Determining the Extent of Statistical Discrimination: Evidence from a field experiment in India*

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Abstract

In order to determine the relative size of taste-based and statistical discrimination, we develop a simple model to distinguish these two theories. We then test the model’s predictions by conducting a field experiment that elicits patients’ rankings of physicians of different castes and years of experience in the healthcare market in India. We also run a survey and conduct a lab-in-the-field experiment to measure patients’ attitudes towards different caste groups. We find that 47 to 80 percent of patients statistically discriminate physicians. The overwhelming size of statistical discrimination has important implications for the use of affirmative action policies in India.

JEL: I15, J15, O12

Keywords: Field experiment, castes, statistical discrimination, taste-based discrimination, affirmative action, health.

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1 Introduction

The economics literature posits two major sources of discrimination: taste-based and statistical. The first is due to the fact that agents dislike some categories of the population while statistical discrimination occurs in an environment of imperfect information where agents form expectations based on limited signals that correlate with some observable characteristics. To empirically differentiate these two theories of discrimination is challenging because differential treatments across groups are often consistent with the predictions of both taste-based and statistical discrimination. Measuring the extent of statistical discrimination, in particular, is crucial as the prevalence of statistical discrimination has important implications for the use of affirmative action (AA) policies.

The aim of this paper is to provide a novel test that is able to disentangle statistical discrimination from taste-based discrimination. Using a correspondence method that elicits patients’ rankings of physicians of different castes and years of experience as well as a survey and a lab-in-the-field experiment, our research methodology enables us to provide a lower bound of the extent of caste-based statistical discrimination in India.

We develop a simple model where patients from different castes decide which doctor to visit. Doctors have two observable characteristics to the patients: their experience (number of years worked as a doctor) and their caste. Patients have preference for high quality (health) service, which is positively correlated with experience. We first develop this model under taste-based discrimination (Becker, 1957) where patients have homophily preferences, i.e., they always prefer a doctor from their own caste. As a result, when choosing a doctor, there will be a tradeoff between experience (high versus low) and the cost of choosing a doctor from a different caste (in-group versus out-group). Within this framework, four out of 24 (preference) rankings of doctors are possible under taste-based discrimination.

Within the same consumer preference relation framework, but without taste-based discrimination, we develop a model of statistical discrimination where the experience of a doctor is a noisy signal of the quality of the doctor (health service). The quality of the doctor and the noise of the signal (experience) follow a normal distribution that depend on the doctor’s caste. Each patient infers the expected quality of the doctor from the noisy signal using the available information by caste of the doctor. The choice of a doctor depends on the (perceived) caste-specific group average quality of the doctor, the caste-specific variance of the doctor’s quality, the caste-specific variance of the doctor’s experience, and the observed doctor’s experience. Within this framework, six out of 24 rankings of doctors are possible. Four of these six rankings overlap with those under taste-based discrimination, implying
that, in only two cases, we can differentiate the predictions of the two theories.

To test these theoretical predictions, we conduct a field experiment in 40 locations in Uttar Pradesh (UP) in India using a correspondence method that elicits 3,128 patients’ rankings of physicians of different castes and years of experience. We find that 33% of patients have rankings consistent with both taste-based and statistical discrimination of doctors while 47% of patients have rankings only consistent with statistical discrimination of doctors. The remaining 20% of patients behave according to neither theories. It may be because they do not discriminate at all or because they do not necessarily prefer doctors with more years of experience.

To account for the latter, we extend the theoretical model to incorporate the possibility that experience could be negatively correlated with quality.\(^1\) It is indeed possible that, in India, some patients prefer low-experience doctors because they have had lower quality service with high-experience doctors in the past than with low-experience doctors or because they believe that younger doctors are more qualified than older doctors. In this context, we show that, for the taste-based discrimination model, there are now eight possible rankings while, for the statistical discrimination model, all 24 rankings are possible. Thus, in 16 rankings, we can safely say that only statistical discrimination is at work. Using data from our field experiment to reassess the predictions, we find that 36% (instead of 33%) of patients have rankings consistent with both taste-based and statistical discrimination of doctors, while 64% (instead of 47%) of patients have rankings only consistent with statistical discrimination of doctors.

To further separate the rankings consistent with both theories of discrimination into either taste-based or statistical discrimination, we use two additional instruments and assume that taste is not context specific. First, we administer a survey to the same 3,128 patients immediately after the ranking exercise, asking them about their attitudes towards different caste groups. The survey reveals that patients display strong homophily behaviors since they exhibit more positive attitudes toward their own caste than towards the other caste. We use the relative attitudes toward different castes to classify whether a patient’s caste preference in the field experiment is consistent with the patient’s caste preference in the survey. For example, if a low-caste person prefers high-caste persons over low-caste ones, then this person cannot taste-based discriminate against a high-caste doctor in the field experiment (assuming taste is not context specific). We show that the percentage of statistical discriminators

\(^1\)In two robustness checks, we investigate the case where the 20% of patients who behave according to neither theories are assumed to be non-discriminators. We show that among the 80% of the patients who are discriminators, the majority are statistical discriminators.
increases to 70%, with the share of statistical discriminators increasing relatively more for high-caste patients than for low-caste patients.

