay in days, median (IQR)*	3 (1–5)	3 (2–4)	0.57	3 (1–6)	2 (2–3)	<0.001
Adjusted predicted median length of stay in days†	2.8	2.8	0.99	2.5	2.5	0.99
Hospital cost, median (IQR) in 2018 USD*	$10 801 ($6543–$20 437)	$21 233 ($16 325–$29 655)	<0.001	$15 091 ($8100–$33 133)	$21 131 ($16 319–$29 497)	<0.001
Adjusted predicted median hospital cost in 2018 USD†	$11 340	$21 963	<0.001	$15 069	$22 245	<0.001

IQR indicates interquartile range; PCI, percutaneous coronary intervention; and USD, United States dollars.
*Using Wilcoxon rank sum test.
†Using a quintile regression followed by marginal command to estimate the adjusted predicted median.

women suffer worse outcomes (and hence derive less benefit) from pPCI. To assess whether this is true, we used a well-established method (ATE) to compare the impact of pPCI on short-term outcomes in men versus women. A heterogeneous treatment effect would indicate that one sex derives worse outcomes than the other.[13,21] Conversely, a homogenous treatment effect would suggest that the benefit of pPCI is consistent among both sexes. The primary treatment effect of interest was in-hospital mortality, which is known to be significantly less among patients with STEMI treated with pPCI compared with no pPCI.

The findings of this study confirmed our hypothesis that the magnitude of benefit from pPCI in reducing mortality is comparable in both men and women. However, these findings deserve more elaboration; first, women undergoing PCI experience more vascular and bleeding complications and receive more blood transfusions than men. Although the ATEs of pPCI on those secondary end points were more favorable among men, the ATE of pPCI on in-hospital mortality was almost identical in both groups. These data disprove the perception that the lower usage of life-saving therapies such as pPCI could be attributed to risk aversion and call for further efforts to understand the reasons for this disparity and identify strategies for its mitigation. Second, the treatment effect of pPCI remained homogeneous among men and women in multiple sensitivity analyses accounting for within-hospital clustering and potential differences in the pathophysiology and culprit vessel anatomy of STEMI between men and women. Finally, the incremental cost associated with pPCI versus no pPCI was higher among women. Although speculative, this could include higher use of resources because of bleeding and vascular complications (eg, testing, equipment,) among women because of possible later presentation or delayed treatment.

Table 7. AME of Primary Percutaneous Coronary Intervention in Men and Women

Clinical outcomes	Women, n=126 885		Men, n=286 530		*P* value*
	AME (95% CI)	*P* value	AME (95% CI)	*P* value	
In-hospital mortality	−10.0% (−11.0% to −9.0%)	<0.001	−7.9% (−8.6% to −7.2%)	<0.001	0.001
Acute stroke	0.9% (−0.2% to 1.9%)	0.097	−1.3% (−2.0% to −0.5%)	0.043	0.001
Acute kidney injury	−0.6% (−0.9% to −0.2%)	0.002	−0.4% (−0.6% to −0.1%)	0.042	0.31
New dialysis requirement	−3.9% (−4.9% to −2.8%)	<0.001	−4.3% (−5.1% to −3.6%)	<0.001	0.47
Vascular complications	−0.2% (−0.4% to 0.0%)	0.11	−0.1% (−0.2% to 0.1%)	0.113	0.47
Gastrointestinal bleeding	0.6% (0.3% to 1.0%)	<0.001	0.0% (−0.2% to 0.2%)	0.520	0.001
Blood transfusion	−0.3% (−0.8% to 0.1%)	0.12	−0.4% (−0.7% to −0.1%)	0.029	0.77
Mechanical ventilation	−1.1% (−1.8% to −0.4%)	0.002	−2.3% (−2.7% to −1.8%)	<0.001	0.007
Palliative care encounter	−3.3% (−4.3% to −2.3%)	<0.001	−5.4% (−6.2% to −4.6%)	<0.001	0.001
Left against medical advice	−6.9% (−7.6% to −6.1%)	<0.001	−3.6% (−4.0% to −3.1%)	<0.001	<0.001
Home discharge	−0.6% (−0.9% to −0.2%)	0.001	−0.8% (−1.1% to −0.5%)	<0.001	0.22
Nonhome discharge	24.1% (22.6% to 25.5%)	<0.001	22.8% (21.7% to 23.8%)	<0.001	0.15

AME indicates average marginal effect.
*Comparing AMEs between both groups.

Limitations

First, the NIS collects data for billing purposes, and is subject to miscoding errors. However, coding for STEMI and pPCI are directly linked to reimbursement, and hence are less prone to this limitation. Besides, we used validated codes that have been used extensively in prior studies using the NIS.[31,32] Second, the NIS does not capture pharmacotherapy, echocardiography, or angiographic data. Thus, granular information on the differences in antithrombotic regimes, ejection fraction, successful versus unsuccessful PCI, and reasons for not performing PCI is not available. Third, despite the rigorous use of propensity matching and other risk-adjustment strategies in this study, the impact of residual and unknown confounders could not be eliminated. For example, we cannot adjust for patient's preferences, presentation delays, and angiographic findings. These variables might have affected the decision to pursue or forgo pPCI.

Nonetheless, there is no nationwide clinical database containing adequate information about all potential residual confounders to our knowledge. We believe that our findings are relevant to clinical practice, especially considering that randomized data in this population are improbable. Fourth, there are differences in the pathophysiology of STEMI between men and women, which may impact the allocation of treatment. Although we have accounted for most of such differences in our sensitivity analyses, there are no billing codes for myocardial infarction with nonobstructive coronary arteries. Hence, we are unable to account for patients with this entity completely. Finally, the NIS does not contain laboratory values or include long-term outcomes beyond hospital discharge. Thus, its findings should be interpreted in light of these limitations.

CONCLUSIONS

Among patients admitted with STEMI, pPCI results in a similar reduction of in-hospital mortality in men and women. Nonetheless, risk-adjusted rates of pPCI remain much lower in women than in men in contemporary US practice.

ARTICLE INFORMATION

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Affiliations

Division of Cardiology, West Virginia University, Morgantown, WV (S.S., A.K.); Keele Cardiovascular Research Group, Centre for Prognosis Research, Keele University, Stoke-on-Trent, United Kingdom (M.O.M., M.A.M.); Department of Medicine, Division of Cardiology (H.G.V.S.), and Department of Health Research Methods, Evidence, and Impact (H.G.V.S.), McMaster University, Hamilton, Ontario, Canada; Population Health Research Institute, Hamilton, Ontario, Canada (H.G.V.S.); ICES (Cardiovascular Research Program), McMaster University, Hamilton, Ontario, Canada (H.G.V.S.); Division of Cardiovascular Medicine, Department of Internal Medicine, University of Michigan, Ann Arbor, MI (N.S.); and Department of Cardiovascular Disease, Mayo Clinic, Rochester, MN (D.R.H., M.A.).

