Patient–physician gender concordance and increased mortality among female heart attack patients

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We examine patient gender disparities in survival rates following acute myocardial infarctions (i.e., heart attacks) based on the gender of the treating physician. Using a census of heart attack patients admitted to Florida hospitals between 1991 and 2010, we find higher mortality among female patients who are treated by male physicians. Male patients and female patients experience similar outcomes when treated by female physicians, suggesting that unique challenges arise when male physicians treat female patients. We further find that male physicians with more exposure to female patients and female physicians have more success treating female patients.

gender disparity | patient–physician gender concordance | patient advocacy | heart attacks | mortality

A significant number of life's outcomes are not determined through self-advocacy. Instead, they result, at least in part, from people who advocate for, and act on, a person's behalf. Furthermore, people do not always have their choice of advocate, and advocates may differ from those they advocate for in terms of values, beliefs, background, race, and even gender. However, distressingly, in the absence of gender concordance between advocates and those they advocate for—particularly in instances where men are advocating for women—women have been found to fare worse than their male counterparts, facing disadvantages in terms of pay equality (1), ascension to leadership positions (2), educational outcomes (3), legal dispute resolution (4), and even medical treatment (5). In the medical setting, research suggests that gender discordance may yield lower rapport and patient satisfaction (6), reduced adherence to preventative care protocols (7), and weaker patient–physician communication (8).

These concerns regarding the deleterious effects of gender discordance are becoming increasingly salient in the presence of two emerging literatures: a growing body of medical research suggesting that women are less likely to survive traumatic health episodes like acute myocardial infarctions (AMIs) and research examining performance heterogeneity across male and female physicians. To date, researchers have offered a number of explanations for the gender disparity in AMI survival: Female patients may have an increased propensity to delay seeking treatment (9), may present symptoms that differ from men (5, 10, 11), and may be more challenging to diagnose and treat (12). At the same time, researchers have observed that female physicians outperform their male counterparts across a variety of conditions (in terms of mortality and readmission) once potential confounds (e.g., risk profiles, age, and race) are accounted for (13).

In this work, we posit that gender discordance between physician and patient helps to explain why female patients are less likely to survive AMIs. A deep body of social science research explains why individuals often possess in-group biases (14) and have difficulty communicating effectively with members of social groups who possess different ascriptive characteristics than their own (15). Furthermore, extant work in physician–patient communication (8, 16) and patient satisfaction (6) shows that these issues are salient in the medical setting. We posit that these challenges exacerbate the difficulty of diagnosing and treating AMIs, such that physician–patient gender concordance contributes to better patient outcomes. We further argue that the benefits of gender concordance will be strongest for female patients due to the difficulty of diagnosing and treating AMIs in female patients. We find empirical support for these ideas, documenting that gender concordance between the patient and physician influences measurable, substantive outcomes like patient survival and length of stay during an AMI. Furthermore, this relationship is much stronger for female patients. Results suggest that medical providers may need to account for the possible challenges physicians (particularly male physicians) face when treating AMI patients of the opposite gender.

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Materials and Methods

To examine the impact of gender match between patient and physician during an AMI, we used emergency department (ED) admittances of patients to Florida hospitals between 1991 and 2010. Patients were identified by using International Classification of Diseases 9 diagnosis codes associated with their stay at the hospital (i.e., code 410.X1). Our decision to focus on ED admittances was deliberate, because it creates a discrete interaction between a patient and the attending physician, allowing for a clear and immediate measure of success (i.e., patient survival). In addition, when patients visit the emergency room (ER), they have little agency over their choice of attending physician, allowing for a quasirandom assignment of physician and patient (13). We first examined mortality differences in outcomes when there was gender concordance between the attending physician and the patient (i.e., men treating men or women treating women). We then examined each specific concordance configuration—men treating women, men treating men, women treating men, and women treating women. Finally, we examined contextual factors that may exacerbate or attenuate the

Significance

A large body of medical research suggests that women are less likely than men to survive traumatic health episodes like acute myocardial infarctions. In this work, we posit that these difficulties may be partially explained, or exacerbated, by the gender match between the patient and the physician. Findings suggest that gender concordance increases a patient's probability of survival and that the effect is driven by increased mortality when male physicians treat female patients. Empirical extensions indicate that mortality rates decrease when male physicians practice with more female colleagues or have treated more female patients in the past.