Second, we select a representative subsample of 482 individuals to participate in a lab-in-the-field experiment and let them play four dictator games as an alternative method to distinguish taste-based and statistical discrimination. If a low-caste (high-caste) person gives more to a high-caste (low-caste) person than to a low-caste (high-caste) person in the lab-in-the-field experiment, after controlling for what this person would give to a person living above (below) the poverty line than to a person living below (above) the poverty line, then this person cannot taste-based discriminate against high-caste (low-caste) doctors in the field experiment. Using this approach to define taste-based discrimination, we find that the percentage of statistical discriminators increases to 80%.

Many papers have examined discrimination using laboratory experiments, field experiments, natural experiments, and non-experimental approaches. In particular, the correspondence method has been the primary approach used in recent studies to investigate discrimination in a variety of settings, including employment (Bertrand and Mullainathan 2004; Banerjee et al., 2009; Giulietti et al., 2019), housing (Ewens et al., 2014), product markets (Gneezy et al., 2012; Doleac and Stein 2013; Zussman, 2013), financial markets (Bayer et al., 2018), education (Hanna and Linden, 2012), and along different dimensions, including race, ethnicity, gender, age, disability, sexual orientation, obesity, caste, and religion.²

However, as noted by Kofi Charles and Guryan (2011) and Neumark (2018), few studies were able to empirically differentiate behaviors consistent with taste-based discrimination and statistical discrimination, and, when they do, it is implicitly done at the aggregate (group) level. We believe that, in this paper, we move the literature forward by proposing a more convincing test that allows us to empirically differentiate predictions of these theories at the individual level.

In particular, we have the following contributions to the literature on discrimination. First, we use correspondence methods to elicit (customer) discriminators’ rankings of service providers of different types in real transactions. The rankings elicited allow us to categorize responses that are consistent with both economic theories of discrimination and responses that are unique to statistical discrimination at the individual level. The technique of eliciting preference rankings was previously implemented in the laboratory setting to test theories

about self-regarding and other-regarding preferences (Levati et al., 2014) and correlated be-
liefs (Cason et al., 2017). To the best of our knowledge, this is the first time that this 
technique was implemented in a field setting and employed to examine the sources of dis-
crimination. Our approach allows us to circumvent an important shortcoming of past studies 
on discrimination in which the discriminator’s preference rankings over the choice set was un-
observed and enables us to determine an individual’s preference consistent with both theories 
of discrimination or only with statistical discrimination.

Second, because we use a correspondence method and observe the rankings of different 
types of individuals by different types of discriminators in the final decision stage of a trans-
action, we circumvent some of the common criticisms of correspondence studies (Guryan and 
Kofi Charles, 2013) where outcomes examined were often measured at a preliminary stage 
of a transaction, and characteristics of the decision-making discriminators were usually un-
observed or limited. Our setting of caste discrimination and the use of caste-based surnames 
also minimize a typical concern in most correspondence studies of racial discrimination done 
the labor and rental markets, where a fictitious applicant’s race is primarily signaled via 
the first name of the applicant: less-common names that may be more indicative of a person’s 
socio-economic background than the person’s race (Fryer and Levitt, 2004). In contrast, a 
caste-based surname is one of the defining features of a caste group, and the surnames that 
we use are common surnames that unequivocally reveal the castes of doctors.

Third, our field experiment involves randomly contacting households in each village or 
town to advertise for an upcoming free-of-charge health check service offered by a mobile 
clinic and asking the subjects to express their preference over four potential doctors listed on a 
sign-up sheet. In India, mobile medical units are a common practice in places where medical 
facilities are non-existent or inadequate, or in areas populated by low-income households 
(e.g., urban slums). Thus, the main advantage of our field experiment is that it occurred 
in a “natural” environment since people in these areas have used such services. It is also 
not unusual for patients to register their interest for an upcoming service and express their 
preference. We therefore believe that these individuals did not know that they were taking 
part in a caste discrimination study and they acted the way they normally would.

Finally, by using a survey and extending List’s (2004) incentivized method to collect 
measures of relative attitudes of discriminators towards different groups of individuals and 
combining the measures with inferences drawn about preferences in our field experiment, 
we can identify the minimum share of statistical discriminators and the maximum share of 
taste-based discriminators. This approach has never been implemented in the discrimination 
literature and demonstrates that the majority of discriminators in our setting statistically
This paper is closely related to past studies in the Indian context, which have shown significant socio-economic differences between low-caste and high-caste individuals. Some of these studies specifically examine the impacts of caste-based although affirmative action (AA) policies in addressing the problem. For example, Bertrand et al. (2010) find that, although AA policies in college admissions lead to higher earnings and greater job quality for lower-caste individuals, the income gains experienced by lower-caste individuals are smaller than income losses experienced by displaced upper-caste applicants. Similarly, Bagde et al. (2016) find that AA policies in college admissions improve educational outcomes of lower-caste students at the expense of higher-caste students. On the other hand, Frisancho and Krishna (2012) note that, under AA policies in higher education, lower-caste (Dalits) students perform poorly and do not catch up with students in other groups. Those enrolled in more selective majors through AA policies end up earning less than what they would have had they enrolled in a less selective major.

