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Identity and access: Gender-based preferences and physician availability in primary care

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ABSTRACT

Patient preferences for physicians may be influenced by shared characteristics such as gender. We analyzed experimental data from a survey of US adults in which respondents were asked to choose between physician profiles that on average varied only by gender. We find that female patients prefer female physicians to male physicians by 51.8 percentage points (95 % CI: 0.470 to 0.566, $p < 0.01$), and that result holds across Black, White, and Hispanic sub-groups. With no countervailing preference among male patients, this result holds in the overall sample at 26.8 percentage points (95 % CI: 0.228 to 0.307, $p < 0.01$). We also analyzed data from a simulated patient field experiment concerning access to primary care appointments and find that female physicians, on average, offer appointments 7.1 days later than male physicians (95 % CI: 5.1 to 9.1, $p < 0.01$), consistent with the finding that female physicians are preferred. Female physicians' offices appear to favor female patients, offering appointments to them 2.6 days earlier compared to male patients (95 % CI: -5.3 to 0.195, $p = 0.07$). However, Hispanic female patients were offered 4.2-percentage-points fewer appointments compared to Hispanic males (95 % CI: -0.069 to -0.014, $p < 0.01$) by female physicians' offices. Similarly, Black female patients were told that the physician is "not taking new patients" 3.5 percentage points more often (95 % CI: -0.004 to 0.073, $p = 0.08$) and were offered appointments that were 2.6 minutes shorter compared to Black males (95 % CI: -4.8 to -0.44, $p = 0.02$). Overall, our analysis suggests that female primary care physicians are in high demand relative to their supply, and that access to scarce female physicians is mediated by race and ethnicity.

1. Background

In contemporary health systems, there has been a palpable shift towards patient-centered care, reflecting a recognition of the profound impact patient preferences wield on healthcare outcomes and experiences. Embracing this ethos, providers and policymakers alike are increasingly prioritizing a holistic understanding of patient preferences as a cornerstone of effective care delivery (Mühlbacher et al., 2016; Ruhnke et al., 2020). At the same time, researchers are beginning to understand how cognitive biases impact physician decision-making, whether in treatment or in access (Chandra et al., 2019; Jin et al., 2023). While the interplay between

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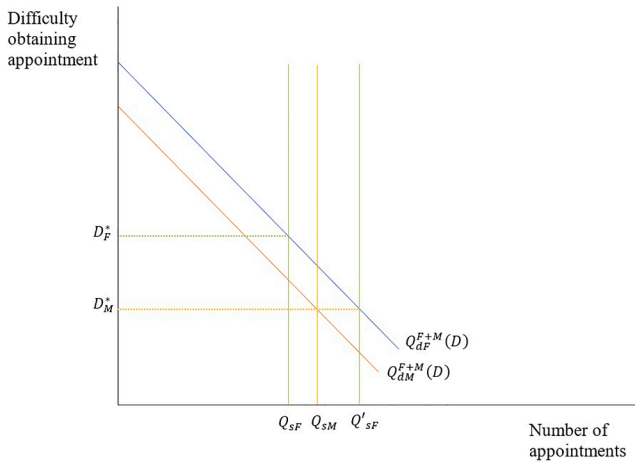

Fig. 1. Preference for gender concordant physicians and difficulty obtaining appointments.

patient preferences and shared decision-making in care delivery has been increasingly emphasized in recent literature (Alsan et al., 2019), gaps remain in comprehensively situating research methodologies and findings within the broader landscape of the current physician workforce, and the relative availability of physicians who possess the traits preferred by patients.

Perceived personal similarity between the patient and the physician has been suggested to predict patients' trust, satisfaction, and intent to adhere to care recommendations (Street et al. 2008). There is some evidence that gender concordance may be associated with improved outcomes including reduced mortality among female heart attack patients (Greenwood et al., 2018), highlighting its potential importance. However, the evidence on the degree to which patients prefer gender-concordant or gender-discordant physicians is mixed. One study finds that about two thirds of women had no preference by gender for obstetric and gynecologic care but instead valued other physician characteristics (Howell et al. 2002). Another study suggests that patients do prefer gender-concordance with their primary care physician, finding that both male and female patients often preferred to see a gender-concordant physician, with that preference more pronounced in males (Fink et al. 2020).

Today, more women are enrolling in medical school than men, improving the trajectory of their historical shortage in the field (Boyle 2019). Despite such progress, the majority of the primary care workforce is male. In 2019, family medicine or general practice medicine was 59 % male and internal medicine was 61 % male (AAMC 2020). At the same time, there is evidence that female physicians face higher demands on their time. In a study assessing gender differences in electronic health records workload, female physicians were subject to more requests from both patients and staff, increasing the risk of burnout among female physicians (Rittenberg et al. 2022). Another study concluded that female obstetrician gynecologists (OB/GYNs) provide longer visits and are more likely to perform preventative screenings compared to male OB/GYNs (Franks and Bertakis 2003). Thus, despite some evidence suggesting that patients may prefer to see gender-concordant physicians, whether those preferences are reciprocated by physicians and whether these preferences play a part in physician decision-making with respect to patient scheduling is not well understood.

In this study, we use experimental methods to quantify patient preferences related to gender concordance and consider the potential interplay between patient preferences and physician availability for new patient appointments. We also assess the extent to which physicians exhibit preferences in extending offers of appointments by patient gender or race/ethnicity. We employ data from two separate field experiments: one evaluating patient preferences for gender concordance and the other evaluating physician availability by physician gender. On the patient side, we also consider whether there are any racial or ethnic differences in patient preferences for concordance or differences in availability of concordant physicians. In the sections that follow, we introduce a conceptual framework through which patient preferences for concordance may drive availability of preferred physician groups, describe the methods through which we measure preferences and availability, and discuss the implications of our findings in the context of the current primary care workforce.

2. Conceptual framework

A large empirical literature examines differences in availability of physician care across different patient groups (Sharma et al., 2015; Polsky et al., 2015, 2018; Wisniewski and Walker, 2020; Wisniewski et al., 2021; Wisniewski et al., 2023). Sloan et al. (1978) developed a theoretical model of the market for medical care in which different types of patients yield different marginal revenue to physicians, leading to differences in physician acceptance rates across patient types. Their framework has been extensively employed to study differences in physician availability across patient groups. In this paper, we focus on a less studied question: how do differences in patient preferences over physician types affect availability across physician groups? In the simple framework below, we abstract away from issues related to differences in physician preferences across different types of patients of the type modeled by Sloan et al. (1978) to examine differences in patient preferences.