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Table 1. LPM estimates of relationship between gender concordance and patient survival

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Full sample	Matched sample	Full sample	Matched sample	Full sample	Matched sample
Physician–patient gender concordance	0.0231***	0.0190***	0.00613***	0.0103***	0.00613***	0.0104***
	(0.000912)	(0.00186)	(0.000907)	(0.00197)	(0.000915)	(0.00183)
Constant	0.858***	0.854***	0.705***	1.092***	0.915***	1.090***
	(0.000791)	(0.00140)	(0.248)	(0.0267)	(0.0430)	(0.0935)
Observations	581,845	134,426	581,797	134,420	581,797	134,420
R squared	0.001	0.001	0.143	0.205	0.156	0.196
Model	OLS	OLS	OLS	OLS	OLS	OLS
Physician experience control	No	No	Yes	Yes	Yes	Yes
Patient age dummies	No	No	Yes	Yes	Yes	Yes
Patient race dummies	No	No	Yes	Yes	Yes	Yes
Comorbidity dummies	No	No	Yes	Yes	Yes	Yes
Fixed effect	None	None	Hospital-Qtr	Hospital-Qtr	Physician	Physician
Cluster	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr

Robust SEs are in parentheses. OLS, ordinary least squares; Qtr, quarter. ***$P < 0.01$.

effects to better understand the relationship between gender concordance and survival.

We drew on data from Florida's Agency for Healthcare Administration. Used extensively in prior research (17–19), these data granted us access to a census of patients admitted to hospitals in the state of Florida between 1991 and 2010. In addition to bed-level information about the patient (e.g., comorbidities, age, race, and gender), these data provided detailed physician-level data (e.g., name and date of licensure). We used physician name to infer gender and excluded from the sample those physicians with gender-ambiguous names. A full discussion of these data, including descriptive statistics broken down by physician–patient concordance and descriptions of the empirical estimations, are available in the *SI Appendix*. We modeled the effect of gender concordance on healthcare outcomes using the following equation:

$$y_{ijt} = \alpha + \beta_1 x_1 + M'\theta_1 + W'\delta_1 + K'\xi_1 + \varepsilon, \quad [1]$$

where y_{ijt} represents patient survival and x_1 is gender concordance (coded as 1 if the patient and physician share gender and 0 otherwise). M is a vector of

Table 2. LPM estimates of relationship between gender concordance on patient survival

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Full sample	Matched sample	Full sample	Matched sample	Full sample	Matched sample	Full sample	Matched sample
Male physician	−0.00473**	0.00116	−0.00781***	−0.00433				
	(0.00185)	(0.00409)	(0.00181)	(0.00427)				
Female patient	−0.0214***	−0.00401	−0.00207	0.00234	−0.00332	0.00227		
	(0.00265)	(0.00542)	(0.00259)	(0.00560)	(0.00263)	(0.00513)		
Male physician × female patient	−0.00778***	−0.0178***	−0.00580**	−0.0136**	−0.00418	−0.0137**		
	(0.00282)	(0.00577)	(0.00273)	(0.00590)	(0.00277)	(0.00542)		
Male doctor, female patient							−0.0157***	−0.0152***
							(0.00189)	(0.00433)
Male doctor, male patient							−0.00784***	−0.00380
							(0.00180)	(0.00424)
Female doctor, female patient							−0.00221	0.00277
							(0.00258)	(0.00556)
Constant	0.888***	0.872***	0.718***	1.106***	0.922***	1.101***	0.718***	1.105***
	(0.00177)	(0.00387)	(0.248)	(0.0270)	(0.0431)	(0.0936)	(0.248)	(0.0270)
Observations	581,845	134,426	581,797	134,420	581,797	134,420	581,797	134,420
R squared	0.002	0.001	0.143	0.205	0.156	0.196	0.143	0.205
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Physician experience control	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Patient age dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Patient race dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect	None	None	Hospital-Qtr	Hospital-Qtr	Physician	Physician	Hospital-Qtr	Hospital-Qtr
Cluster	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr

Robust SEs are in parentheses. OLS, ordinary least squares; Qtr, quarter. **$P < 0.05$; ***$P < 0.01$.