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Supplementary Material

Table S1–S14
Figure S1

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SUPPLEMENTAL MATERIAL

Table S1. ICD-10 Codes Utilized in the Study.

Disease/ Complication	ICD-10-CM
ST-Elevation Myocardial Infarction	I21.0, I21.01, I21.02, I21.09, I21.1, I21.11, I21.19, I21.2, I21.21, I21.29, I21.3
Dependence on dialysis	Z99.2
Acute kidney injury	N170, N171, N172, N178, N179, N19
Chronic Kidney disease	Z992, Z940, Z9115, Z4932, Z4931, Z4902, Z4901, R880, N189, N186, N181, N185, N184, N183, N182
End-Stage Renal Disease	Codes combination of chronic kidney disease and dependence on renal dialysis excluding patients who had codes of acute kidney injury/failure.
Smoking	F17200, F17201, F17203, F17208, F17209, F17210, F17211, F17213, F17218, F17219, F17220, F17221, F17223, F17228, F17229, F17290, F17291, F17293, F17298, F17299
Hypertension	I10, I11*, I12*, I13*, I15*
Diabetes mellitus	E08-E13, R7302, R7303, R7309, R739, R81, R824, Z4681, Z9641, G3289, G3289
Chronic heart failure	I0981, I110, I130, I132, I501, I5020, I5022, I5030, I5032, I5040, I5042, I50810, I50812, I50814, I5082, I5083, I5084, I5089, I509
Atrial fibrillation	I480, I481, I482, I4891, I483, I484, I4892, I489, I48
Peripheral vascular disease	I739, I7389, Z95820, Z9862, Z95828, I700, I701, I70201, I70202, I70203, I70208, I70209, I70211, I70212, I70213, I70218, I2581, I70219, I70221, I70222, I70223, I70228, I70229, II70231, I70232, I70243, I70244, I70245, I70248, I70249, I70231, I70242, I70291, I70292, I70293, I70298, I70299, I7090, I7091, I7092, K551, K558, K559, I6529
Prior stroke	Z8673
Conduction disorder	I444, I445, I4460, I4469, I447, I450, I4510, I4519, I452, I453, I454, I4589, I459
Prior sternotomy	Z951, Z952, Z95811, Z95812
Pulmonary Hypertension	I27, I270, I271, I272, I2720, I2721, I2722, I2723, I2724, I2729, I278, I2781, I2782, I2782, I2783, I2789, I279,
COPD	J449, J441
Anemia	D50-D53, D55-D59, D60-D61, D63-D64, Z8631
Liver disease	K70-K77, I85, I850, I8500, I8501, I851, I8510, I8511
Dementia	F1917, F1027, F0391, F0390, F039, F03, F0151, F0150, F015, F01, F0281, F0280, F1927, F1997, F1097
Obesity	E669, E662, E6601, E668, E660, E6609
Coronary angiogram	272346, 027234Z, B210010, B2100ZZ, B210110, B2101ZZ, B210Y10, B210YZZ, B211010, B2110ZZ, B211110, B2111ZZ, B211Y10, B211YZZ, B212010, B2120ZZ, B212110, B2121ZZ, B212Y10, B212YZZ, B213010, B2130ZZ, B213110, B2131ZZ, B213Y10, B213YZZ, B2140ZZ, B2141ZZ, B214YZZ, B2150ZZ, B2151ZZ, B215YZZ, B2160ZZ, B2161ZZ, B216YZZ, B2170ZZ, B2171ZZ, B217YZZ, B2180ZZ, B2181ZZ, B218YZZ, B21F0ZZ, B21F1ZZ, B21FYZZ,