Let $Q_{dj}^{i}(D)$ denote the demand for appointments by patients of gender i with physicians of gender j where i and j can be either female

(F) or male (M). Let $D > 0$ denote the difficulty of obtaining an appointment with difficulty being comprised of several factors such as having a low probability of being offered an appointment, an appointment with a long wait time, or an appointment that is otherwise inconvenient. Abstracting away from issues of financial costs, including travel, we assume that patients' demand for appointments decreases with D. Let female and male patients have identical demands for gender discordant physicians (i.e., $Q^F_{dM}(D) = Q^M_{dF}(D)$), and let both female and male patients prefer physicians of their own gender (i.e., $Q^F_{dF}(D) > Q^F_{dM}(D)$ and $Q^M_{dM}(D) > Q^M_{dF}(D)$). We further assume that female patients have a stronger preference for gender-concordant physicians than male patients (i.e., $Q^F_{dF}(D) > Q^M_{dM}(D)$). The total demand for appointments with physicians of gender j is $Q^{F+M}_{dj}(D) \equiv Q^F_{dj}(D) + Q^M_{dj}(D)$. Since $Q^{F+M}_{dF}(D) > Q^{F+M}_{dM}(D)$, the model implies that the demand for female physicians exceeds the demand for male physicians. Fig. 1 illustrates such a situation.

Let Q_{sj} denote the number of appointments available with physicians of gender j. Q_{sj} is perfectly inelastic with respect to D. Using this framework, it can be seen that appointments available in equilibrium become less desirable to patients (i.e., D increases), for example, when the number of physicians decreases or the number of patients increases. Note that the availability of appointments at the level of the individual physician is determined by the physician's production function which may be affected by factors including experience, facilities and support staff, and professional and personal responsibilities. Male and female physicians experience different circumstances and expectations (e.g., Rittenberg et al. 2022 and Franks and Bertakis 2003) which means that gender-based differences in individual physicians' production functions are likely, and these differences affect Q_{sj}, or aggregate supply.

Let D^*_j denote the equilibrium difficulty of obtaining appointments with physicians of gender j, and let Q^{i*}_j denote the number of appointments patients of gender i obtain with physicians of gender j in equilibrium. In line with the composition of the US physician workforce, Fig. 1 shows that fewer appointments are available with female physicians than with male physicians. The resulting equilibria yield a greater difficulty of obtaining appointments with female physicians than with male physicians (i.e., $D^*_F > D^*_M$).

Results are unaffected by a relaxation of the assumption that the number of available appointments (Q_{sj}) is perfectly inelastic with respect to the difficulty of obtaining appointments. The results are also unaffected if the number of appointments available with female physicians equals that available with male physicians (i.e., when $Q_{sF} = Q_{sM}$).

One implication of our model is that ensuring equal access to gender concordant physicians for male and female patients when female patients have stronger preferences for gender concordance requires that the availability of appointments with female physicians must exceed the availability of appointments with male physicians to the extent necessary to equalize the difficulty of obtaining appointments across physician gender. That is, Q_{sF} must exceed Q_{sM} to the extent necessary to ensure that $D^*_F = D^*_M$. In Fig. 1, this level is $= Q'_{sM}$.

Intuitively, the simple model in this section is one where consumers choose between differentiated products (e.g., Hotelling 1929). The differentiated products in this case are the female and male physicians for whom patients have different preferences. If patients do not have differential gender-based preferences for physicians, then differences in the difficulty of obtaining appointments between female and male physicians are not sustainable in equilibrium. That is, if patients regard female and male physicians as perfect substitutes, then $D^*_F \neq D^*_M$ is not a sustainable equilibrium outcome since patients will seek out physicians offering more desirable appointments until any difference is competed away. This remains true even when female and male physicians have different production functions and, consequently, different supply curves as shown in Fig. 1. Intuitively, patients will tolerate less convenient appointments from a group of physicians only if that group of physicians provides some patients with an offsetting advantage regardless of whether the physicians are high-cost or low-cost producers.

In the context of Fig. 1, without patients' gender-based preferences for physicians, the demand curves for female and male physicians could be aggregated into a single market demand curve. Market equilibrium (not shown in Fig. 1) would be determined by the intersection of the market demand curve with the market supply curve obtained by aggregating supply curves for female and male physicians.

In subsequent sections, we describe two field experiments which provide empirical evidence relevant to the model described here. The first experiment is designed to measure patient preferences for gender-concordant patients. The second provides evidence regarding the availability of appointments with female and male physicians. Together, they illustrate how patient preferences may affect the availability of physician appointments and appointment characteristics such as the wait time for an appointment.

3. Methods

3.1. Data collection for patient preferences

We conducted a patient choice experiment using Lucid, an online platform for convenience samples that has been previously validated for online experimental research (Coppock and McClellan 2019; Alsan et al. 2021; Tobia et al. 2021). In 2021, we deployed a survey of patient preferences on the platform (see *Appendix* for the full set of survey questions). Prospective subjects were asked their age and place of residence to determine whether they were eligible for the survey given inclusion criteria of being at least 22 years old and living in the United States. We first collected basic demographic details on respondents including gender, race and ethnicity, state of residence, citizenship status, type of insurance, and how many times they had scheduled a primary care appointment in the last year.

We then asked a series of questions about respondent preferences when seeking primary care, such as what characteristics of a physician were most important to them, and how long they would be willing to wait to be seen. The core prompt for this survey read as follows:

"You are experiencing a lot of pain in your lower stomach. The pain is dull and comes and goes. It has been about two weeks since the pain began. Please review the following doctor profiles and indicate which doctor you would proceed with. We found two doctors (below) whose next available appointment is in 29 days. If you have to pick one, which doctor would you choose to schedule an appointment with?"

On the same screen and below this prompt, survey respondents were presented with two primary care physician profiles similar in fashion to those commonly found on insurance websites and meant to guide patients to in-network providers (see Appendix Fig. A1). After selecting a physician, the respondents were asked how long they would be willing to wait for one physician over the other in order to examine whether the characteristics of a particular physician influence how long the respondents are willing to wait for an appointment.

The physician profiles contained a silhouette intended to signal gender, the physician's years of experience, and medical school attended. Presentation effects were controlled for by randomization of the order in which the physician profiles appeared on the page (left versus right). Respondents were required to choose one physician to proceed with when presented with a pairing in which the two physicians varied only by gender. Other physician characteristics, such as years of experience, were on average kept constant within pairings. The full set of survey questions is outlined in Appendix Table A1. We also separate results by tier of medical school to see if results vary.