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Table 3. LPM and conditional logit estimates of relationship between gender concordance on patient survival with sample split by physician gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Full sample	Full sample	Full sample	Full sample	Matched sample	Matched sample	Full sample	Full sample
Physician set	Male physicians only	Female physicians only	Male physicians only	Female physicians only	Male physicians only	Female physicians only	Male physicians only	Female physicians only
Female patient	−0.00760***	−0.00278	−0.00719***	−0.00613**	−0.0114***	0.000985	−0.0382***	0.0116
	(0.00101)	(0.00326)	(0.000998)	(0.00283)	(0.00201)	(0.00556)	(0.00909)	(0.0291)
Constant	0.713***	1.084***	0.922***	0.896***	1.119***	0.0890		
	(0.247)	(0.0530)	(0.0432)	(0.0469)	(0.0934)	(0.131)		
Observations	520,078	61,719	520,078	61,719	119,456	14,964	507,203	40,578
R squared	0.147	0.276	0.155	0.166	0.192	0.238		
Model	OLS	OLS	OLS	OLS	OLS	OLS	Logit	Logit
Physician experience control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Patient age dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Patient race dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comorbidity dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect	Hospital-Qtr	Hospital-Qtr	Physician	Physician	Physician	Physician	Hospital-Qtr	Hospital-Qtr
Cluster	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr

Robust SEs are in parentheses. OLS, ordinary least squares; Qtr, quarter. **P < 0.05; ***P < 0.01.

patient controls, including dummies for patient age (yearly), seven dummies capturing patient race, and dummies capturing the 43 most common comorbidities (listed in *SI Appendix*). W is a linear measure of physician tenure, calculated as the number of years the physician has been licensed to practice in Florida. K is a vector of fixed effects, either for hospital-quarter (the most granular unit of time in the data) or the physician, depending on the model being estimated. ε is the error term, and α is the constant. β, θ, δ, and ξ are the terms to be estimated. SEs are clustered at the hospital-quarter level. In most models, the estimator was a linear probability model (LPM). While nonlinear models, such as a logit, are sometimes used to model dichotomous outcomes, the LPM is easier to interpret, particularly for interaction terms (20), and has been extensively relied upon by researchers using administrative data to examine patient mortality (13). Nonetheless, we also reported results from a conditional logit model. Finally, to further account for physician heterogeneity, we created a matched sample that paired (without replacement) each female patient to a male patient who was treated by the same doctor in the same hospital in the same year. If more than one candidate match was available, one was selected at random.

Results

In column 1 of Table 1, we estimate Eq. **1** in the absence of controls or fixed effects. As can be seen from the coefficient of *Concordance*, there was a significant and positive effect of shared physician–patient gender on survival ($P < 0.01$). This result is robust to the use of the matched sample (column 2), the inclusion of controls and hospital-quarter fixed effects (columns 3 and 4), and controls with physician fixed effects (columns 5 and 6). The baseline mortality rate is 11.9%. The estimated coefficient of gender concordance implied that gender concordance reduced the probability of death by 5.4%, relative to this baseline.

We next broke concordance into its component pieces. This was done in two ways. First, we used a simple interaction between patient female and physician male. Second, we used a vector of dummies containing *Patient Female/Physician Male*, *Patient Male/Physician Female*, and *Patient Female/Physician Female*, with *Patient Male/Physician Female* serving as the base case. All other indicators were consistent with Eq. **1**. Results are in Tables 2 and 3 and displayed graphically in Figs. 1 and 2.

