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Differences in Practice Patterns and Outcomes in the Emergency Department by Physician Sex

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Introduction:

Prior evidence on practice pattern differences between female and male physicians have found female physicians order more diagnostic testing[1] and provide more guideline-concordant (e.g., for diabetes)[2] and preventive care;[3] findings regarding low-value care are mixed.[4,5] These studies have largely focused on primary care, while less is known about settings where selection between patients and physicians is more limited, such as emergency departments (EDs). Smaller ED studies have found no differences in testing or hospital admission.[6] We used nationwide Veterans Affairs (VA) data to examine differences in test ordering and hospital admission between female and male physicians working in the same EDs.

Methods:

Using VA EHR data, we identified patients ≥20 years old visiting a VA ED from 2011-2019 with chief complaints of chest pain (CP), shortness of breath (SOB), or abdominal pain. Practice pattern measures were number of radiology and laboratory tests and hospital admission. Outcomes were death within 30 days of ED visit among all patients and whether inpatient stays among admitted patients were <24 hours. Covariates include time (hour, day, month, year), location (ED, ED room), patient characteristics (age, sex, race and ethnicity [self-reported; VA-defined options], Elixhauser score, emergency severity index), and other physician characteristics (age, specialty) (**eMethods**). Using multivariable linear regressions, we examined adjusted differences by physician sex in patient characteristics to assess whether patients seen differed systematically, controlling for time and location. We then examined adjusted differences in practice pattern measures and outcomes, controlling for time, location, and patient and physician characteristics. In a sub-analysis of potentially low-value testing,[7] we examined ordering of CT chest with contrast as initial testing in patients with CP or SOB without high

pretest probability of pulmonary embolism. In a second sub-analysis, we examined 1) ordering of select laboratory tests [A) D-dimer and BNP for CP and SOB; B) lipase for abdominal pain] and 2) share of tests that are positive (test positivity). Significant differences in test positivity would suggest differences in testing appropriateness (**eMethods**). To investigate for what types of patients any differences between female and male physicians occur, we examined by subgroups of Elixhauser score (<3 and ≥3), ESI (≥3 and <3), patient age (<65 and ≥65), and patient sex. Analyses were conducted using Stata 18.5. P-values were from 2-sided tests. UCLA IRB approved the study. Informed consent was waived because data were deidentified. This study followed STROBE reporting guidelines.

Results:

Our sample included 1,557,071 patient visits cared for by 1,078 male and 448 female physicians across 105 VA EDs. Within the same ED, differences in patient characteristics by physician sex were either not statistically significant or not clinically significant (**Table 1**). Female physicians ordered more tests and admitted a higher share of patients (**Table 2**). For example, share of patients with CP admitted was 1.7pp higher (95%CI 1.2 to 2.2; relative difference 3.9%) for female physicians. Across chief complaints, absolute differences for radiology testing ranged from 0.04-0.05; for laboratory testing, 0.21-0.33; for share admitted, 1.0-2.2pp. There were no statistically significant differences by physician sex in mortality or likelihood of short inpatient stay. In our first sub-analysis, female physicians ordered more potentially low-value CT scans; for example, share of patients with SOB with a potentially low-value CT scan using our sensitive measure was 0.4pp higher (95%CI 0.2-0.6; relative difference 8.6%) for female physicians. In our second sub-analysis, female physicians ordered more testing in 3 of 5 test-chief complaint scenarios (D-dimer for CP and SOB, BNP for CP), but we found no differences across scenarios

in test positivity. In subgroup analyses, the differences by physician sex were not consistently larger or smaller for patients with higher mortality risk (e.g., higher Elixhauser score, more severe ESI).

Discussion:

We found female physicians ordered more tests and admitted more patients than male physicians working in the same EDs, although differences were modest. While this additional care was not associated with lower mortality, that these additional admitted patients were not more likely to be discharged within 24 hours may suggest they had inpatient needs. While female physicians ordered more potentially low-value CT scans, we could not assess differences in share of scans with a significant finding. When we directly examined differences in share of tests that were positive (for select laboratory tests), we found no differences, suggesting the additional tests ordered by female physicians may be clinically appropriate. Limitations include VA-specificity of findings, inability to determine whether more or less testing and admission represents higher-quality care outside of the CT sub-analysis, and use of older data ending in 2019. We believe that these differences, although small, would not dramatically change over time and that our findings remain relevant. These modest differences may result from differences in risk aversion and peer judgment.[8] Female physicians may give greater consideration to other biopsychosocial factors beyond medical acuity known to drive admission decisions, including symptom management,[9] functional status, and social support.[10]

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Disclaimer: The views expressed here are those of the authors and do not necessarily represent the views of the U.S. Department of Veterans Affairs or the U.S. government.

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Table 1: Sample characteristics by physician sex