We believe that our results have important implications for the use of caste-based AA policies. Our results provide an empirical justification for the statistical discrimination assumption typically made in the related research on AA. Low-caste individuals in India benefit from AA, particularly in college admissions and job placement. As noticed by Deshpande (2016), there is considerable debate about whether caste is a valid indicator of disadvantages or whether AA policy in India should be defined in terms of class/income or other social markers, such as religion. Our findings that the majority of patients statistically discriminate against doctors, particularly doctors from a low-caste background, highlight the interconnection between caste-based AA policies and statistical discrimination. It also implies that much of the advancement in the literature on race-based AA policies in the United States can be used to examine caste-based AA policies in India.

The rest of the paper unfolds as follows. In Section 2, we develop our benchmark model by differentiating tasted-based discrimination (Section 2.1) and statistical discrimination (Section 2.2). In Section 3, we describe our experiment and the India context. In Section 4,
we provide our empirical results, testing the two benchmark models. In Section 5, we extend our model to incorporate the possibility of a negative correlation between experience and quality, provide some evidence on this, and, then, examine the model predictions. In Section 6, we refine the definition of (uniquely) statistical discriminators by first using information from a survey (Section 6.1) and then a lab-in-the-field experiment (Section 6.2). In Section 7, we first examine whether gender differences between doctors may influence our ranking and then perform different robustness checks. Finally, Section 8 concludes and offers some discussion and implications of this study.

2 The benchmark model

We outline the two major economic theories of discrimination and the respective theoretical predictions that we test in the field experiment. In order to match our field experiment, there are only two types of castes for both the doctors and the patients: the low and the high caste, and two different levels of (years of) experiences for the doctors: low and high. We denote the caste of a doctor by \( c = c_H, c_L \), where \( c_H \) corresponds to the high caste and \( c_L \) corresponds to the low caste, and the caste of a patient by \( c^p = c^p_H, c^p_L \) where the superscript \( p \) refers to the patient. We denote the experience of a doctor by \( e = e_H, e_L \), with \( e_H > e_L \).

2.1 Taste-based discrimination

According to Becker’s (1957) theory of taste-based discrimination, prejudiced employers (or workers or consumers) dislike employing (or working with, or purchasing from) people with certain observable traits (e.g., race, gender, caste, etc.).

Here, we model taste-based discrimination as a consumer choice problem. The patient/consumer chooses a doctor consumption bundle, \( x \), which contains both the closeness (\( \Phi \)) to the doctor’s caste group relative to the patient’s own caste group and the quality of health care (\( q \)) provided by the doctor, among the patient’s consumption set \( X \) of all possible doctors. We denote by \( \Phi(c^p, c) \), the closeness of a patient from caste \( c^p \) to a doctor from caste \( c \). Quite naturally, we assume that patients have a preference bias for own type or homophily (McPherson et al., 2001; Currrarini et al., 2009), so that, for a patient of a given caste, there is a cost of interacting with a doctor from a different caste. Thus, for a low-caste patient, we assume that \( \Phi(c^p_L, c_L) > \Phi(c^p_H, c_L) \), which means that the caste closeness to a low-caste doctor is higher than to that of a high-caste doctor. Likewise, for a high-caste patient, we assume that \( \Phi(c^p_H, c_L) < \Phi(c^p_H, c_L) \), i.e., the caste closeness to a high-caste doc-
tor is greater than that of a low-caste doctor. Furthermore, the quality of health care provided by a doctor is fully characterized by the years of experience $e$ the doctor has been practicing medicine. We assume that doctors with more years of experience provide higher quality health care, i.e., $q'(e) > 0$. A consumption bundle $x \in X$ is thus represented by a vector $x \in \mathbb{R}_+^2$.

We assume that patients’ preferences for doctors with various levels of caste closeness and health care quality satisfy five fundamental axioms of consumer choice: completeness, transitivity, continuity, strict monotonicity, and strict convexity. It follows that a patient’s preference relation between two doctors with different levels of caste closeness and health care quality can be represented by a real-valued utility function: $U : \mathbb{R}_+^2 \rightarrow \mathbb{R}$, such that $U(x^0) \geq U(x^1) \iff x^0 \succeq x^1$. We denote this utility function for a patient $c^p$ by: $U(\Phi(c^p, c), q)$.

### 2.1.1 Ranking from the perspective of a patient from a low caste $c^L_L$

On the basis of the axioms and assumptions of the consumer choice specified above for taste-based discriminators, we can provide the possible rankings for a low-caste patient $c^L_L$ given their choice set of doctors with two levels of experience $e_L$ and $e_H$ and two caste backgrounds $c_L$ and $c_H$. It should be clear that under the strict monotonicity axiom, for a low-caste patient, the best possibility is a doctor $c_L e_H$, i.e., a doctor from a low-caste group $c_L$ and with a high experience level $e_H$, because the caste closeness and the quality of this doctor are both the highest. For this patient, the worst possibility is a doctor $c_H e_L$, as the caste closeness and quality of the doctor are both the lowest. For a low-caste patient, there are two possible rankings of doctors that are compatible with this taste-based discrimination model:

$$c_L e_H \succ c_L e_L \succ c_H e_H \succ c_H e_L$$

$$c_L e_H \succ c_H e_H \succ c_L e_L \succ c_H e_L$$

Figure 1 illustrates these two possible rankings for a low-caste patient given an arbitrary utility function $U(\Phi(c^L_L, c), q)$ that satisfies the axioms and assumptions of consumer choice.