Single vessel coronary intervention	02703D6, 02703DZ, 02703E6, 02703EZ, 02703F6, 02703FZ, 02703G6, 02703GZ, 02703Z6, 02703ZZ, 02704D6, 02704DZ, 02704EZ, 02704F6, 02704FZ, 02704G6, 02704GZ, 02704Z6, 02704ZZ, 02703E6, 02704E6, 02703E6, 02704E6, 270346, 027034Z, 270356, 027035Z, 270366, 027036Z, 270376, 027037Z, 270446, 027044Z, 270456, 027045Z, 270466, 027046Z, 270476, 027047Z
Multivessels coronary intervention	271346, 027134Z, 271356, 027135Z, 271366, 027136Z, 271376, 027137Z, 271446, 027144Z, 271456, 027145Z, 271466, 027146Z, 271476, 027147Z, 272346, 027234Z, 272356, 027235Z, 272366, 027236Z, 272376, 027237Z, 272446, 027244Z, 272456, 027245Z, 272466, 027246Z, 272476, 027247Z, 273346, 027334Z, 273356, 027335Z, 273366, 027336Z, 273376, 027337Z, 273446, 027344Z, 273456, 027345Z, 273466, 027346Z, 273476, 027347Z, 02713D6, 02713DZ, 02713EZ, 02713F6, 02713FZ, 02713G6, 02713GZ, 02713Z6, 02713ZZ, 02714D6, 02714DZ, 02714EZ, 02714F6, 02714FZ, 02714G6, 02714GZ, 02714Z6, 02714ZZ, 02713E6, 02714E6, 02723D6, 02723DZ, 02723F6, 02723EZ, 02723FZ, 02723GZ, 02723Z6, 02723ZZ, 02724D6, 02724DZ, 02724EZ, 02724F6, 02724FZ, 02724G6, 02724GZ, 02724Z6, 02724ZZ, 02723E602724E6, 02733D6, 02733DZ, 02733EZ, 02733F6, 02733FZ, 02733G6, 02733GZ, 02733Z6, 02733ZZ, 02734D6, 02734DZ, 02734EZ, 02734F6, 02734FZ, 02734G6, 02734GZ, 02734Z6, 02734ZZ, 02733E6, 02734E6, 02723E6, 02724E6, 02713E6, 02733E6, 02714E6, 02734E6
Bare metal stent	02703E6, 02723E6, 02704E6, 02724E6 , 02713E6 , 02733E6, 02714E6, 02734E6 , 02703D6, 02703DZ, 02723DZ, 02723D6, 02703EZ, 02703F6, 02703FZ, 02703G6, 02703GZ, 02723EZ, 02723F6, 02723FZ, 02723G6, 02723GZ, 02723Z6, 02704D6, 02704DZ, 02704EZ, 02704F6, 02724D6, 02724DZ, 02724EZ, 02724F6, 02704FZ, 02704GZ, 02724FZ, 02724G6, 02704G6, 02724GZ, 02713D6, 02713DZ, 02713F6, 02713FZ, 02713G6, 02713GZ, 02733D6, 02733DZ, 02733EZ, 02733F6, 02733FZ, 02733G6, 02733GZ, 02714D6, 02714DZ, 02714EZ, 02714F6, 02714FZ, 02714G6, 02714GZ, 02734D6, 02734DZ, 02734EZ, 02734F6, 02734FZ, 02734G6, 02734GZ, 02703E6, 02723E6, 02704E6, 02724E6, 02713E6, 02733E6, 02714E6, 02734E6, 02703EZ, 02703F6, 02703FZ, 02703G6, 02703GZ, 02723EZ, 02723F6, 02723FZ, 02723G6, 02723GZ, 02723Z6, 02704EZ, 02704F6, 02724EZ, 02724F6, 02704FZ, 02704G6, 02704GZ, 02724FZ, 02724G6, 02724GZ, 02713F6, 02713FZ, 02713G6, 02713GZ, 02733EZ, 02733F6, 02733FZ, 02733G6, 02733GZ, 02714EZ, 02714F6, 02714FZ, 02714G6, 02714GZ, 02734EZ, 02734F6, 02734FZ, 02734G6, 02734GZ
Coronary artery bypass grafting	210093, 210098, 210099, 021009C, 021009F, 021009W, 02100A3, 02100A8, 02100A9, 02100AC, 02100AF, 02100AW, 02100J3, 02100J8, 02100J9, 02100JC, 02100JF, 02100JW, 02100K3, 02100K8, 02100K9, 02100KC, 02100KF, 02100KW, 02100Z3, 02100Z8, 02100Z9, 02100ZC, 02100ZF, 211093, 211098, 211099, 021109C, 021109F, 021109W, 02110A3, 02110A8, 02110A9, 02110AC, 02110AF, 02110J3, 02110J8, 02110J9, 02110JC, 02110JF, 02110K3, 02110K8, 02110K9, 02110KC, 02110KF, 02110KW, 02110Z3, 02110Z8, 02110Z9, 02110ZC, 02110ZF, 212093, 212098, 212099, 021209C, 021209F, 021209W, 02120A3, 02120A8, 02120A9, 02120AC, 02120AF, 02120AW, 02120J3, 02120J8, 02120J9, 02120JF, 02120JW, 02120K3, 02120K8, 02120K9, 02120KC, 02120KF, 02120KW, 02120Z3, 02120Z8, 02120Z9, 02120ZC, 02120ZF, 213093, 213098, 213099, 021309C, 021309F, 021309W, 02130A3, 02130A8, 02130A9, 02130AC, 02130AF, 02130AW, 02130J3, 02130J8, 02130J9, 02130JC, 02130JF, 02130JW, 02130K3, 02130K8, 02130K9, 02130KC, 02130KF, 02130KW, 02130Z3, 02130Z8, 02130Z9, 02130ZC, 02130ZF
Intra-aortic balloon pump	5A02210

Mechanical support devise other than intra-aortic balloon pump	02HA3RS, 02HA3RZ, 02HL3DZ, 5A0211D, 5A0221D, 5A15223
Cardiogenic shock	R570, T8110XA, T8111, T8111XA, T8111XS, T8119
Acute ischemic stroke	I63*, G43601, G43609, G43611, G43619, I97810, I97811, I97820, I97821
Acute hemorrhagic stroke	I60-I62
Vascular complications	S36899A, T81718A, T81719A, T8172XA, T81710A, T81711A, T801XXA, I770, S2500XA, S2501XA, S2502XA, S2509XA, S3500XA, S3501XA, S3502XA, S3509XA, S75011A, S75012A, S75019A, S75021A, S75022A, S75029A, S75099A, I97410, I97411, I97418, I9742, I97610, I97611, I97618, I97620, L7602, L7622, M96811, M96831, I9751, I9752, L7612, M96821, T8171, T8172, S25499A, S3559XA, S45001A, S45099A, S75001A, S75199A, S85001A, S85599A
Blood transfusion	30230H1, 30230J0, 30230J1, 30230K0, 30230K1, 30230L0, 30230L1, 30230M0, 30230M1, 30230N0, 30230N1, 30230P0, 30230P1, 30230Q0, 30230Q1, 30230R0, 30230R1, 30230S0, 30230S1, 30230T0, 30230T1, 30230V0, 30230V1, 30230W0, 30230W1, 30233H0, 30233H1, 30233J0, 30233J1, 30233K0, 30233K1, 30233L0, 30233L1, 30233M0, 30233M1, 30233N0, 30233N1, 30233P0, 30233P1, 30233Q0, 30233Q1, 30233R0, 30233R1, 30233S0, 30233S1, 30233T0, 30233T1, 30233V0, 30233V1, 30233W0, 30233W1, 30240H0, 30240H1, 30240J0, 30240J1, 30240K0, 30240K1, 30240L1, 30240L0, 30240M0, 30240M1, 30240N0, 30240N1, 30240P0, 30240P1, 30240Q0, 30240Q1, 30240R0, 30240R1, 30240S0, 30240S1, 30240T0, 30240T1, 30240V0, 30240V1, 30240W0, 30240W1, 30243H0, 30243H1, 30243J0, 30243J1, 30243L0, 30243L1, 30243K0, 30243K1, 30243M0, 30243M1, 30243N0, 30243N1, 30243P0, 30243P1, 30243Q0, 30243Q1, 30243R0, 30243R1, 30243S0, 30243S1, 30243T0, 30243T1, 30243V0, 30243V1, 30243W0, 30243W1, 30250H0, 30250H1, 30250J0, 30250J1, 30250K0, 30250K1, 30250L0, 30250L1, 30250M0, 30250M1, 30250N0, 30250N1, 30250Q0, 30250Q1, 30250P0, 30250P1, 30250R0, 30250R1, 30250S0, 30250S1, 30250T0, 30250T1, 30250V0, 30250V1, 30250W0, 30250W1, 30253H0, 30253H1, 30253J0, 30253J1, 30253K0, 30253K1, 30253L0, 30253L1, 30253M0, 30253M1, 30253N0, 30253N1, 30253P0, 30253P1, 30253Q0, 30253Q1, 30253R0, 30253R1, 30253S0, 30253S1, 30253T0, 30253T1, 30253V0, 30253V1, 30253W0, 30253W1, 30260H0, 30260H1, 30260J0, 30260J1, 30260K0, 30260K1, 30260L0, 30260L1, 30260M0, 30260M1, 30260N0, 30260N1, 30260P0, 30260P1, 30260Q0, 30260Q1, 30260R0, 30260R1, 30260S0, 30260S1, 30260T0, 30260T1, 30260V0, 30260V1, 30260W0, 30260W1, 30263H0, 30263H1, 30263J0, 30263J1, 30263K0, 30263K1, 30263L0, 30263L1, 30263M0, 30263M1, 30263N0, 30263Q0, 30263Q1, 30263P0, 30263P1, 30263N1, 30263R0, 30263R1, 30263T0, 30263T1, 30263V0, 30263V1, 30263W0, 30263W1, 30273H0, 30273H1, 30273J0, 30273J1, 30273K0, 30273K1, 30273L0, 30273L1, 30273M0, 30273M1, 30273N0, 30273Q0, 30273Q1, 30273P0, 30273P1, 30273N1, 30273R0, 30273R1, 30273T0, 30273T1, 30273V0, 30273V1, 30273W0, 30273W1, 30277H1, 30277J1, 30277K1, 30277L1, 30277M1, 30277Q1, 30277P1, 30277N1, 30277R1, 30277T1, 30277V1, 30277W1, 30280B1, 30283B1, 3E030GC, 3E033GC, 3E040GC, 3E043GC, 3E050GC, 3E053GC, 3E060GC, 3E063GC, 30230H0
Gastrointestinal bleed	I8501, I8511, K250, K252, K254, K256, K260, K262, K264, K266, K270, K272, K274, K276, K280, K282, K284, K286, K625, K920, K921, K922
Mechanical ventilation	5A1935Z, 5A1945Z, 5A1955Z
Palliative care encounter	Z515