Results in Table 2 indicate that female patients treated by male physicians were the least likely to survive an episode of care. Furthermore, and corroborating recent research, we saw that patients treated by female physicians were, in the unmatched sample, more likely to survive, regardless of patient gender (13). Columns 1 and 2 display results of the base interaction model without control variables or fixed effects. Columns 3 and 4 add control variables and hospital-quarter fixed effects. Columns 5 and 6 includes control variables and physician fixed effects. In each case, results indicate a significant penalty to female patients when being treated by male physicians [with the exception of column 5, which is marginally insignificant at conventional levels ($P = 0.15$)]. Columns 7 and 8 replace the interaction term with a vector of

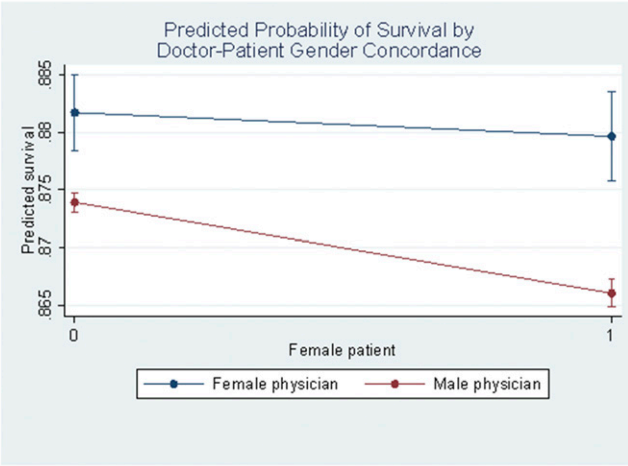

Fig. 1. Gender concordance and patient survival: results from Table 2, column 3, 90% confidence interval displayed. Estimates include controls and hospital quarter fixed effects. Covariates held at sample means. $n = 581{,}797$.

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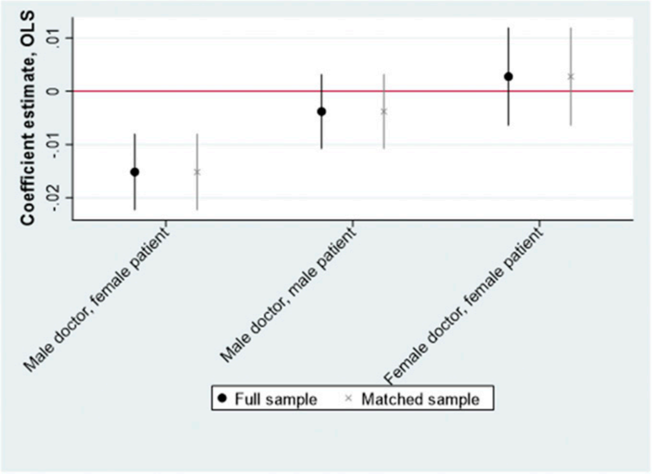

Fig. 2. Gender concordance and patient survival: results from Table 2, columns 7 and 8, 90% confidence interval displayed. Estimates include controls and hospital quarter fixed effects. Comparison group is male doctor, male patient. n = 581,797 for full sample, n = 134,420 for matched sample.

patient–physician gender concordance dummies. Results were consistent using alternate measures of performance quality (i.e., length of stay), as shown in *SI Appendix*, Table S4. In terms of effect size, we see in column 8 that female patients treated by male physicians were 1.52% less likely to survive than male patients treated by female physicians. This represents an ∼12% decrease off the baseline mortality rate of 11.9%.

Results in Table 3 test the interaction effects by splitting the sample based on physician gender. This approach allows patient characteristics to vary flexibly across male and female physicians. Results in columns 1 and 2 indicate that survival rates were two to three times higher for female patients treated by female physicians compared with female patients treated by male physicians. Furthermore, the likelihood of survival for female patients treated by male physicians remained lower when physician fixed effects were included (columns 3 and 4), in the matched sample (columns 5 and 6), and if the estimate was made by using a conditional logit (columns 7 and 8). We compared differences in the effect of *Female Patient* across male and female physicians using the Z-score approach noted in Clogg et al. (21). We saw P values of 0.15 (columns 1 and 2), 0.72 (columns 3 and 4), 0.03 (columns 5 and 6), and 0.09 (columns 7 and 8) for these comparisons.

Finally, we examined conditions under which female patients were more likely to survive being treated by a male physician. Such analyses may help explain the stark relationship between gender concordance and survival and provide direction to policymakers attempting to resolve such issues. In doing so, we tested how the environment in which the physician practices and the physician's patient history correlated with outcomes.