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6What matters to patients is not the experience of a doctor per se, but the quality of health care, such as the accuracy of diagnosis, the efficacy of the prescribed medicine, etc. provided by the doctor. For simplicity, we assume that the quality of health care can be fully described by the doctor’s experience in this taste-based discrimination model. In reality, patients may use experience as a noisy signal of quality to form a prediction about the quality of health care to be provided by the doctor. Indeed, patients may also use information about the doctor’s caste in forming this prediction. In order to put aside the possibility of statistical discrimination, we thus make this simplified assumption in our taste-based discrimination model.
specified above. Note that in the first ranking (panel A), the patient exhibits stronger preference for caste than for experience, while in the second ranking (panel B), the patient exhibits stronger preference for experience than for caste.\(^7\)

\[\text{[Insert Figure 1 here]}\]

2.1.2 Ranking from the perspective of a patient from a high caste \(c^p_H\)

Let us give the possible rankings for a high-caste patient whose preferences satisfy the axioms and assumptions of consumer choice specified above and who faces with the choice set of doctors with two levels of experience \(e_L\) and \(e_H\) and two caste backgrounds \(c_L\) and \(c_H\). It should be clear that under the strict monotonicity axiom, for a high-caste patient, the best possibility is a doctor \(c_H e_H\), i.e., a doctor from a high caste group \(c_H\) and with a high experience level \(e_H\), because the caste closeness and quality of this doctor are both the highest. For this patient, the worst possibility is a doctor \(c_L e_L\), as the caste closeness and quality of the doctor are both the lowest. Here are the possible rankings for high-caste patients:

\[
c_H e_H \succ c_H e_L \succ c_L e_H \succ c_L e_L
\]

\[
c_H e_H \succ c_L e_H \succ c_H e_L \succ c_L e_L
\]

Figure 2 illustrates these two possible rankings for a high-caste patient given an arbitrary utility function \(U(\Phi(c^p_H, c), q)\) that satisfies the axioms and assumptions of consumer choice specified above.\(^8\)

\[\text{[Insert Figure 2 here]}\]

Overall, in the taste-based discrimination case, there are 4 possible rankings compatible with preference relations that satisfy the five axioms of preference relation and assumptions about homophily preference and positive relation between quality and experience of a doctor.

\(^7\)The Online Appendix A.1.1 shows an example of an additively separable utility function (see (A.1)) that generates exactly these rankings for a low-caste patient.

\(^8\)The Online Appendix A.1.1 shows an example of an additively separable utility function (see (A.4)) that generates exactly these rankings for a high-caste patient.
2.2 Statistical discrimination

Phelps (1972) and Arrow (1973) pioneered statistical discrimination theory. The theory posits that, in the absence of direct information about quality, a decision maker would substitute group averages. For instance, labor market discrimination may exist because employers do not know with certainty workers’ productivity and, therefore, may base their employment decisions on the workers’ visible features, such as group identity or race, as long as these features correlate with the unobserved productivity. This type of discrimination can result in self-fulfilling behavior from the disadvantaged groups. For example, Verdier and Zenou (2004) show that, if all agents, including blacks themselves, believe with no reason that blacks are more criminal than whites, blacks can become more criminal than whites because, based on wrong beliefs, employers pay them less, which forces them to reside far away from job centres, which leads blacks to rationally commit more crime than whites.9

As in the case of taste-based discrimination, we assume that a statistically discriminating patient’s preference relations satisfy five fundamental axioms of consumer choice: completeness, transitivity, continuity, strict monotonicity, and strict convexity. This statistically discriminating patient in our experiment, however, does not have any distaste for a doctor from another caste group. She has only a preference for the quality of health care provided. Because the actual quality of health care, \( q \), to be delivered by a doctor is unobserved to the patient before the transaction takes place, she uses the information about the doctor’s caste, \( c \), and experience, \( e \), to form a prediction about this quality, \( \mathbb{E}(q \mid e, c) \). It is important to note that what matters to this patient is not the experience of a doctor per se but the quality of health care or treatment provided by the doctor. Her consumption bundle, \( x \), thus contains only the expected quality of health care, \( \mathbb{E}(q \mid e, c) \). The patient’s preference relation between two doctors is now represented by a real-valued utility function: \( U : \mathbb{R}_+ \to \mathbb{R} \), \( \forall x^0, x^1 \in \mathbb{R}_+ \), such that \( U(x^0) \geq U(x^1) \iff x^0 \succeq x^1 \).

Based on Phelps (1972) and Aigner and Cain (1977), we develop a model of statistical discrimination for our case. The experience \( e \) of a doctor from caste group \( c \) now provides a signal of the doctor’s quality \( q \) with an error (noise) \( \varepsilon \) so that:

\[
e = q + \varepsilon
\]

where \( \varepsilon \sim N(0, \sigma^2_{\varepsilon,c}) \) and \( q \sim N(\beta_c, \sigma^2_{q,c}) \). It is assumed that \( \text{Cov}(q, \varepsilon) = 0 \). Thus: \( \mathbb{E}(e) = \beta_c \) and \( \text{Var}(e) = \sigma^2_{q,c} + \sigma^2_{\varepsilon,c} \). Each patient infers the expected value of the doctor quality \( q \) from the noisy signal \( e \) (experience) using the available information, including the caste of the