Neoplasms	C00-C14, C15-C26, C30-C39, C40-C41, C43-C58, C60-C80, C81-96, C7A, D00-D09, C4A*, C7B, C7B0, C7B00, C7B01, C7B02, C7B03, C7B04, C7B09, C7B1, C7B8, D10, D100, D101, D102, D103, D1030, D1039, D104, D105, D106, D107, D109, D11, D110, D117, D119, D12, D120, D121, D122, D123, D124, D125, D126, D127, D128, D129, D13, D130, D131, D132, D133, D1330, D1339, D134, D135, D136, D137, D139, D14, D140, D141, D142, D143, D1430, D1431, D1432, D144, D15, D150, D151, D152, D157, D159, D16, D160, D1600, D1601, D1602, D161, D1610, D1611, D1612, D162, D1620, D1621, D1622, D163, D1630, D1631, D1632, D164, D165, D166, D167, D168, D169, D17, D170, D171, D172, D1720, D1721, D1722, D1723, D1724, D173, D1730, D1739, D174, D175, D176, D177, D1771, D1772, D1779, D179, D18, D180, D1800, D1801, D1802, D1803, D1809, D181, D19, D190, D191, D197, D199, D20, D200, D201, D21, D210, D211, D2110, D2111, D2112, D212, D2120, D2121, D2122, D213, D214, D215, D216, D219, D22, D220, D221, D2210, D2211, D22111, D22112, D2212, D22121, D22122, D222, D2220, D2221, D2222, D223, D2230, D2239, D224, D225, D226, D2260, D2261, D2262, D227, D2270, D2271, D2272, D229, D23, D230, D231, D2310, D2311, D23111, D23112, D2312, D23121, D23122, D232, D2320, D2321, D2322, D233, D2330, D2339, D234, D235, D236, D2360, D2361, D2362, D237, D2370, D2371, D2372, D239, D24, D241, D242, D249, D25, D250, D251, D252, D259, D26, D260, D261, D267, D269, D27, D270, D271, D279, D28, D280, D281, D282, D287, D289, D29, D290, D291, D292, D2920, D2921, D2922, D293, D2930, D2931, D2932, D294, D298, D299, D30, D300, D3000, D3001, D3002, D301, D3010, D3011, D3012, D302, D3020, D3021, D3022, D303, D304, D308, D309, D31, D310, D3100, D3101, D3102, D311, D3110, D3111, D3112, D312, D3120, D3121, D3122, D313, D3130, D3131, D3132, D314, D3140, D3141, D3142, D315, D3150, D3151, D3152, D316, D3160, D3161, D3162, D319, D3190, D3191, D3192, D32, D320, D321, D329, D33, D330, D331, D332, D333, D334, D337, D339, D34, D35, D350, D3500, D3501, D3502, D351, D352, D353, D354, D355, D356, D357, D359, D36, D360, D361, D3610, D3611, D3612, D3613, D3614, D3615, D3616, D3617, D367, D369, D37, D370, D3701, D3702, D3703, D37030, D37031, D37032, D37039, D3704, D3705, D3709, D371, D372, D373, D374, D375, D376, D378, D379, D38, D380, D381, D382, D383, D384, D385, D386, D39, D390, D391, D3910, D3911, D3912, D392, D398, D399, D40, D400, D401, D4010, D4011, D4012, D408, D409, D41, D410, D4100, D4101, D4102, D411, D4110, D4111, D4112, D412, D4120, D4121, D4122, D413, D414, D418, D419, D42, D420, D421, D429, D43, D430, D431, D432, D433, D434, D438, D439, D44, D440, D441, D4410, D4411, D4412, D442, D443, D444, D445, D446, D447, D449, D45, D46, D460, D461, D462, D4620, D4621, D4622, D46A, D46B, D46C, D464, D46Z, D469, D47, D470, D4701, D4702, D4709, D471, D472, D473, D474, D47Z, D47Z1, D47Z2, D47Z9, D479, D48, D480, D481, D482, D483, D484, D485, D486, D4860, D4861, D4862, D487, D489, D3A, D3A0, D3A00, D3A01, D3A010, D3A011, D3A012, D3A019, D3A02, D3A020, D3A021, D3A022, D3A023, D3A024, D3A025, D3A026, D3A029, D3A09, D3A090, D3A091, D3A092, D3A093, D3A094, D3A095, D3A096, D3A098, D3A8, D49, D490, D491, D492, D493, D494, D495, D4951, D49511, D49512, D49519, D4959, D496, D497, D498, D4981, D4989, D499
Irritable bowel syndrome	K58*
Infectious arthropathy	M00*, M01*, M02*

Table S2. Comparison of Crude Rates of Clinical Outcome Between Men and Women age ≥85 years Stratified by pPCI Use