To measure the physician's practice environment, we counted the number of female physician colleagues at the hospital where the AMI treatment takes place. We used the presence of female physicians treating AMI patients at the same hospital as the focal physician because female colleagues may offer opportunities for male physicians to benefit from intraorganizational knowledge spillovers (as they may be more equipped to properly diagnose and treat female patients suffering from AMIs). Female colleagues might also influence ER protocols in a way which helps the diagnosis and treatment of female patients. To measure the physician's patient history, we examined the number of female AMI patients the physician had treated in the past. This experience offers the physician an increased opportunity to experience any difference in symptom presentation that might occur between female and male patients. This type of experience might be particularly valuable for male physicians.

Table 4. LPM estimates of the relationship between gender concordance and patient survival as moderated by number of female colleagues and number of female patients seen by the physician

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Full sample	Full sample	Full sample	Full sample	Matched sample	Matched sample
Physician set	Male physicians only	Female physicians only	Male physicians only	Female physicians only	Male physicians only	Female physicians only
Female patient × ratio of female physicians	0.0944***	0.0616**	0.0863***	0.0987***	0.0994***	−0.00141
	(0.0142)	(0.0310)	(0.0135)	(0.0299)	(0.0272)	(0.0558)
Female patient × prior female patients	0.000244**	−0.000496	0.000367***	−0.000284	0.000806**	−0.000825
	(0.000113)	(0.000335)	(0.000110)	(0.000331)	(0.000355)	(0.00110)
Female patient	−0.0419***	−0.0285***	−0.0192***	−0.0206***	−0.0258***	0.00474
	(0.00198)	(0.00606)	(0.00191)	(0.00605)	(0.00386)	(0.0120)
Ratio of female physicians	−0.0181*	−0.0245	−0.0392***	0.00534	−0.0583**	0.130***
	(0.00985)	(0.0194)	(0.0106)	(0.0230)	(0.0227)	(0.0489)
Prior female patients	0.00151***	0.00143***	0.000195**	0.000571*	0.000250	0.000805
	(7.85e-05)	(0.000203)	(9.62e-05)	(0.000299)	(0.000303)	(0.000892)
Constant	0.875***	0.883***	0.919***	0.888***	1.114***	0.0673
	(0.00133)	(0.00388)	(0.0428)	(0.0469)	(0.0929)	(0.129)
Observations	520,126	61,719	520,078	61,719	119,456	14,964
R squared	0.003	0.002	0.155	0.166	0.193	0.239
Model	OLS	OLS	OLS	OLS	OLS	OLS
Physician experience control	No	No	Yes	Yes	Yes	Yes
Patient age dummies	No	No	Yes	Yes	Yes	Yes
Patient race dummies	No	No	Yes	Yes	Yes	Yes
Comorbidity dummies	No	No	Yes	Yes	Yes	Yes
Fixed effect	None	None	Physician	Physician	Physician	Physician
Cluster	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr	Hospital-Qtr

Robust SEs are in parentheses. OLS, ordinary least squares; Qtr, quarter. *P < 0.1; **P < 0.05; ***P < 0.01.

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To empirically capture the effect of female colleagues, we interacted the percent of female physicians in the ED with the gender of the patient. To examine the effect of patient history, we interacted the number of female AMI patients the physician treated in the last quarter (the most granular measurement of time in our data) with the gender indicator of the patient. We split the sample by physician gender, which allowed us to see how these interactions vary across male and female physicians. Results are in Table 4.

In columns 1 and 2 of Table 4, we see that female patients experienced better outcomes in EDs that have a higher percentage of female physicians. This relationship was particularly true for patients treated by male physicians (column 1), although female patients also experienced better outcomes from female physicians in EDs that have a higher density of female physicians (column 2). These results persisted in the presence of a physician fixed effect (columns 3 and 4), but the moderating effect of female colleagues on female physicians dissipated in the matched sample (columns 5 and 6). The estimates in column 3 suggest that female patients treated in EDs with 5% more female physicians (e.g., 10% vs. 15%) were 0.4% more likely to survive (i.e., 0.086×0.05). Compared with the base mortality rate of 11.9%, this represents an increase of almost 3.5%. Results were similar if we relied on the raw number of female colleagues, as opposed to the percentage of female colleagues.