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9For a substantive survey on the theory of statistical discrimination, see Fung and Moro (2011).
doctor $c$. In order to make his/her doctor choice, each individual forms $\mathbb{E}(q \mid e, c)$. Since $q$ and $e$ are jointly normally distributed, for each caste of doctor $c = c_L, c_H$, we have (DeGroot, 2004):

$$\hat{q}_c := \mathbb{E}(q_c \mid e_c) = (1 - \gamma_c) \beta_c + \gamma_c e_c$$

where $0 < \gamma_c < 1$ is given by:

$$\gamma_c = \frac{\sigma^2_{q,e}}{\sigma^2_{q,e} + \sigma^2_{\varepsilon, c}} = \frac{\text{Cov}(q_c, e_c)}{\text{Var}(e_c)}$$

where $\text{Cov}(q_c, e_c) > 0$, (i.e., experience is a signal of quality). In other words, for a given caste of doctor, $c$, a doctor with higher experience is perceived to be providing a higher quality health service. Equation (2) says that $\hat{q}_c := \mathbb{E}(q_c \mid e_c)$, the conditional distribution of $q_c$ given $e_c$, follows a normal distribution with mean equal to a weighted average of the signal $e_c$ and the unconditional group mean $\beta_c$. If the signal $e_c$ is very noisy, i.e., $\sigma^2_{\varepsilon, c}$, the variance of $\varepsilon$ is very high, the expected conditional value of doctor’s quality is close to $\beta_c$, the population average, regardless of the signal’s value. On the other hand, if the signal is very precise, i.e., $\sigma^2_{\varepsilon, c}$ close to zero, then the signal $e_c$ provides an accurate estimate of the doctor’s quality. In some sense, $\gamma_c$ can be interpreted as the “reliability” of the signal since the higher is $\gamma_c$, the less noisy and thus the more precise is the signal $e_c$.

The choice of a doctor from a patient of caste $c$ will depend on these different aspects of the model, in particular, on $\gamma_c$, the “reliability” of the signal, the average doctor’s experience of the caste $c$, $\mathbb{E}(e_c) = \beta_c$, and the signal $e_c$.

Different cases may arise. For example, assume that the unconditional distribution of doctor qualities are the same between the two castes, i.e., $\beta_{c_H} = \beta_{c_L}$ and $\sigma^2_{q,c_H} = \sigma^2_{q,c_L}$ but the signals patients receive are differently informative, i.e., $\sigma^2_{\varepsilon,c_L} > \sigma^2_{\varepsilon,c_H}$. This means that $\gamma_{c_H} > \gamma_{c_L}$ so that the signal about a doctor’s experience is noisier and less precise for the lower caste $c_L$ than for the higher caste $c_H$. In that case, doctors from a lower caste with high signals (high experience) are less preferred to same-signal doctors from the higher caste, and the opposite occurs to doctors with low signals.

Let us now study the patient’s decision in terms of doctor’s choice. Contrary to the taste-based discrimination, we do not need to differentiate a patient from a low caste and a patient from a high caste since there is no direct cost of interacting with someone from a different caste. The only difference that may matter is the fact that low-caste patients may hold different beliefs than high-caste patients. We are agnostic about how the differences in their beliefs may arise. One can image that everyone starts with a common prior about the
quality of doctor from various caste groups but their different experiences over their lifetimes with different types of doctors lead to hold different posterior beliefs. In other words, their beliefs are shaped by the draws of doctors they have encountered. For now, we assume that \( Cov(q_c, e_c) > 0 \) to allow comparisons with the predictions of taste-based discrimination. We will relax this assumption in Section 5.1.

What kind of ranking can we have for a patient who behaves according to this statistical discrimination model? First, we can have the same rankings as in the taste-based discrimination, i.e.,

\[
\begin{align*}
&c_L e_H > c_L e_L > c_H e_H > c_H e_L \\
&c_L e_H > c_H e_H > c_L e_L > c_H e_L
\end{align*}
\]

Indeed, for a low-caste or high-caste patient, \( c_L e_H > c_L e_L \) and \( c_H e_H > c_H e_L \) are always true since, for two doctors of the same caste, a high-experience doctor is always preferred to a low-experience doctor given that \( 0 < \gamma_c < 1 \). What about \( c_L e_L > c_H e_H \)? This preference relation is true if

\[
\beta_{c_H} - \beta_{c_L} < \gamma_{c_H} (\beta_{c_H} - e_H) - \gamma_{c_L} (\beta_{c_L} - e_L)
\]

This is clearly possible under statistical discrimination. For example, if \( \beta_{c_H} = \beta_{c_L} = \beta \) (the expected experience of a doctor is the same independent of caste), then it suffices that \( \gamma_{c_H} < \gamma_{c_L} \) (either the covariance \( Cov(q, e) \) is lower or the variance \( Var(e) \) is lower for high-caste doctors). The other ranking given by

\[
c_L e_H > c_H e_H > c_L e_L > c_H e_L
\]

is also possible. Indeed, for \( c_H e_H > c_L e_L \) to be true, it has to be that:

\[
\beta_{c_H} - \beta_{c_L} > \gamma_{c_H} (\beta_{c_H} - e_H) - \gamma_{c_L} (\beta_{c_L} - e_L)
\]

Again, this is possible under statistical discrimination.