Clinical Outcomes	Female N=16,300			Male N=10,085		
	No PCI (53%)	PCI (47%)	P	No PCI (41%)	PCI (59%)	P
In-hospital mortality	33.0%	15.0%	<.001	31.0%	14.0%	<.001
Acute stroke	1.1%	1.4%	.46	1.1%	0.9%	.7
Acute kidney injury	30.0%	24.0%	<.001	35.0%	28.0%	.001
New dialysis	0.2%	0.3%	.85	0.4%	1.4%	.02
Vascular complications	0.2%	1.7%	<.001	0.4%	1.4%	.01
Gastrointestinal bleeding	3.6%	3.1%	.44	3.0%	3.2%	.8
Blood transfusion	4.7%	6.7%	.02	4.0%	5.1%	.3
Mechanical ventilation	8.5%	10.0%	.14	12.0%	12.0%	.66
Palliative care encounter	28.0%	7.7%	<.001	25.0%	6.6%	<.001
Left against medical advice	0.1%	0.3%	.33	0.2%	0.7%	.17
Discharge home	31.0%	56.0%	<.001	35.0%	65.0%	<.001
Non-home discharges	36.0%	28.0%	<.001	33.0%	20.0%	<.001

Table S3. Comparison of Crude Rates of Clinical Outcome Between Men and Women age 65-84 years Stratified by pPCI Use.

Clinical Outcomes	Female N=57,845			Male N=103,065		
	No PCI (25.2%)	PCI (74.8%)	P	No PCI (21.4%)	PCI (78.6%)	P
In-hospital mortality	19.7%	8.0%	<.001	18.3%	6.7%	<.001
Acute stroke	2.3%	1.1%	<.001	1.5%	0.8%	<.001
Acute kidney injury	24.7%	15.9%	<.001	29.7%	18.5%	<.001
New dialysis	1.2%	0.5%	<.001	1.1%	0.5%	<.001
Vascular complications	1.2%	1.7%	.06	1.1%	0.9%	.37
Gastrointestinal bleeding	3.0%	2.3%	.06	3.3%	2.1%	<.001
Blood transfusion	7.8%	5.1%	<.001	8.0%	3.7%	<.001
Mechanical ventilation	16.4%	11.3%	<.001	19.8%	10.9%	<.001
Palliative care encounter	10.9%	2.7%	<.001	8.2%	2.5%	<.001
Left against medical advice	0.7%	0.3%	.002	1.0%	0.4%	<.001
Discharge home	46.6%	77.6%	<.001	50.7%	82.6%	<.001
Non-home discharges	33.0%	14.1%	<.001	29.9%	10.3%	<.001

Table S4. Comparison of Crude Rates of Clinical Outcome Between Men and Women age 45-64 years Stratified by pPCI Use.

Clinical Outcomes	Female N=46,045			Male N=151,445		
	No PCI (18%)	PCI (82%)	P	No PCI (14.2%)	PCI (85.8%)	P
In-hospital mortality	11.1%	3.6%	<.001	11.9%	3.0%	<.001
Acute stroke	1.3%	0.6%	.002	1.5%	0.5%	<.001
Acute kidney injury	14.5%	8.5%	<.001	20.2%	11.0%	<.001
New dialysis	0.7%	0.3%	.02	0.7%	0.3%	.001
Vascular complications	0.8%	1.2%	.26	0.7%	0.6%	.27
Gastrointestinal bleeding	1.8%	1.0%	.01	2.0%	1.1%	<.001
Blood transfusion	6.5%	3.8%	<.001	5.7%	2.3%	<.001
Mechanical ventilation	16.0%	8.4%	<.001	16.8%	7.9%	<.001
Palliative care encounter	4.8%	1.2%	<.001	4.4%	1.0%	<.001
Left against medical advice	1.8%	0.6%	<.001	2.4%	1.2%	<.001
Discharge home	68.8%	90.7%	<.001	66.3%	91.1%	<.001
Non-home discharges	18.3%	4.9%	<.001	19.3%	4.7%	<.001

Table S5. Comparison of Crude Rates of Clinical Outcome Between Men and Women age <45 years Stratified by pPCI Use.

Clinical Outcomes	Female N=6,690			Male N=21,910		
	No PCI (20.5%)	PCI (79.5%)	P	No PCI (16.7%)	PCI (83.3%)	P
In-hospital mortality	7.3%	2.8%	<.001	5.9%	2.0%	<.001
Acute stroke	1.1%	0.6%	.34	0.1%	0.4%	.26
Acute kidney injury	14.6%	7.4%	<.001	14.6%	9.2%	<.001
New dialysis	0.4%	0.2%	.58	0.7%	0.3%	.16
Vascular complications	0.7%	1.0%	.64	0.4%	0.7%	.43
Gastrointestinal bleeding	2.6%	1.1%	.07	1.5%	0.7%	.04
Blood transfusion	4.7%	4.3%	.76	3.3%	1.9%	.02
Mechanical ventilation	12.0%	7.0%	.008	10.4%	6.5%	<.001
Palliative care encounter	1.1%	1.3%	.77	1.4%	0.8%	.11
Left against medical advice	3.6%	2.3%	.19	3.5%	1.5%	<.001
Discharge home	71.5%	90.7%	<.001	78.3%	93.5%	<.001
Non-home discharges	17.2%	4.2%	<.001	12.1%	2.9%	<.001

Table S6. Average Treatment Effect of PCI in Men and Women age 85-years or above Who Presented with STEMI using Propensity Score Matching.

Clinical Outcomes	Female N=16,300		Male N=10,085		P**
	ATE (95 CI)	P*	ATE (95 CI)	P*	
In-hospital mortality	-15.2% (-18.6%, -11.8%)	<.001	-17.5% (-22.4%, -12.5%)	<.001	.46
Acute stroke	4.8% (1.7%, 8.0%)	.002	2.2% (-1.9%, 6.3%)	.301	.31
Acute renal failure	0.2% (-0.9%, 1.2%)	.729	-0.4% (-1.4%, 0.5%)	.371	.39
New dialysis	-1.5% (-5.0%, 2.0%)	.401	-0.8% (-5.6%, 4.0%)	.752	.81
Vascular complications	-0.1% (-0.4%, 0.3%)	.732	1.2% (0.3%, 2.0%)	.009	.01
Gastrointestinal bleeding	1.4% (0.5%, 2.3%)	.003	1.1% (0.3%, 1.9%)	.007	.65
Blood transfusion	-0.8% (-2.2%, 0.6%)	.259	0.2% (-1.6%, 2.0%)	.822	.39
Mechanical ventilation	1.7% (-0.3%, 3.7%)	.091	1.5% (-0.6%, 3.5%)	.160	.86
Palliative care encounter	1.5% (-1.2%, 4.1%)	.280	-3.8% (-7.6%, 0.0%)	.049	.03
Left against medical advice	-17.1% (-20.0%, -14.2%)	<.001	-15.1% (-18.9%, -11.2%)	<.001	.41
Discharge home	0.1% (-0.1%, 0.3%)	.329	0.8% (0.0%, 1.5%)	.043	.09
Non-home discharges	21.9% (17.8%, 26.0%)	<.001	26.0% (20.4%, 31.6%)	<.001	.25

* This P value indicates the significance of ATE against the null hypothesis of no effect (ATE=0%) within each group.