3.2. Data collection for the physician availability experiment

Data comes from an ongoing national audit assessing access to primary care appointments in the United States. The sampling frame was the American Medical Association's (AMA) Physician Masterfile, a comprehensive list of Doctors of Medicine (MDs) and Doctors of Osteopathic Medicine (DOs) that is often used in analyses of physician availability in the United States (AAMC and IHS Markit Ltd 2021; AMA 2020). We drew an unstratified national random sample from the Masterfile that included physicians with primary specialties in family medicine (47 %), internal medicine (49 %), general practice (3 %), general preventive medicine (1 %), and urgent care medicine (0.3 %). The demographic characteristics of our physician sample are similar to those of actively licensed U.S. physicians (e.g., 39 % female, a mean age of 53 years, and osteopathic physicians representing 11 % of the sample) (Young et al. 2019). The geographic distribution of physicians in our sample approximates the distribution of primary care physicians across US states.

Each physician was randomly assigned a simulated patient profile comprising a name indicative of race or ethnicity (Black, Hispanic, or White), gender, and insurance type (private insurance through an employer, Medicaid, traditional Medicare, or self-pay). Trained research assistants (RAs) called physicians' offices to inquire about the availability of appointments for a physical exam saying that they were helping an aunt or uncle (the simulated patient) who was new to the area find a doctor. Multiple physicians were randomly assigned to each RA who themselves were randomized over multiple simulated patient profiles. RAs recorded the date and time of each call, the date and estimated duration of a potential appointment, and any questions asked or remarks made by the scheduler, including reasons for a lack of appointment availability, if applicable. RAs did not ask information regarding providers other than the requested physician but noted whether the physician's office offered an alternate provider in the same practice. We regard an appointment as offered if the physician's office provided a possible appointment date or date range and confirmed that at least one plan from the patient's insurance type was accepted. No actual appointments were made.

3.3. Protection of human subjects

The studies described here were approved and overseen by Institutional Review Boards at the authors' institutions. The patient preference study participants gave informed consent prior to participating in the study. The study protocol for the physician audit was assessed to create no more than minimal risk to the audited physicians and their staff, and the requirement for informed consent was waived. The research design for the audit of appointment availability with physicians permits systemic analysis of access and disparities while protecting the confidentiality of individual physicians and their practices.

3.4. Empirical approach to analysis of patient preference data

Multivariable regression was used to measure preferences for physicians. Our specification is as follows:

$$Y_{ijk} = \alpha + \beta \text{Gender}_j + \varphi \text{Covariates}_i + \varepsilon_{ijk} \quad (1)$$

where Y_{ijk} is the choice of physician varying by respondent (i) and physician (j) in state (k). β is an estimate of the effect of physician gender (coded as either female or male, depending on the specification, with the other gender serving as the omitted category). Covariates_i is a vector of respondent characteristic controls (e.g., gender, age, insurance status, ethnicity, race, and state of residence), and the robust error term is clustered on state. Analyses were also stratified by respondent race and ethnicity to better understand whether there is variation among racial and ethnic groups in preferences for gender concordance with primary care physicians.

3.5. Empirical approach to analysis of physician audit data

We estimate the relationship between call outcomes (i.e., no new patients accepted, insurance accepted, requested appointment offered, any appointment offered, appointment duration, and wait to requested appointment offered) and concordance by gender

Table 1
Respondent self-reported and physician signaled characteristics, patient preferences study.

Attribute	Overall
Patients	
Female	0.512 (0.500)
White	0.738 (0.440)
Black	0.105 (0.306)
East Asian	0.026 (0.158)
South Asian	0.024 (0.154)
Hispanic	0.131 (0.337)
Physicians (Signaled)	
White	0.202 (0.402)
Black	0.197 (0.398)
East Asian	0.188 (0.391)
South Asian	0.201 (0.401)
Hispanic	0.212 (0.409)

Notes: $N = 1684$. Half of the physicians were by definition female in this paired profile experiment.

between physicians and patients. We specify the model as follows:

$$Y_{ijkt} = \alpha + \beta_1 \text{FemalePhysician}_k + \beta_2 \text{PatientGender}_i + \sigma_i + \lambda \text{Demographics}_i + \varphi \text{Covariates}_{kt} + \delta \text{Call}_t + \varepsilon_{ijkt} \quad (2)$$

Where Y_{ijkt} is the call outcome varying by patient (i) in state (j) with physician (k) across time (t). β_1 is the estimate for female physician and β_2 is the estimate for patient gender, which is coded as either female or male, depending on the specification, with the other gender serving as the omitted category. In specifications in which we are testing for concordance patterns for female patients, Patient Gender is coded for female patients and the sample is run on only female physicians (and vice versa for male concordance). Additionally, α is the intercept; σ_i captures caller fixed effects; λ is a vector of estimates on patient demographic indicators (i.e. Hispanic and Black [with White as the omitted group] and payer type (i.e. private, Medicare, Medicaid, or self-pay); φ covers whether the physician was a Doctor of Medicine (MD) or Doctor of Osteopathy (DO) and physician age; δ covers the call covariates (i.e. day of week, month, and wave of data collection); and ε_{ijkt} is the robust error term clustered on state. Analyses were also stratified by prospective patients race and ethnicity to determine whether different racial and ethnic groups experience variation in access and availability when seeking care at a gender concordant physician's office. As a robustness check, we additionally assess the role of physician age and its intersection with gender by adding an indicator variable "older physician" for which the cutoff is the sample's median physician age of 52, and interact this variable with the "female physician" variable.

3.6. Measurement of the relative strength of female versus male preferences

We additionally measure the strength of preference for female physicians relative to male physicians by assessing how long the respondents were willing to wait for the one they preferred. A *t*-test was used to determine whether the number of days that respondents were willing to wait for female physicians differed from the number of days respondents were willing to wait for male physicians.

3.7. Empirical approach to link the patient preference data with the physician audit data

Finally, we estimate a relationship between the two datasets by plotting state-level observations concerning the relative availability of female physicians (i.e., differences in wait times in days, sourced from the physician audit data) and the degree of overall preference for female physicians (sourced from the patient preferences data). Specifically, we use variations of equations [1] and [2] in which state-level indicator variables were interacted with the female physician variable. We then plot these state-level estimates against each other, weighted by the number observations in each state, and estimate a linear regression line between these two variables.