In fact, under statistical discrimination, it is easily verified that there are exactly six possible rankings with two castes and two experience levels that are compatible with (1), the assumption that \( Cov(q_c, e_c) > 0 \), and the five axioms of consumer choice. All the rankings

\[10\text{ Bohren et al. (forthcoming) examine whether such beliefs get updated as new information arrives in the context of gender discrimination in online evaluations of user-generated content. They find that without prior evaluations, women face significant discrimination, but the direction of discrimination reverses following a sequence of positive evaluations.}\]
that have \(c_L e_L \succ c_L e_H\) or \(c_H e_L \succ c_H e_H\) are not possible because signals are informative and \(\text{Cov}(q_c, e_c) > 0\). These six rankings are:

\[
\begin{align*}
    c_H e_H & \succ c_H e_L \succ c_L e_H \succ c_L e_L \\
    c_H e_H & \succ c_L e_H \succ c_H e_L \succ c_L e_L \\
    c_L e_H & \succ c_H e_H \succ c_L e_L \succ c_H e_L \\
    c_L e_H & \succ c_L e_L \succ c_H e_H \succ c_H e_L \\
    c_L e_H & \succ c_L e_H \succ c_L e_L \succ c_H e_L \\
    c_L e_H & \succ c_H e_H \succ c_H e_L \succ c_L e_L
\end{align*}
\]

Figure 3 illustrates these six rankings. Panels (A)-(B) show rankings identical to those in Figure 1, panels (C)-(D) show rankings identical to those in Figure 2, and panels (E)-(F) show the last two rankings that are consistent with only statistical discrimination.

[Insert Figure 3 here]

3  Context and experimental design

In this section, we first provide some background on the caste system in India and the policies that have been in place to overcome discrimination against low-caste individuals. Then, we explain the way we implemented our correspondence study.

3.1  Caste discrimination and affirmative action policies in India

The caste system in India played an important role in ancient Hindu tradition. The term \textit{caste} originated from the Iberian word \textit{Casta}, which means “lineage” or “breed.” Most Indians use the terms “Varna” and “Jat” when referring to caste. The caste system divides Hindus into four main categories (Varna) – Brahmins, Kshatriyas, Vaishyas, and Shudras. At the top of the hierarchy are the Brahmins, who were priests, teachers and intellectuals. The next category is the Kshatriyas, who were rulers and aristocrats of the society. The third category encompasses traders, landlords, farmers, and businessmen. The bottom category is the Shudras, who were peasants and working class of the society. Below these castes are the outcasts who are untouchable to these four castes and who call themselves Dalit. These untouchables worked in degrading jobs, such as cleaning, sewage, etc.
The first three castes had social and economic rights, which the Shudras and the untouchables did not have, and were classified as high caste. The lower classes were listed in three categories: (1) Scheduled Castes (SCs) who were untouchables; (2) Scheduled Tribes (STs) who did not accept the caste system and preferred to reside in the forests and mountains; and, (3) Other Backward Classes (OBCs), which include Shudras, untouchables who converted from Hinduism to other religions, nomads and tribes who made a living from criminal acts.

For centuries, caste dictated almost every aspect of Hindu religious and social life. Rural communities were long divided on the basis of caste—the upper and lower castes almost always lived in segregated colonies. Brahmins did not share water wells with them, neither did they accept food nor drink and married only within one’s caste. Traditionally, the system bestowed many privileges on the upper castes while sanctioning repression of the lower castes by privileged groups. In recent decades, the influence of caste has somewhat declined, especially in cities where different castes live side-by-side and inter-caste marriages are becoming more common. Despite the changes though, caste identities remain strong, and surnames are almost always indications to which caste a person belongs. There is also evidence suggesting that the lowest-caste groups continue to face stigmatization, exclusion and rejection (Shah et al., 2006; Navsarjan, 2010).

After independence of India, discriminating a person based on his or her caste was legally forbidden. Affirmative action (AA) policies (known as the “reservation” policy in India) were launched in 1950 to promote equal opportunity to the SCs and STs in areas of employment, education, and politics (Deshpande, 2012). The Ministry of Education, in 1954, suggested a 20% quota (“reservation”) for SCs and STs in educational institutions. In 1982, 15% and 7.5% of vacancies were specified to be reserved for SC and ST candidates, respectively.

Although Islam does not recognize any castes, Muslim communities in India apply a comparable caste system of social stratification, and they differ widely in power, privilege, and wealth. Thus, the low-class Muslims in India have faced similar discrimination as low-caste Hindus. The upper-class Muslims dominated government jobs and parliamentary representation. As a result, there have been campaigns to include the Muslim untouchables and lower castes among the groups eligible for affirmative action programs in India under SC and STs provision act. There have also been cases, for example, in the Bihar state of India, reported in which the higher-caste Muslims have opposed the burials of lower-caste Muslims in the same graveyard. In UP, Muslims are divided into 68 castes and sub-castes: 35 of them are OBCs.

in public sector jobs and admission into higher public educational organizations, including medical schools. In addition, in the late 1980s, a commission of inquiry (known as the “Mondal Commission”), recommended a 27% quota reserved for OBCs.\textsuperscript{13} Candidates from SCs, STs, and OBCs have to take entrance examinations for educational institutions, but they compete only among themselves to fill the allocated number of reserved seats, which are not available to candidates from other backgrounds. The admission requirement is also lower for these lower-caste groups. For example, for admission to the undergraduate level in a public medical college, a candidate must pass with minimum of 50% marks. However, for candidates belonging to SC/ST/OBC, the threshold is 40% instead of 50%.