**This P value indicates the significance of ATE difference between males and females. We used z-score= (B1 - B2) / √ (seB1^2 + seB2^2) to compare average treatment effects between groups.

Table S7. Average Treatment Effect of PCI in Men and Women age 65-84 years Who Presented with STEMI using Propensity Score Matching.

Clinical Outcomes	Female N=57,845		Male N=103,065		P**
	ATE (95 CI)	P*	ATE (95 CI)	P*	
In-hospital mortality	-9.4% (-11.3%, -7.5%)	<.001	-9.6% (-11.0%, -8.3%)	<.001	0.85
Acute stroke	-0.9% (-2.9%, 1.2%)	.41	-1.8% (-3.2%, -0.3%)	0.019	0.48
Acute renal failure	-1.0% (-1.8%, -0.2%)	.011	-0.4% (-0.9%, 0.1%)	0.11	0.20
New dialysis	-4.1% (-6.1%, -2.1%)	<.001	-4.1% (-5.6%, -2.6%)	<.001	0.98
Vascular complications	-0.2% (-0.6%, 0.2%)	.28	-0.2% (-0.5%, 0.1%)	0.193	0.97
Gastrointestinal bleeding	0.4% (-0.2%, 1.0%)	.19	0.1% (-0.3%, 0.4%)	0.79	0.34
Blood transfusion	0.2% (-0.8%, 1.2%)	.66	-0.7% (-1.4%, 0.0%)	0.039	0.12
Mechanical ventilation	-1.2% (-2.4%, 0.0%)	.05	-3.2% (-4.2%, -2.2%)	<.001	0.01
Palliative care encounter	-3.5% (-5.3%, -1.7%)	<.001	-6.5% (-8.0%, -5.0%)	<.001	0.01
Left against medical advice	-5.8% (-7.1%, -4.5%)	<.001	-3.7% (-4.6%, -2.9%)	<.001	0.01
Discharge home	-0.4% (-0.7%, 0.0%)	.038	-0.7% (-1.1%, -0.3%)	0.001	0.19
Non-home discharges	26.6% (24.1%, 29.2%)	<.001	27.8% (25.9%, 29.8%)	<.001	0.46

* This P value indicates the significance of ATE against the null hypothesis of no effect (ATE=0%) within each group.

**This P value indicates the significance of ATE difference between males and females. We used z-score= (B1 - B2) / √ (seB1^2 + seB2^2) to compare average treatment effects between groups.

Table S8. Average Treatment Effect of PCI in Men and Women age 45-64 years Who Presented with STEMI using Propensity Score Matching.

Clinical Outcomes	Female N=46,045		Male N=151,445		P**
	ATE (95 CI)	P*	ATE (95 CI)	P*	
In-hospital mortality	-5.3% (-6.9%, -3.7%)	<.001	-7.2% (-8.2%, -6.1%)	<.001	.056
Acute stroke	-0.6% (-2.5%, 1.4%)	.577	-1.9% (-3.1%, -0.7%)	.002	.26
Acute renal failure	-0.6% (-1.2%, 0.0%)	.035	-0.7% (-1.1%, -0.3%)	.001	.9
New dialysis	-2.2% (-3.9%, -0.5%)	.011	-3.2% (-4.4%, -1.9%)	<.001	.34
Vascular complications	-0.1% (-0.5%, 0.2%)	.5	-0.1% (-0.4%, 0.2%)	.410	.97
Gastrointestinal bleeding	0.1% (-0.7%, 0.8%)	.851	0.1% (-0.2%, 0.3%)	.654	.99
Blood transfusion	-0.2% (-0.8%, 0.4%)	.565	-0.4% (-0.8%, 0.0%)	.064	.59
Mechanical ventilation	-0.9% (-2.2%, 0.4%)	.163	-2.0% (-2.7%, -1.2%)	<.001	.15
Palliative care encounter	-4.9% (-6.8%, -3.0%)	<.001	-5.4% (-6.6%, -4.2%)	<.001	.64
Left against medical advice	-2.8% (-3.9%, -1.8%)	<.001	-2.4% (-3.1%, -1.8%)	<.001	.52
Discharge home	-1.1% (-1.8%, -0.4%)	.002	-0.9% (-1.5%, -0.4%)	.001	.77
Non-home discharges	20.5% (17.8%, 23.2%)	<.001	22.0% (20.2%, 23.7%)	<.001	.38

* This P value indicates the significance of ATE against the null hypothesis of no effect (ATE=0%) within each group.

**This P value indicates the significance of ATE difference between males and females. We used z-score= (B1 - B2) / √ (seB1^2 + seB2^2) to compare average treatment effects between groups.

Table S9. Average Treatment Effect of PCI in Men and Women age <45 years Who Presented with STEMI using Propensity Score Matching.

Clinical Outcomes	Female N=6,690		Male N=21,910		P**
	ATE (95 CI)	P*	ATE (95 CI)	P*	
In-hospital mortality	-3.7% (-6.0%, -1.5%)	.001	-2.1% (-4.0%, -0.2%)	.028	.28
Acute stroke	3.8% (0.7%, 6.9%)	.015	1.6% (-0.5%, 3.6%)	.148	.23
Acute renal failure	-0.7% (-3.7%, 2.3%)	.662	0.3% (-0.1%, 0.7%)	.101	.52
New dialysis	-6.1% (-10.7%, -1.5%)	.009	-1.7% (-4.8%, 1.4%)	.283	.12
Vascular complications	0.0% (-0.7%, 0.7%)	1.000	-0.1% (-0.6%, 0.4%)	.672	.81
Gastrointestinal bleeding	0.3% (-0.9%, 1.5%)	.643	0.1% (-0.8%, 0.9%)	.868	.78
Blood transfusion	-1.5% (-3.8%, 0.8%)	.190	0.1% (-0.5%, 0.8%)	.651	.17
Mechanical ventilation	-0.3% (-4.1%, 3.6%)	.888	0.1% (-1.3%, 1.4%)	.930	.87
Palliative care encounter	-3.6% (-8.3%, 1.1%)	.129	-0.9% (-3.2%, 1.4%)	.453	.30
Left against medical advice	0.6% (-0.6%, 1.7%)	.356	0.0% (-0.8%, 0.7%)	.912	.40
Discharge home	-1.6% (-3.9%, 0.8%)	.190	-1.5% (-3.1%, 0.2%)	.077	.95
Non-home discharges	17.8% (10.5%, 25.0%)	<.001	13.0% (9.2%, 16.8%)	<.001	.25

* This P value indicates the significance of ATE against the null hypothesis of no effect (ATE=0%) within each group.