4. Results

4.1. Results of the patient preferences study

As shown in Table 1, roughly 51 % of respondents were female, 74 % were White, 11 % were Black, and 13 % were Hispanic. The hypothetical physician pairings presented to the respondents with concordant race and ethnicity but discordant gender physicians were approximately 20 % each for White, Black, East Asian, South Asian, and Hispanic respondents. Results of the patient preferences regression indicate that female respondents express a strong preference for gender concordance, while male respondents do not. As shown in Table 2, female respondents were 52 percentage points more likely (95 % CI: 0.470 to 0.566, $p < 0.01$) to choose female physicians over male physicians. Male respondents demonstrated no statistically significant preference for gender concordant

Table 2
Preference for physicians by respondent gender, patient preferences study.

	Female Respondents	Male Respondents	All Respondents
Female Physician	0.518***, [0.470, 0.566]	Ref	0.268***, [0.228, 0.307]
p	<0.01		<0.01
Male Physician	Ref	−0.0002, [−0.068, 0.067].	Ref
p		1.00	
N	862	822	1684

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Each respondent counts as one observation, and faced a choice between a male and a female physician. 95 % confidence intervals in brackets. Estimates generated using equation [1].

Table 3
Preference for physicians by respondent gender, patient preferences study (comparison of results when asking demographics first or last).

	Female Respondents		Male Respondents		All Respondents	
	Demographics First	Demographics Last	Demographics First	Demographics Last	Demographics First	Demographics Last
Female, Physician	0.518***, [0.470, 0.566]	0.336**, [0.034, 0.637]	Ref	Ref	0.268***, [0.228, 0.307]	0.241**, [0.001, 0.480]
p	<0.01	0.03			<0.01	0.049
Male, Physician	Ref	Ref	−0.0002, [−0.068, 0.067]	0.034, [−0.265, 0.333	Ref	Ref
p			1.00	0.82		
N	862	46	822	50	1684	96

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Each respondent counts as one observation, and faced a choice between a male and a female physician. 95 % confidence intervals in brackets. Estimates generated using equation [1]. For the estimates where the demographic questions were asked last, given that there were few observations, insurance status, ethnicity, race, and states of residence were grouped to avoid model saturation.

physicians. Taken together, this female patient preference for female physicians led, in the pooled analysis, to a 26.8 percentage point preference for female physicians (95 % CI: 0.228 to 0.307, $p < 0.01$). As can be seen in Table 3 and Table 4, respectively, these results hold even when respondent demographics were asked at the end of the experiment and do not differ by medical school tier.

In stratified analyses by race and ethnicity, the preference for gender concordance among female respondents holds across racial and ethnic groups. While the confidence intervals overlap, the point estimate for gender concordance preference was largest among female Hispanic patients. As can be seen in Table 5, Hispanic women were 56.8 percentage points more likely (95 % CI: 0.342 to 0.794, $p < 0.01$) to choose female physicians over male physicians. White women were 54.4 percentage points (95 % CI: 0.482 to 0.606, $p < 0.01$) and Black women were 43.2 percentage points (95 % CI: 0.187 to 0.677, $p < 0.01$) more likely to choose female physicians over male physicians. No males of any race or ethnicity demonstrated any measurable preference for the gender of their prospective physician.

More than 90 % of respondents were willing to wait less than 10 days for their chosen physician and 11.5 % of respondents were not willing to wait one day for their preferred physician. Per Table 6, on average, when the preferred physician was female, the respondent was willing to wait 5.0 days. For preferred male physicians, the respondent was willing to wait 5.7 days. Using a *t*-test, the probability that these means are statistically significantly different from each other is 0.43.

4.2. Results of the physician audit study

As shown in Table 7, the physician sample was about 65 % male and the mean age was 52 years. Overall, 48.8 % of calls resulted in the requested appointment being offered (the office accepted the caller's insurance and could offer an appointment date range with the requested physician). Approximately 56.2 % of calls resulted in some appointment being offered, meaning the office accepted the caller's insurance and could offer an appointment with the requested physician or an alternate provider in the practice. The average wait time to the proposed appointment date was 28.5 days. Approximately one quarter of the physicians were not accepting new patients at the time of the call.

As can be seen in Table 8, female physicians had an average wait to appointment that was 7.1 days longer than male physicians (95 % CI: 5.1 to 9.1, $p < 0.01$). Per Table 9, we found no differences at the intersection of age and gender. In Table 10, we find that female patients were offered appointments with female physicians 2.5 days sooner than male patients (95 % CI: −5.3 to 0.2, $p = 0.07$). In contrast, as shown in Table 11, there was no evidence that male physician-patient concordance was associated with any difference in call outcomes relative to female patients. Per Table 12, stratified analyses revealed differences by patient race and ethnicity. For White patients, female physicians had an average wait to appointment that was 3.4 days longer (95 % CI: 0.11, 6.62, $p = 0.04$) than male physicians. Hispanic patients, in contrast, waited an average 11.2 days longer (95 % CI: 7.2 to 15.2, $p < 0.01$) and Black patients waited about 7.9 days longer (95 % CI: 4.4 to 11.5, $p < 0.01$) to see a female physician. However, Hispanic patients were 2.1 percentage points (95 % CI: −0.0001 to 0.042, $p = 0.051$) more likely to be offered an appointment with a female physician than a male physician.

Compared to White male patients, as shown in Table 13, White female patients faced no statistically significant differences in appointment availability with female physicians. In contrast, Hispanic female patients were 4.2 percentage points less likely (95 % CI:

Table 4
Preference for physicians by respondent gender and tier of physician's medical school, patient preferences study.

	Female Respondents			Male Respondents			All Respondents		
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Female, Physician	0.463***, [0.338, 0.588]	0.568***, [0.437, 0.699]	0.588***, [0.473, 0.703]	Ref	Ref	Ref	0.226***, [0.147, 0.305]	0.210***, [0.116, 0.305]	0.332***, [0.229, 0.435]
p	<0.01	<0.01	<0.01				<0.01	<0.01	<0.01
Male, Physician	Ref	Ref	Ref	0.050, [−0.125, 0.226]	0.124*, [−0.004, 0.253]	−0.090, [−0.259, 0.080]	Ref	Ref	Ref
p				0.57	0.06	0.29			
N	304	272	286	257	296	269	561	568	555

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Each respondent counts as one observation, and faced a choice between a male and a female physician. 95 % confidence intervals in brackets. Estimates generated using equation [1].