With regard to patient history, columns 1 and 2 of Table 4 suggest that female patients treated by male physicians experience a 0.02% increase in survival for each female patient the physician treated in the prior quarter. Compared with the baseline mortality rate of 11.9%, this was an increase of 0.16% per patient. For female physicians, we did not observe a change in female patient survival when the physician had seen more female patients. Results were similar in the presence of a physician fixed effect and in the matched sample. A Z-score comparison of the slope of *Female patient* × *Prior female patients* across male and female physicians has a *P* value of 0.03 (columns 1 and 2), 0.06 (columns 3 and 4), and 0.16 (columns 5 and 6). Results were similar if we relied on number of female patients seen in the last year, rather than the last quarter.

Discussion

In this study, we found a distinct asymmetry in AMI mortality based on physician–patient gender concordance. This asymmetry was particularly notable for female patients, who are less likely to survive an AMI when treated by a male physician. We also found that male physicians are more effective at treating female AMI patients when they work with more female colleagues and when they have treated more female patients in the past.

These results suggest a reason why gender inequality in heart attack mortality persists: Most physicians are male, and male physicians appear to have trouble treating female patients. The fact that gender concordance correlates with whether a patient survives a heart attack has implications for theory and practice. First, medical practitioners should be aware of the possible challenges male providers face when treating female AMI patients. Second, our extended findings indicate a fundamental catch-22 for medical providers and female patients. Although mortality rates for female patients treated by male physicians decrease as the male physician treats more female patients, this decrease may come at the expense of earlier female patients. Given the cost of male physicians' learning on the job, it may be more effective to increase the presence of female physicians within the ED. This corroborates prior work of researchers studying racial concordance in medicine, who have consistently concluded that increasing the presence of minority physicians in the hospital is critical (22, 23). Furthermore, it underscores the need to update the training that physicians receive to ensure that heart disease is not simply cast as a "male" condition, an observation underscored by recent popular press accounts (24).

This work has important limitations which offer fruitful avenues of future research. First, although our empirical design allowed us to observe increased mortality for women who are treated by men, we cannot directly observe the reason for this disparity. The contextual factors we examined (e.g., presence of female physicians and past exposure to female patients) suggest that male physicians benefit from increased exposure to the "atypical" experiences of female AMI patients. Future work is needed to fully understand the precise mechanism behind why gender concordance appears critical, particularly for female patients. Such research might include experimental interventions, or tests of more targeted training, to examine how exposing male physicians more thoroughly to the presentation of female patients might impact outcomes.

Second, it is important to emphasize that omitted variables which correlate with physician–patient gender concordance and patient mortality might influence the results. For example, female physicians tend to perform better than male physicians across a wide variety of ailments (13). If female patients tend to be more challenging for male and female doctors to diagnose and treat, the patterns we document may reflect the fact that the most skillful physicians (i.e., female physicians) provide the highest return to their skills when treating the most challenging patients (i.e., female patients). While our ability to control for physician quality with a physician fixed effect helps address this concern, future work that has stronger time-varying measures of physician skill can advance our work further. Additionally, it is possible that ED administrators make an effort to match physicians and patients on gender when hospital resources allow. Thus, we may be more likely to observe discordance in situations when caseloads are high and physicians are stressed and distracted. We address this possibility in *SI Appendix* and do not find much evidence for it, but cannot rule it out explicitly. Future research in settings where patients are assigned to physicians randomly can make important progress on this issue.

Finally, interesting opportunities for research exist in an examination of the role played by residents, nurses, and other physicians who may be present or provide information to the supervising physician. We were unable to observe the effect of these actors in our study, but future work that considers these supporting figures would advance our understanding of how coordination between healthcare providers might influence the relationship between physician–patient gender concordance and patient survival.