**This P value indicates the significance of ATE difference between males and females. We used z-score= (B1 - B2) / √ (seB1^2 + seB2^2) to compare average treatment effects between groups.

Table S10. Comparison of Crude Rates of Clinical Outcome Between Men and Women Stratified by pPCI Use Excluding Patients with Elective Admissions and Subsequent STEMI.

Clinical Outcomes	Female N=122,000			Male N=275,725		
	No PCI (25.7%)	PCI (74.3%)	P	No PCI (17.6%)	PCI (82.4%)	P
In-hospital mortality	20.5%	6.6%	<.001	16.0%	4.5%	<.001
Acute stroke	1.7%	0.9%	<.001	1.4%	0.6%	<.001
Acute kidney injury	23.1%	13.3%	<.001	25.3%	14.0%	<.001
New dialysis	0.8%	0.4%	<.001	0.8%	0.4%	<.001
Vascular complications	0.8%	1.4%	<.001	0.8%	0.7%	.368
Gastrointestinal bleeding	2.8%	1.8%	<.001	2.6%	1.4%	<.001
Blood transfusion	6.5%	4.7%	<.001	6.1%	2.8%	<.001
Mechanical ventilation	14.2%	9.9%	<.001	17.6%	9.0%	<.001
Palliative care encounter	13.6%	2.5%	<.001	7.5%	1.6%	<.001
Left against medical advice	0.9%	0.5%	0.002	1.8%	0.9%	<.001
Discharge home	49.3%	81.9%	<.001	57.6%	87.7%	<.001
Non-home discharges	29.2%	11.0%	<.001	24.6%	6.9%	<.001

Table S11. Average Treatment Effect of PCI in Men and Women Who Presented with STEMI using Propensity Score Matching Excluding Patients with Elective Admissions and Subsequent STEMI.

Clinical Outcomes	Female N=122,000		Male N=275,725		P**
	ATE (95 CI)	P*	ATE (95 CI)	P*	
In-hospital mortality	-9.2% (-10.4%, -8.1%)	<.001	-7.9% (-8.7%, -7.2%)	<.001	.08
Acute stroke	0.3% (-1.0%, 1.6%)	.65	-1.2% (-2.1%, -0.4%)	.006	.05
Acute renal failure	-0.6% (-1.0%, -0.1%)	.01	-0.4% (-0.7%, -0.2%)	.002	.56
New dialysis	-3.1% (-4.3%, -1.9%)	<.001	-3.5% (-4.4%, -2.5%)	<.001	.65
Vascular complications	-0.2% (-0.4%, 0.1%)	.12	0.0% (-0.1%, 0.2%)	.61	.11
Gastrointestinal bleeding	0.6% (0.2%, 1.0%)	.005	0.0% (-0.2%, 0.2%)	.97	.01
Blood transfusion	-0.2% (-0.7%, 0.3%)	.52	-0.4% (-0.7%, 0.0%)	.044	.54
Mechanical ventilation	-0.9% (-1.7%, 0.0%)	.042	-2.1% (-2.6%, -1.5%)	<.001	.02
Palliative care encounter	-3.3% (-4.6%, -2.1%)	<.001	-5.4% (-6.3%, -4.5%)	<.001	.01
Left against medical advice	-6.1% (-6.9%, -5.2%)	<.001	-3.2% (-3.7%, -2.7%)	<.001	.00
Discharge home	-0.4% (-0.7%, 0.0%)	.045	-0.7% (-1.1%, -0.4%)	<.001	.16
Non-home discharges	23.8% (22.1%, 25.5%)	<.001	23.9% (22.7%, 25.1%)	<.001	.93

* This P value indicates the significance of ATE against the null hypothesis of no effect (ATE=0%) within each group.

**This P value indicates the significance of ATE difference between males and females. We used z-score= (B1 - B2) / √ (seB1^2 + seB2^2) to compare average treatment effects between groups.

Table S12. Comparison of Crude Rates of Clinical Outcome Between Men and Women Stratified by pPCI Use Excluding Patients with Coronary Dissection of Takotsubo Cardiomyopathy.

Clinical Outcomes	Female N=122,450			Male N=284,180		
	No PCI (24.7%)	PCI (75.3 %)	P	No PCI (17.8%)	PCI (82.2%)	P
In-hospital mortality	21.7%	6.5%	<.001	15.8%	4.4%	<.001
Acute stroke	1.7%	0.9%	<.001	1.4%	0.6%	<.001
Acute kidney injury	23.9%	13.1%	<.001	25.1%	13.9%	<.001
New dialysis	0.8%	0.4%	<.001	0.8%	0.4%	<.001
Vascular complications	0.8%	1.4%	.001	0.8%	0.7%	.340
Gastrointestinal bleeding	2.9%	1.8%	<.001	2.6%	1.5%	<.001
Blood transfusion	6.8%	4.6%	<.001	6.4%	2.8%	<.001
Mechanical ventilation	14.3%	9.7%	<.001	17.3%	8.9%	<.001
Palliative care encounter	14.3%	2.4%	<.001	7.5%	1.6%	<.001
Left against medical advice	0.9%	0.5%	.004	1.7%	0.9%	<.001
Discharge home	47.0%	81.9%	<.001	57.8%	87.8%	<.001
Non-home discharges	30.3%	10.9%	<.001	24.6%	6.8%	<.001

Table S13. Average Treatment Effect of PCI in Men and Women Who Presented with STEMI using Propensity Score Matching Excluding Patients with Coronary Dissection or Takotsubo Cardiomyopathy.