Universities were grouped into higher tier (1), middle tier (2), and lower tier (3) medical universities using the 2020 Quacquarelli Symonds (QS) World University Rankings for medical schools (Quacquarelli Symonds Limited, 2020).

Tier 1 medical schools included: University of Pennsylvania; Yale University; Johns Hopkins University; Northwestern University; University of California-Los Angeles (UCLA); University of Michigan-Ann Arbor; University of California-San Francisco (UCSF); and University of Texas-Austin.

Tier 2 medical schools included: Northeastern University; Wake Forest University; University of Iowa; University of Missouri-Columbia; Florida State University; University of California-Riverside; University of Connecticut; University of South Carolina; and Colorado State University.

Tier 3 medical schools included: Low: University of Cincinnati; University of New Mexico; Drexel University; University of Kentucky; University of Oklahoma; City University of New York; University of Central Florida; and Loyola University Chicago.

Table 5
Preference for physicians by respondent gender and race/ethnicity, patient preferences study.

		Female Respondents	Male Respondents
White Patients	Female Physician	0.544***, [0.482, 0.606]	Ref
	p	<0.01	
	Male Physician	Ref	0.050, [−0.014, 0.114]
	p		0.12
	N	618	614
Hispanic Patients	Female Physician	0.568***, [0.342, 0.794]	Ref
	p	<0.01	
	Male Physician	Ref	−0.113, [−0.318, 0,091]
	p		0.27
	N	116	102
Black Patients	Female Physician	0.432***, [0.187, 0.677]	Ref
	p	<0.01	
	Male Physician	Ref	−0.200, [−0.588, 0.188]
	p		0.30
	N	99	76

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. Each respondent counts as one observation, and faced a choice between a male and a female physician. 95 % confidence intervals in brackets. Estimates generated using equation [1].

Table 6
Respondent willingness to wait for preferred physician (days).

	N	Mean (SD)	95 % CI	*t*-test p-value
Male Physician	618	5.7 (21.7)	4.0 to 7.4	Ref.
Female Physician	1066	5.0 (15.5)	4.0 to 5.9	0.43

Table 7
Physician characteristics and call outcomes, physician availability study.

Attribute	Mean (SD)	N
Physician and caller characteristics		
Female Physician	0.355 (0.479)	11,006
Male Physician	0.645 (0.479)	11,006
Female Patient	0.505 (0.500)	11,006
Male Patient	0.495 (0.500)	11,006
Physician Age	52.4 (10.8)	11,006
Sample concordance		
Gender Concordance	0.502 (0.500)	11,006
Female Concordance	0.181 (0.385)	11,006
Male Concordance	0.321 (0.467)	11,006
Call outcomes		
Insurance Accepted[a]	0.607 (0.488)	11,006
No New Patients[b]	0.256 (0.436)	11,006
Appointment Offered[c]	0.488 (0.500)	11,006
Any Appointment Offered[d]	0.562 (0.496)	11,006
Wait Days Until Appointment[e]	28.5 (38.3)	5374
Appointment Duration[f]	40.0 (17.5)	4752

Notes.
[a] Information on insurance acceptance was not requested from physicians' offices that provided reasons unrelated to insurance for lack of appointment availability (e.g., not accepting new patients).
[b] Physician's office indicated that they are not accepting new patients at this time.
[c] Potential appointment date (or date range) offered with requested physician, and at least one plan of the patient's insurance type was accepted.
[d] Potential appointment date (or date range) offered with requested physician or alternate physician in the same practice, and at least one plan of the patient's insurance type was accepted.
[e] Determined based on the potential appointment date (or date range) offered for any appointment if one was offered.
[f] Amount of time the physician or alternate physician offered typically spends with patient for a physical exam. Not requested from physicians' offices that did not provide a potential appointment date or date range.

Table 8
Outcomes of calls to female physicians, physician availability study.

	Insurance Accepted	No New Patients	Requested Appt Offered	Any Appt Offered	Wait to Appt	Appt Duration
Female Physicians Overall	0.008, [−0.015, 0.030]	0.013, [−0.007, 0.034]	−0.004, [−0.026, 0.017]	0.017, [−0.006, 0.041]	7.112***, [5.127, 9.097]	1.038, [−0.505, 2.581]
p	0.48	0.19	0.68	0.13	<0.01	0.18
N	11,006	11,006	11,006	11,006	5374	4752

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. 95 % confidence intervals in brackets. Estimates generated using equation [2].

Table 9
Appointment availability by physician age and gender, physician availability study.

	Insurance Accepted	No New Patients	Requested Appt Offered	Any Appt Offered	Wait to Appt	Appt Duration
Female Physician	−0.015	0.020	−0.018	0.002	−2.72	−0.24
*Older Physician	[−0.045, 0.015]	[−0.016, 0.056]	[−0.041, 0.006]	[−0.024, 0.028]	[−7.73, 2.30]	[−1.61, 1.13]
p	0.32	0.25	0.14	0.90	0.27	0.72
Female Physician	0.014, [−0.016, 0.044]	0.005, [−0.024, 0.035]	0.003. [−0.021, 0.027]	0.017, [−0.010, 0.043]	8.19***, [5.09, 11.30]	1.13, [−0.62, 2.89]
p	0.34	0.72	0.80	0.20	<0.01	0.19
Older Physician	0.010, [−0.024, 0.044]	−0.027, [−0.062, 0.007]	0.017, [−0.019, 0.054]	0.003, [−0.041, 0.047]	3.84, [−1.26, 8.94]	−0.30, [−2.48, 1.89]
p	0.55	0.11	0.33	0.88	0.13	0.78
N	11,006	11,006	11,006	11,006	5374	4752

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. 95 % confidence intervals in brackets. Estimates generated using equation [2] with an indicator for "older physician", defined as those older than the median physician age of 52, and the interaction of this variable with the "female physician" variable.

Table 10
Outcomes of gender concordant calls to female physicians, physician availability study.

	Insurance Accepted	No New Patients	Requested Appt Offered	Any Appt Offered	Wait to Appt	Appt Duration
Female Concordance	−0.001, [−0.034, 0.031],	−0.003, [−0.016, 0.001],	−0.011, [−0.037, 0.016]	−0.012, [−0.044, 0.012]	−2.551*, [−5.298, 0.195]	−0.313, [−1.442, 0.815]
P	0.93	0.63	0.40	0.43	0.07	0.57
N	3907	3907	3907	3907	1804	1937

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. 95 % confidence intervals in brackets. Estimates generated using equation [2].