3.2 The field experiment

We conducted a field experiment to test for the presence and sources of caste discrimination in the demand for health care in the Kanpur Nagar district of Uttar Pradesh (UP), India. UP is the most populous state in India with a population of about 225 million. UP has the largest concentration of lower-caste people in India. Caste-based issues and policies have historically dominated the state’s politics. The Kanpur Nagar district has a total population of around 4.6 million people as per the 2011 Census, with 1.6 million people living in rural areas and 3 million people living in urban area (Population Census, 2011). The sex ratio is 862 females per 1000 males. Figure B.1 in the Online Appendix B shows the location of the Kanpur Nagar district in the state of UP.

Similar to Section 3.1, our experiment considers different castes for both patients and doctors: high-caste individuals are those who belong to the general-category (GC) caste while low-caste persons are those who belong to either a Scheduled Caste (SC), a Scheduled Tribe (ST), or an Other Backward Caste (OBC). The field experiment took place in 40 areas across the Kanpur Nagar district between August and October of 2017. Figure B.2 in the Online Appendix B shows the locations where the experiment was conducted. The selected locations have demographic characteristics that are representative of the overall demographic characteristics of the state of UP. A total of 3,128 individuals participated in the field experiment.\textsuperscript{14}

\textsuperscript{13}In 1992, the Supreme Court of India put a cap on reservation and ruled that reservations should not exceed 50%. The exact percentages of reservation vary from state to state. In 2017, the new state government in UP declared that caste-based reservations in private medical and dental colleges will cease to exist. However, the quota for lower-caste groups remained at 49% (SC-21%; ST-1% ; and OBC-27%).

\textsuperscript{14}Table 1 below shows that the characteristics of our sampled individuals are on average statistically similar to the demographic and social economic characteristics of individuals in Uttar Pradesh.
We implemented the field experiment in four stages. In the first stage, subjects registered interests and expressed preference for different types of doctors presented to them. In the second stage, subjects answered a short survey questionnaire. In the third stage, subjects were assigned to doctors and appointments. In the fourth stage, subjects received services.

In the first stage, we randomly approached households in each locality to advertise for an upcoming, free-of-charge health check service offered by a mobile clinic. Due to safety and ethical concerns, individuals with potential urgent and life-threatening diseases or injuries were advised to seek immediate medical attention at the local hospital, instead of waiting for the upcoming health check.

At the point of registration, we requested subjects to express their preference over four potential doctors listed on a sign-up sheet. The sign-up sheet showed a two-by-two matrix containing the information for four different doctors: (i) a doctor with a high-caste surname and a high number of years of experience \( c_{H}e_{H} \); (ii) a doctor with a low-caste surname and a high number of years of experience \( c_{L}e_{H} \); (iii) a doctor with a high-caste surname and a low number of years of experience \( c_{H}e_{L} \); and (iv) a doctor with a low-caste surname and a low number of years of experience \( c_{L}e_{L} \). The high-caste surname that appears on the sign-up sheet belongs to the general-category (GC) caste. The low-caste surname that appears on the sign-up sheet is either an SC or ST or OBC surname but never both. Similarly, the high number of years of experience is either 12 years or 8 years but never both. The low number of years of experience is always 4 years. We do not disclose the first name of the doctor but only the initial, and we randomize the order in which each type of doctor appears in the matrix.

We instructed subjects to rank these doctors from the most desired (rank 1) to the least desired (rank 4), without the possibility of an equal rank. We explained to the subjects that they had the highest chance of getting their rank-one doctor, the second highest chance of getting their rank-two doctor, the third highest chance of getting their rank-three doctor, and the lowest chance of getting their rank-four doctor.

Once we elicited subjects’ rankings of the four doctors, we invited them to fill out a short survey that asked questions about their demographic and socio-economic information.

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\(^{15}\)In India, mobile medical units have been introduced into service to provide primary medical care to people living in remote areas in India where medical facilities are non-existent or inadequate. The mobile units typically offer low-cost services from doctors and paramedics, and also medicine.

\(^{16}\)The sign-up sheet also indicated that, in case the subject was not assigned to any of the listed doctors, an alternative doctor would be provided.

\(^{17}\)The high-caste surnames used were: Bajpai, Dixit, Mishra, Pandey. The low-caste surnames used were: Katiyar, Pal, Rajput, Yadav, Kanauiya, Kureel, Sonkar, and Valmiki.
such as their own caste, poverty status, education level, and so on. The short survey also includes questions about their past experience related to health services, their attitudes toward individuals of different castes, their risk attitudes, etc. By surveying them after the elicitation exercise, we minimized any potential priming effect. The correspondence study effectively concluded by the end of stage two.

In stage three, we informed the subject about the doctor they were assigned to and the location and time of their upcoming health-check appointment. This stage typically occurred on the day after registration. In stage four, the mobile clinic arrived in the village to deliver service. The mobile clinic delivered the service within one week of registration.