Clinical Outcomes	Female N=122,450		Male N=284,180		P**
	ATE (95 CI)	P*	ATE (95 CI)	P*	
In-hospital mortality	-10.1% (-11.3%, -8.9%)	<.001	-8.0% (-8.8%, -7.2%)	<.001	<.01
Acute stroke	-0.1% (-1.3%, 1.2%)	.94	-1.2% (-2.1%, -0.4%)	.005	.13
Acute renal failure	-0.8% (-1.3%, -0.4%)	.001	-0.4% (-0.7%, -0.2%)	.002	.11
New dialysis	-3.1% (-4.4%, -1.9%)	<.001	-3.3% (-4.3%, -2.4%)	<.001	.8
Vascular complications	-0.4% (-0.6%, -0.1%)	.006	0.0% (-0.2%, 0.1%)	.891	.02
Gastrointestinal bleeding	0.6% (0.2%, 1.0%)	.001	0.0% (-0.2%, 0.2%)	.786	<.01
Blood transfusion	-0.3% (-0.8%, 0.3%)	.3	-0.2% (-0.6%, 0.1%)	.137	.88
Mechanical ventilation	-1.3% (-2.2%, -0.3%)	.009	-2.1% (-2.6%, -1.6%)	<.001	.12
Palliative care encounter	-4.0% (-5.3%, -2.7%)	<.001	-5.4% (-6.2%, -4.5%)	<.001	.09
Left against medical advice	-6.9% (-7.8%, -6.0%)	<.001	-3.2% (-3.7%, -2.7%)	<.001	<.01
Discharge home	-0.6% (-1.0%, -0.2%)	.008	-0.7% (-1.0%, -0.4%)	<.001	.66
Non-home discharges	25.2% (23.4%, 26.9%)	<.001	23.9% (22.7%, 25.1%)	<.001	.24

* This P value indicates the significance of ATE against the null hypothesis of no effect (ATE=0%) within each group.

**This P value indicates the significance of ATE difference between males and females. We used z-score= (B1 - B2) / √ (seB1^2 + seB2^2) to compare average treatment effects between groups.

Table S14. Average Treatment Effect and Average Marginal Effect of pPCI on Falsification Endpoints.

Clinical Outcomes	Women n=126,885		Men n=286,530		P*
	ATE	P	ATE	P	
Irritable Bowel Syndrome	0.0% (-0.4%, 0.3%)	.37	0.0% (-0.1%, 0.2%)	.87	.69
Infectious arthropathy	0.01% (-0.04%, 0.06%)	.52	-0.02% (-0.07%, 0.04%)	.62	.42
	AME	P	AME	P	
Irritable Bowel Syndrome	0.0% (-0.3%, 0.3%)	.77	0.0% (-0.1%, 0.1%)	.78	.60
Infectious arthropathy	-0.01% (-0.10%, 0.08%)	.77	-0.01% (-0.05%, 0.03%)	.63	.93

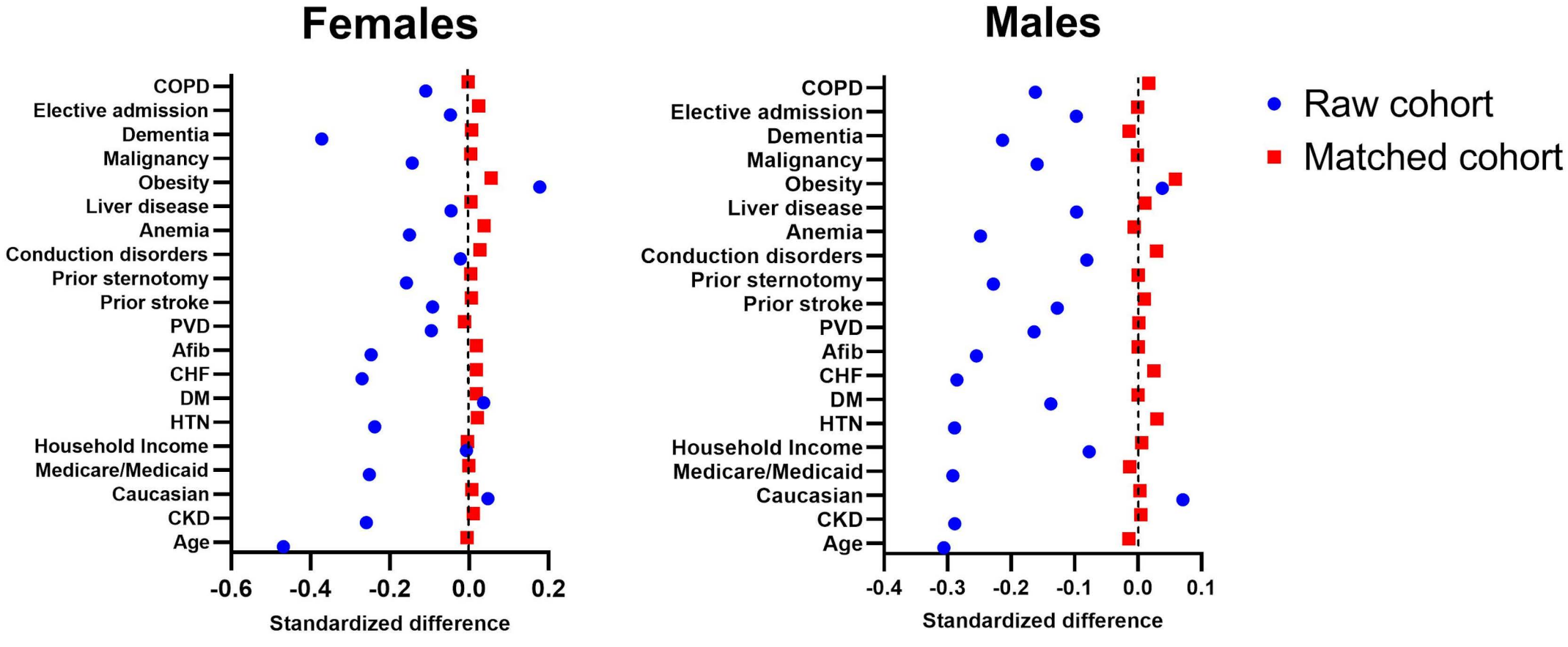
Females
COPD
Elective admission
Dementia
Malignancy
Obesity
Liver disease
Anemia
Conduction disorders
Prior sternotomy
Prior stroke
PVD
Afib
CHF
DM
HTN
Household Income
Medicare/Medicaid
Caucasian
CKD
Age
-0.6
-0.4
-0.2
0.0
0.2
Standardized difference
Males
COPD
Elective admission
Dementia
Malignancy
Obesity
Liver disease
Anemia
Conduction disorders
Prior sternotomy
Prior stroke
PVD
Afib
CHF
DM
HTN
Household Income
Medicare/Medicaid
Caucasian
CKD
Age
-0.4
-0.3
-0.2
-0.1
0.0
0.1
Standardized difference
Raw cohort
Matched cohort

Figure S1. Distribution of Standardized Differences Before and After Propensity Score Matching

COPD; chronic obstructive lung disease, PVD; peripheral vascular disease, Afib; atrial fibrillation, CHF; congestive heart failure, DM; diabetes, HTN; hypertension, CKD; chronic kidney disease.