1. Cohen PN, Huffman ML (2007) Working for the woman? Female managers and the gender wage gap. *Am Sociol Rev* 72:681–704.
2. Cohen LE, Broschak JP, Haveman HA (1998) And then there were more? The effect of organizational sex composition on the hiring and promotion of managers. *Am Sociol Rev* 63:711–727.
3. Carrell SE, Page ME, West JE (2010) Sex and science: How professor gender perpetuates the gender gap. *Q J Econ* 125:1101–1144.
4. Knepper M (2017) When the shadow is the substance: Judge gender and the outcomes of workplace sex discrimination cases. *J Labor Econ* 36:623–664.
5. Kudenchuk PJ, Maynard C, Martin JS, Wirkus M, Weaver WD (1996) Comparison of presentation, treatment, and outcome of acute myocardial infarction in men versus women (the Myocardial Infarction Triage and Intervention Registry). *Am J Cardiol* 78:9–14.
6. Gross R, et al. (2008) The association of gender concordance and primary care physicians' perceptions of their patients. *Women Health* 48:123–144.
7. Malhotra J, et al. (2017) Impact of patient-provider race, ethnicity, and gender concordance on cancer screening: Findings from Medical Expenditure Panel Survey. *Cancer Epidemiol Biomarkers Prev* 26:1804–1811.
8. Elliott AM, Alexander SC, Mescher CA, Mohan D, Barnato AE (2016) Differences in physicians' verbal and nonverbal communication with black and white patients at the end of life. *J Pain Symptom Manage* 51:1–8.
9. Dempsey SJ, Dracup K, Moser DK (1995) Women's decision to seek care for symptoms of acute myocardial infarction. *Heart Lung* 24:444–456.
10. Dey S, et al.; Global Registry of Acute Coronary Events investigators (2009) Sex-related differences in the presentation, treatment and outcomes among patients with acute coronary syndromes: The Global Registry of Acute Coronary Events. *Heart* 95:20–26.
11. Goldberg RJ, et al. (1998) Sex differences in symptom presentation associated with acute myocardial infarction: A population-based perspective. *Am Heart J* 136: 189–195.

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12. Alter DA, Naylor CD, Austin P, Tu JV (1999) Effects of socioeconomic status on access to invasive cardiac procedures and on mortality after acute myocardial infarction. *N Engl J Med* 341:1359–1367.
13. Tsugawa Y, et al. (2017) Comparison of hospital mortality and readmission rates for Medicare patients treated by male vs female physicians. *JAMA Intern Med* 177:206–213.
14. Brewer MB (1979) In-group bias in the minimal intergroup situation: A cognitive-motivational analysis. *Psychol Bull* 86:307–324.
15. Smith-Lovin L, Brody C (1989) Interruptions in group discussions: The effects of gender and group composition. *Am Sociol Rev* 54:424–435.
16. Hall JA, Irish JT, Roter DL, Ehrlich CM, Miller LH (1994) Gender in medical encounters: An analysis of physician and patient communication in a primary care setting. *Health Psychol* 13:384–392.
17. Greenwood BN, Agarwal R (2016) Matching platforms and HIV incidence: An empirical investigation of race, gender, and socioeconomic status. *Manage Sci* 62: 2281–2303.
18. Burke MA, Fournier G, Prasad K (2003) *Physician Social Networks and Geographical Variation in Medical Care* (Center on Social and Economic Dynamics, Florida State Univ, Tallahassee, FL).
19. Greenwood BN, Agarwal R, Agarwal R, Gopal A (2016) The when and why of abandonment: The role of organizational differences in medical technology life cycles. *Manage Sci* 63:2948–2966.
20. Ai C, Norton EC (2003) Interaction terms in logit and probit models. *Econ Lett* 80:123–129.
21. Clogg CC, Petkova E, Haritou A (1995) Statistical methods for comparing regression coefficients between models. *Am J Sociol* 100:1261–1293.
22. Laveist TA, Nuru-Jeter A (2002) Is doctor-patient race concordance associated with greater satisfaction with care? *J Health Soc Behav* 43:296–306.
23. LaVeist TA, Nuru-Jeter A, Jones KE (2003) The association of doctor-patient race concordance with health services utilization. *J Public Health Policy* 24:312–323.
24. Doshi V (October 16, 2015) Why doctors still misunderstand heart disease in women. *The Atlantic*. Available at https://www.theatlantic.com/health/archive/2015/10/heart-disease-women/412495/. Accessed January 3, 2018.

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