−0.069 to −0.014, $p < 0.01$) than Hispanic male patients to be offered their requested appointment with a female physician. Black female patients were 3.5 percentage points (95 % CI: −0.004 to 0.073, $p = 0.08$) more likely to be told that the physician was "not accepting new patients" and were offered appointments that were about 2.6 min shorter in duration (95 % CI: −4.8 to −0.4, $p = 0.02$) compared to Black male patients.

While there is no difference in access patterns for Hispanic and Black male patients seeking an appointment with a male physician, as can be seen in Table 14, there appears to be a male concordance detriment for White male patients. These patients were told that no new patients were being accepted 4.2 percentage points more often (95 % CI: 0.018 to 0.066, $p < 0.01$), offered any appointment 3.4 percentage points less often (95 % CI: −0.067 to −0.001, $p = 0.047$), and had to wait 6.0 days longer for their appointments (95 % CI: 1.5 to 10.4, $p = 0.012$) compared to White women.

Finally, we find that preferences for female physicians are positively associated with longer wait times for female physicians. Specifically, as shown in Fig. 2, state-level estimates for the difference in wait times for female versus male physicians and the preferences for female physicians have a slope estimate of 5.82 (95 % CI: 3.66 to 7.98, $p < 0.01$). This implies that going from a state with gender indifferent preferences to one with an 80 % preference for female physicians correlates with an increased wait time of 4.66 days for female physicians compared to male physicians.

5. Discussion

In the setting of our patient preferences field experiment, female patients expressed strong preferences for female physicians. Since male patients overall displayed no similar preference for gender-concordance, the female-concordant preferences register as an overall preference for female physicians in the pooled sample. Data from the physician availability experiment finds evidence that female physicians are indeed in higher demand relative to their supply and offer appointments further in the future. Within-race and ethnicity

Table 11
Outcomes of gender concordant calls to male physicians, physician availability study.

	Insurance Accepted	No New Patients	Requested Appt Offered	Any Appt Offered	Wait to Appt	Appt Duration
Male Concordance	−0.008, [−0.042, 0.027]	0.006, [−0.014, 0.025]	−0.009, [−0.041, 0.023]	−0.006, [−0.037, 0.025]	1.065, [−1.135, 3.265]	−0.267, [−1.625, 1.090]
P	0.65	0.55	0.57	0.69	0.32	0.68
N	7109	7109	7109	7109	3442	2953

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. 95 % confidence intervals in brackets. Estimates generated using equation [2].

Table 12
Outcomes of calls to female physicians, by patient race and ethnicity, physician availability study.

		Insurance Accepted	No New Patients	Requested Appt Offered	Any Appt Offered	Wait to Appt	Appt Duration
White	Female Physicians	0.023, [−0.017,	0.023, [−0.010,	0.006, [−0.034,	0.031, [−0.010,	3.366**, [0.108,	0.284, [−2.731,
	Overall	0.064]	0.056]	0.047]	0.072]	6.624]	3.298]
	P	0.25	0.16	0.76	0.14	0.04	0.85
	N	3740	3740	3740	3740	1875	1644
Hispanic	Female Physicians	0.019, [−0.014,	−0.006,	0.006, [−0.019,	0.021*,	11.197***, [7.183,	1.262, [−0.402,
	Overall	0.051]	[−0.042, 0.029]	0.031]	[−0.0001, 0.042]	15.211]	2.926]
	P	0.25	0.71	0.63	0.051	<0.01	0.13
	N	3560	3560	3560	3560	1720	1494
Black	Female Physicians	−0.016,	0.022, [−0.007,	−0.024, [−0.061,	−0.0002,	7.947***, [4.383,	2.156*,
	Overall	[−0.049, 0.018]	0.051]	0.013]	[−0.036, 0.036]	11.510]	[−0.218, 4.530]
	p	0.34	0.13	0.19	0.99	<0.01	0.07
	N	3706	3706	3706	3706	1779	1614

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. 95 % confidence intervals in brackets. Estimates generated using equation [2].

Table 13
Outcomes of gender concordant calls to female physicians, by patient race and ethnicity, physician availability study.

		Insurance Accepted	No New Patients	Requested Appt Offered	Any Appt Offered	Wait to Appt	Appt Duration
White	Female	0.050, [−0.018,	−0.014,	0.040, [−0.027,	0.035, [−0.026,	−3.288,	−0.135, [−3.338,
	Concordance	0.118]	[−0.060, 0.031]	0.107]	0.096]	[−13.160, 6.585]	3.068]
	p	0.14	0.51	0.23	0.24	0.49	0.93
	N	1268	1268	1268	1268	651	597
Hispanic	Female	−0.034,	−0.008,	−0.042***,	−0.032,	−0.545, [−9.634,	1.832, [−1.836,
	Concordance	[−0.075, 0.007]	[−0.053, 0.038]	[−0.069, −0.014]	[−0.072, 0.007]	8.544]	5.500]
	p	0.101	0.73	<0.01	0.103	0.90	0.31
	N	1304	1304	1304	1304	657	591
Black	Female	−0.011,	0.035*,	−0.035. [−0.077,	−0.032,	−1.109, [−7.018,	−2.603**,
	Concordance	[−0.060, 0.039]	[−0.004, 0.073]	0.008]	[−0.088, 0.025]	4.800]	[−4.764, −0.442]
	p	0.66	0.08	0.102	0.25	0.70	0.02
	N	1335	1335	1335	1335	629	616

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. 95 % confidence intervals in brackets. Estimates generated using equation [2]. Reference groups are male patients for each racial/ethnic group.

Table 14
Outcomes of gender concordant calls to male physicians, by patient race and ethnicity, physician availability study.