	Chest pain (n=585,506)				Shortness of breath (n=589,836)				Abdominal pain (n=480,553)			
	Female physicians	Male Physicians	Unadjusted difference	Adjusted difference	Female physicians	Male Physicians	Unadjusted difference	Adjusted difference	Female physicians	Male Physicians	Unadjusted difference	Adjusted difference
Patient age	62.0	61.7	0.3 (0.1 to 0.4)	0.03 (-0.07 to 0.1)	66.8	66.9	-0.2 (-0.3 to -0.02)	-0.02 (-0.1 to 0.06)	58.4	58.4	0.07 (-0.08 to 0.2)	-0.1 (-0.2 to -0.02)
Male patient	90.2%	90.1%	0.1 pp (-0.08 to 0.3)	-0.4 pp (-0.6 to -0.2)	92.9%	93.2%	-0.3 pp (-0.5 to -0.1)	-0.3 pp (-0.5 to -0.1)	85.9%	86.2%	-0.3 pp (-0.5 to 0.01)	-1.0 pp (-1.2 to -0.7)
Female patient	9.8%	9.9%	-0.1 pp (-0.3 to 0.08)	0.4 pp (0.2 to 0.6)	7.1%	6.8%	0.3 pp (0.1 to 0.5)	0.3 pp (0.1 to 0.5)	14.1%	13.8%	0.3 (-0.01 to 0.5)	1.0 pp (0.7 to 1.2)
White, non-Hispanic patient	55.4%	57.5%	-2.1 pp (-3.2 to -0.9)	0.1 pp (-0.2 to 0.4)	61.2%	64.1%	-2.9 pp (-4.1 to -1.8	0.1 pp (-0.2 to 0.4)	57.6%	58.7%	-1.0 (-1.9 to -0.2)	0.01 pp (-0.3 to 0.3)
Not White, non-Hispanic patient	44.6%	42.5%	2.1 pp (0.9 to 3.2)	-0.1 pp (-0.4 to 0.2)	38.8%	35.9%	2.9 pp (1.8 to 4.1)	-0.1 pp (-0.4 to 0.2)	42.4%	41.3%	1.0 (0.2 to 1.9)	-0.01 pp (-0.3 to 0.3)
Emergency severity index	2.56	2.57	-0.007 (-0.02 to 0.006	-0.002 (-0.005 to 0.001)	2.76	2.77	-0.01 (-0.02 to 0.0005)	-0.002 (-0.005 to 0.002)	2.98	2.99	-0.02 (-0.02 to -0.01)	-0.004 (-0.006 to -0.001)
Elixhauser score	5.30	5.27	0.04 (0.007 to 0.07)	0.005 (-0.02 to 0.03)	6.39	6.42	-0.03 (-0.07 to 0.0006)	-0.007 (-0.03 to 0.02)	4.65	4.64	0.02 (-0.01 to 0.05)	0.0005 (-0.02 to 0.02)

Notes: Authors' calculation using VA data from 2011-2019. "Unadjusted difference" refers to differences between female physicians and male physicians in the characteristics of their patients. "Adjusted difference" refers to differences adjusted for the particular emergency department, particular room in that emergency department, hour, day of week, month, and year. More specifically, adjusted differences were calculated using linear regressions (for age, emergency severity index, and Elixhauser score) or linear probability models (for patient sex and patient race and ethnicity) as a function of physician sex, controlling also for binary indicators for each ED interacted with binary indicators for each value of the following variables: hour, day of week, month, year, and ED room. Adjusted differences are the coefficients on physician sex in these linear regression models; adjusted differences were statistically significant if the 95% confidence interval did not include 0. Standard errors are clustered at the emergency department and time level.

Table 2: Adjusted differences in practice patterns and patient outcomes by physician sex

	Female Physicians	Male Physicians	Adjusted difference between female and male physicians	Percent difference relative to mean for male physicians (for statistically significant differences)
Chest pain				
Number of radiology tests	1.14	1.10	0.04 (0.03 to 0.05)	3.5%
Number of laboratory tests	8.64	8.35	0.29 (0.23 to 0.34)	3.4%
Share of patients admitted	45.7%	44.0%	1.7 pp (1.2 to 2.2)	3.9%
30-day mortality	1.28%	1.32%	-0.04 pp (-0.1 to 0.03)	-
Short inpatient stay	27.7%	27.9%	-0.1 pp (-0.6 to 0.3)	-
Shortness of breath				
Number of radiology tests	1.12	1.08	0.04 (0.03 to 0.04)	3.4%
Number of laboratory tests	8.02	7.69	0.33 (0.26 to 0.39)	4.2%
Share of patients admitted	50.0%	47.8%	2.2 pp (1.8 to 2.6)	4.6%
30-day mortality	4.30%	4.22%	0.08 pp (-0.06 to 0.2)	-
Short inpatient stay	13.0%	13.2%	-0.1 pp (-0.5 to 0.2)	-
Abdominal pain				
Number of radiology tests	1.08	1.03	0.05 (0.04 to 0.06)	5.0%
Number of laboratory tests	8.03	7.81	0.21 (0.16 to 0.27)	2.8%
Share of patients admitted	30.8%	29.8%	1.0 (0.6 to 1.4)	3.4%
30-day mortality	1.71%	1.68%	0.04 (-0.06 to 0.1)	-
Short inpatient stay	16.0%	15.6%	0.5 (-0.08 to 1.0)	-

Notes: Authors' calculation using VA data from 2011-2019. Adjusted probabilities were calculated using marginal standardization from linear regressions (for number of radiology tests and number of laboratory tests) or linear probability models (for admission, mortality, and short inpatient stay) as a function of physician sex, controlling also for physician age, physician specialty (emergency medicine, internal medicine, hospitalist, general practice, or family medicine), and binary indicators for each ED interacted with binary indicators for each value of

the following variables: hour, day of week, month, year, ED room, patient sex, patient age (in 5-year increments), patient race and ethnicity, Elixhauser comorbidity score, and emergency severity index level. Adjusted differences are the coefficients on physician sex in these linear regression models; adjusted differences were statistically significant if the 95% confidence interval did not include 0. Standard errors are clustered at the emergency department and time level. In the column "Percent difference relative to mean for male physicians," values are calculated by dividing adjusted differences (3rd column of numbers) by the adjusted means in outcomes for male physicians (2nd column of numbers). These values were only calculated for statistically significant differences. As in prior studies, we defined observation stays and transfers as clinically equivalent to an admission (as patients continue to receive monitoring and are not immediately discharged home). A short inpatient stay is defined as an inpatient stay less than 24 hours among those admitted.