		Insurance Accepted	No New Patients	Requested Appt Offered	Any Appt Offered	Wait to Appt	Appt Duration
White	Male	−0.022, [−0.059,	0.042***, [0.018,	−0.028, [−0.069,	−0.034**, [−0.067,	5.979**, [1.510,	0.128, [−1.346,
	Concordance	0.015]	0.066]	0.014]	−0.001]	10.447]	1.602]
	p	0.23	<0.01	0.18	0.047	0.012	0.86
	N	2476	2476	2476	2476	1228	1051
Hispanic	Male	0.010, [−0.038,	−0.025, [−0.063,	0.017, [−0.034,	0.030, [−0.017,	−2.360,	0.802, [−3.247,
	Concordance	0.059]	0.014]	0.068]	0.078]	[−9.981, 5.261]	4.852]
	p	0.66	0.20	0.50	0.20	0.52	0.68
	N	2257	2257	2257	2257	1063	903
Black	Male	−0.010, [−0.056,	−0.010, [−0.039,	−0.008, [−0.044,	−0.005, [−0.047,	−1.067,	−1.572,
	Concordance	0.036]	0.018]	0.029]	0.037]	[−4.198, 2.064]	[−4.443, 1.299]
	p	0.65	0.47	0.65	0.80	0.48	0.27
	N	2376	2376	2376	2376	1151	999

Notes: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. 95 % confidence intervals in brackets. Estimates generated using equation [2]. Reference groups are female patients for each racial/ethnic group.

analyses suggest differences in female physicians' availability across patient gender. Hispanic female patients were less likely to be offered appointments compared to Hispanic male patients by female physicians' offices. Black female patients were more likely to be told that a female physician was not taking new patients compared to their male counterparts.

Other interesting findings include homogeneity in male concordant preferences regardless of race and ethnicity. That Hispanic female patients have relatively higher appointments offers but relatively longer wait times with a female physician illuminates a trade-off that requires further study. Finally, we find lower levels of access for White male patients with male physicians compared to White female patients. This finding is not replicated for Black and Hispanic men compared to their female counterparts, and also warrants

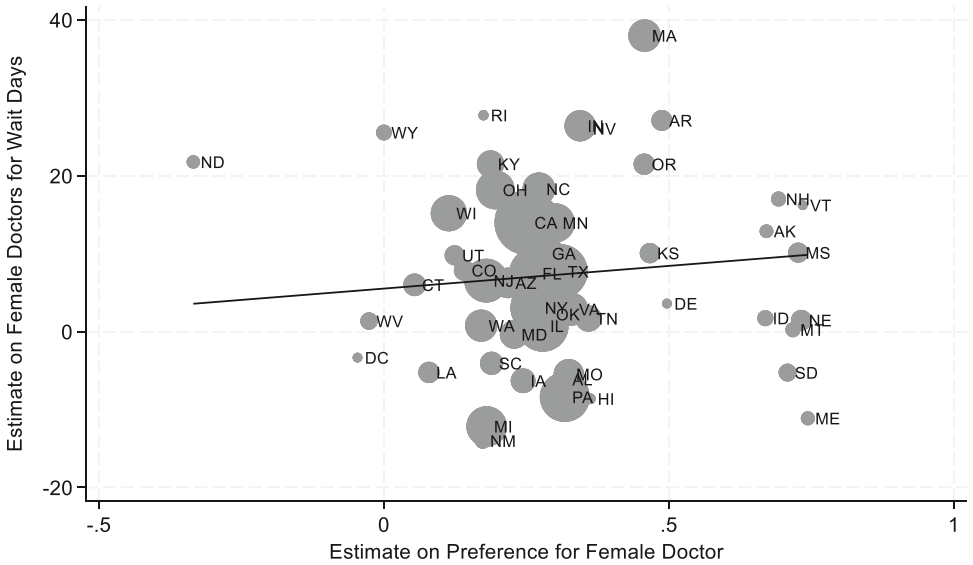

Fig. 2. Plot of state-level estimates for wait days and preferences for female physicians.
Notes: slope estimate is 5.82 (SE = 1.10; 95 % CI 3.66 - 7.98; and $p < 0.01$). Estimates for the Y and X axes were generated using variations of equations [1] and [2] in which state-level indicator variables were interacted with the respective treatment variables. Wyoming is omitted since there was insufficient sample. Analyses were weighted according to the number of observations in each state in the physician availability study.

further exploration.

More broadly, beyond providing quantitative measures of patient preferences and physician availability, this study also highlights important issues related to the relevance of patient preferences. Our work raises the policy questions of when and to what extent these preferences should be taken into consideration, including when recruiting physicians to work at hospitals and clinics. The ability of patients to act on their preferences is highly constrained by worsening physician shortages. On the demand side, by 2034, the population aged 65 and older is projected to grow by at least 42 percent (Institute of Medicine 2008; Petterson et al. 2012; Dall et al. 2013; Zhang et al. 2020). The aging population presents challenges for the primary care workforce as older Americans tend to be high utilizers of health services. In 2020, adults aged 65 and over were the smallest population group, about 17 % of the population, but accounted for approximately 37 % of all healthcare spending in the U.S. (Centers for Medicare and Medicaid Services 2020). On the supply side, the current shortage of primary care physicians in the United States is projected to continue, with a shortage of between 17,800 and 48,000 primary care physicians projected by 2034 (AAMC and IHS Markit Ltd 2021). Fueling the shortage on the supply side is that a large portion of the primary care physician workforce is nearing retirement age, potentially simultaneously shrinking the pool of available primary care physicians in practice overall and increasing the share of female physicians given that older physicians are disproportionately male (AAMC 2020).

5.1. Limitations

This study has several limitations. While the Lucid survey revealed important information about respondents' preferences given the choice between two physicians, in reality, patients face many options and the preferences that we isolated may be less salient in a natural search environment. It is possible that the physician audit study primarily captured the preferences of front office staff which may not necessarily be shared by the physician they represent. Finally, our results utilize self-reported gender identity from the patient survey and physician self-identified gender identity from the AMA Masterfile. The gender signals for their corresponding simulated physician and patient profiles were gender binary. Thus, these results may be limited in their application to populations whose gender identity falls outside the binary construct.

5.2. Conclusions

Our analyses suggest that prospective female patients strongly prefer female physicians, that female physicians are less available than male physicians, and that female patients do get earlier access to female physicians compared to male patients. While preferences are consistent across female patient race and ethnicity, access to scarce female physicians is mediated by race and ethnicity.

Declaration of competing interest

None.

Data availability

The data that has been used is confidential.

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APPENDIX

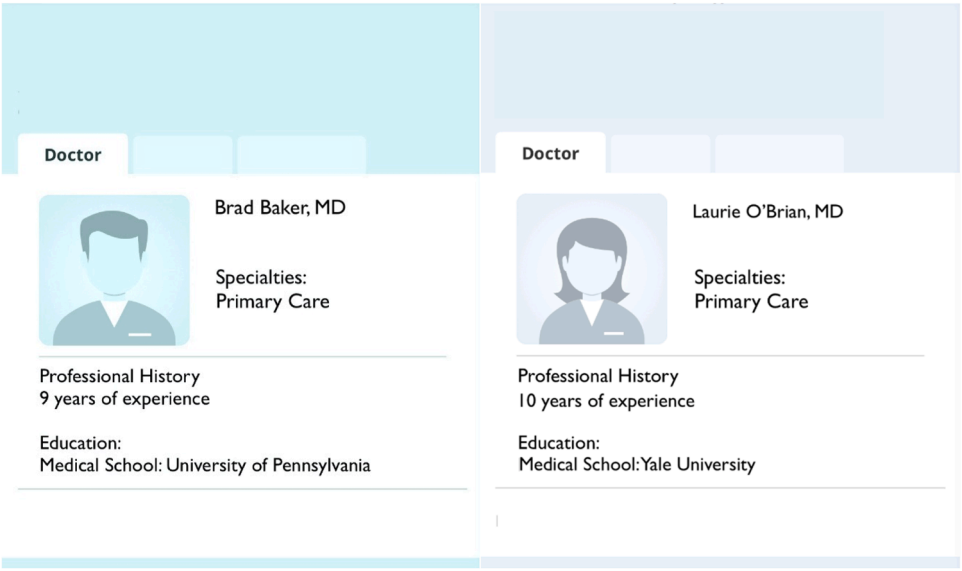

Fig. A1. Sample survey choice between providers of different gender.

Table A1
Survey questions.

Section	Question	Intention
Intro	We are researchers interested in the patient experience when seeking medical care. Your participation will take 5–10 min. Your honest feedback will help us to better understand the patient experience. All responses will remain anonymous. Thank you for your consideration. Click continue if you agree	To provide the respondent with the intention of the survey and to inform the respondent that the survey will be anonymous. To collect consent with proceeding with the survey.
1	Before we begin, we would like to make sure that you qualify for our study. Please indicate your age using only numbers: [free text, with <22 jumping to end]	Screener for age. Respondents will only be allowed to proceed with full survey if they are greater than 21 years old.
2	Please indicate the state in which you live: [drop down with states and "Outside the United States" option]	To identify which region the respondent lives in so we may account for differences in wait times based off geographic region.
3	Please indicate your sex: Male Female Nonbinary/gender fluid Other: [free text]	To see whether respondents choose doctors of their own sex.
4	Please indicate your race(s): Non-Hispanic White or Euro-American Black, Afro-Caribbean, or African American Latino or Hispanic American East Asian or Asian American South Asian or Indian American Middle Eastern or Arab American Native American or Alaskan Native Other	To see whether respondents choose doctors of their own race.

(*continued on next page*)

Table A1 (*continued*)

Section	Question	Intention
5	Do any of these describe you? Hispanic/Latinx None Prefer not to answer	To see whether respondents choose doctors of their own ethnicity.
6	*This survey is anonymous, and your response will be used to better understand the patient experience within the United States.* Please indicate your citizenship status within the United States.	To identify whether or not the respondent is a citizen of the United States so we may account for differences in wait times.
7	Which of the following insurance do you have? Private Medicare Medicaid Self-pay HIS Tricare VA Do not currently have medical insurance Other: [free text]	To identify what type of insurance the respondent so we may consider that a factor in time willing to wait.
8	In the past year, how many times did you schedule a primary care appointment? [free text]	To understand how many times the respondent has experienced the scenario in the past year.
9	Suppose you are experiencing a lot of pain in your lower stomach. The pain is dull and comes and goes. It has been about two weeks since the pain began and you need to schedule an appointment to see a primary care doctor. What are the features of a doctor that are most important to you? [free text]	Identify the respondents most desired features of a doctor at baseline.
10	How many days do you expect to wait until you see your doctor? [free text]	To collect the respondents baseline expectation for wait times when seeking a primary care appointment.
Section	Question	Intention
11	How many doctors will you call to get an appointment within an acceptable number of days? [free text]	To collect the respondents baseline expectation when contacting doctors.
12	If you are unable to get an appointment within an acceptable number of days, will you go to the emergency room? Yes No Other: [free text] *Survey programmed to jump to Question #13 or #14 using respondents answer for #12.	To see what the respondent will do if they are unable to see a primary care physician within the time they are willing to wait.
13	If yes, what is the maximum number of days that you are willing to wait for an appointment until you decide to go to the emergency room? [free text]	To understand how long the respondent will wait for an appointment before seeking emergent care.
14	If no, what is the maximum number of days that you are willing to wait until you decide to no longer seek any form of care? [free text]	To understand how long the respondent will wait before deciding not to seek any form of care.
15	Scenario: You are experiencing a lot of pain in your lower stomach. The pain is dull and comes and goes. It has been about two weeks since the pain began. Please review the following doctor profiles and indicate how you would proceed. We found two doctors (below) whose next available appointment is in 29 days. If you have to pick one, which doctor would you choose to schedule an appointment with? [option to click one or the other] *See Figure #1	Using this scenario, we will ask the respondents a series of questions about what they would do in the proposed situation. There will be two options of doctors and will vary based on age, education, race, and ethnicity. This question will force the respondents to choose one doctors before proceeding with the survey.
16	In the previous question you were required to choose a doctor to advance in the survey. If you were not required to pick one doctor, would you: Accept either doctor, Not accept either offer, Pick Doctor A over Doctor B, Pick Doctor B over Doctor A. *If respondent chooses answer 1 or answer 2, the survey will jump to question #18. If the respondent chooses answer 3 or 4, the survey will use this information in question 17.	To allow the respondents other choices that may be more representative of their action in this situation.
17	Given that you chose [insert answer from Q#16], how many days longer are you willing to wait for [insert answer from Q#16] over [insert other doctor]?	To see if the qualities of the doctor influence how long the respondents are willing to wait.
18	What did you notice about doctor #1? Race; Ethnicity; Sex; Age; Years of Experience; Country of Education	To see what the respondent noticed about the doctor. What stood out? What did they pick up on? Did the signaling work?
19	What did you notice about doctor #2? Race; Ethnicity; Sex; Age; Years of Experience; Country of Education	To see what the respondent noticed about the doctor. What stood out? What did they pick up on? Did the signaling work?
20	Thank you for participating in our survey. Your response will help us understand the patient experience when seeking primary care. Your reward will be delivered in X days.	To thank the respondent and tell them when they will receive their monetary compensation.

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