Table 1 provides summary statistics of the 3,128 participants in the field experiment. The respondent’s caste composition is as follows: 836 GC, 739 SC, 12 ST, and 1541 OBCs, which means that roughly 27 percent of participants are from a high-caste (GC) background and the rest from a low-caste background. The mean age of participants is 38. 80% of the participants are Hindu and 51% of the participants are male. 2,049 (65.5%) participants reside in a rural area. Roughly 34% of participants live below the poverty line and roughly 11% of participants have at least some college education. Low-caste participants are more likely to live in urban areas (36% as opposed to 31%), live below the poverty line (37% as opposed to 31%), and have not attended college before (91% as opposed to 83%). Thus, low-caste participants are more likely to come from a low, socio-economic background. We also see in Table 1 that the observable characteristics of our 3,128 individuals are similar to that of the population in UP where the experiment was conducted.

[Insert Table 1 here]

4 First results

4.1 Evidence of caste discrimination

Figure 4 presents the average ranks for the four doctors, pooling the responses of all patients. On average, high-caste, high-experience (HH) doctors are ranked highest (mean of the rank = 1.77), followed by low-caste, high-experience (LH) doctors (mean = 1.85), high-caste, low-experience (HL) doctors (mean = 3.11), and low-caste, low-experience (LL) doctors (mean = 3.27). The differences in average ranks are all statistically different at the 5% level, with the exception of high-caste, high-experience (HH) doctors and low-caste, high-experience (LH) doctors where the difference in average ranks is statistically different at the 10% level. For two doctors from different castes but with the same years of experience, the
high-caste doctor is better ranked than the low-caste doctor, especially for low-experienced doctors. Thus, Figure 4 shows that patients in our experiment discriminate against low-caste doctors. Indeed, if there were no discrimination, for the same experience level, there should not be any difference between high- and low-caste doctors. Figure 4 also shows that, on average, patients tend to prefer doctors with more years of experience.

Figure 5 reports the average rank for the four different types of doctors by the caste of patient. In panel (A), we see that, for high-caste patients, on average, experience matters relatively more than caste while they exhibit in-group preference. High-caste patients prefer a high-caste doctor to a low-caste doctor if the two have the same years of experience, and they also prefer a high-experience doctor to a low-experience doctor if the two are from the same caste. These differences are statistically significant at the 5% level. However, high-caste patients are, on average, willing to trade caste for experience. They prefer a low-caste doctor with high experience (LH in the figure) than a high-caste doctor with low experience (HL). Similarly, in panel (B), for low-caste patients, we also see that the experience of the doctor matters relatively more than caste while they exhibit in-group preference. They prefer a low-caste doctor to a high-caste doctor if the two have the same years of experience. However, for low-caste patients, the gap in terms of ranking between low- and high-caste doctors for each experience level is much smaller than for high-caste patients.

Overall, there is evidence of discrimination against low-caste physicians, especially for those who have low experience, but, at this stage, it is unclear whether the discrimination is the result of taste-based discrimination, statistical discrimination, or both. This is what we will investigate next.

4.2 Rankings consistent with each theory of discrimination when experience is positively correlated with quality

In the benchmark model (Section 2), we show that, under taste-based discrimination, there are four possibilities of ranking of doctors: two from low-caste patients and two from high-caste patients. Under statistical discrimination, we show that six different rankings of doctors

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18 The significant differences also mean that by not offering patients the possibility to rank doctors equally is not a major concern. Otherwise, the differences would not be statistically significant.
are possible independent of the caste of the doctors. We can distinguish between these two theories when patients rank doctors as follows:

\[ c_{H}e_{H} \succ c_{L}e_{H} \succ c_{L}e_{L} \succ c_{H}e_{L} \]  
\[ (3) \]

\[ c_{L}e_{H} \succ c_{H}e_{H} \succ c_{H}e_{L} \succ c_{L}e_{L} \]  
\[ (4) \]

In that case, we know that these patients statistically discriminate doctors. Indeed, the first ranking (3) cannot be compatible with the strict monotonicity axiom and homophily assumption because a high-caste patient cannot have \( c_{L}e_{L} \succ c_{H}e_{L} \) since, at the same level of experience, he/she always prefers a high-caste doctor, and a low-caste patient cannot have \( c_{H}e_{H} \succ c_{L}e_{H} \) since, at the same level of experience, he/she always prefers a low-caste doctor. Also, the second ranking (4) cannot occur under taste-based discrimination because a high-caste patient cannot have \( c_{L}e_{H} \succ c_{H}e_{H} \) since, at the same level of experience, he/she always prefers a high-caste doctor, and a low-caste patient cannot have \( c_{H}e_{L} \succ c_{L}e_{L} \) since, at the same level of experience, he/she always prefers a low-caste doctor. These two rankings (3) and (4) can, however, arise under statistical discrimination depending on the beliefs people hold of high- and low-caste doctors. For example, at the same experience level, a low-caste patient can choose \( c_{H}e_{H} \succ c_{L}e_{H} \) if \( \beta_{H} > \beta_{L} \) and/or \( \sigma_{\varepsilon,H}^{2} < \sigma_{\varepsilon,L}^{2} \) (noisier signals for low-caste doctors).

We now examine the distribution of the various rankings in our experiments. In Figure 6a, we look at the distribution of rankings by high-caste patients while, in Figure 6b, we focus on that by low-caste patients. In panel (A) of both figures, we see that, in our experiments, some patients rank doctors in ways that are consistent with both taste-based and statistical discrimination while others are only consistent with statistical discrimination (by ranking doctors as in (3) and (4)). More importantly, in panel (B) of Figures 6a and 6b, we see that some patients do not behave according to either the taste-based or statistical discrimination models.

[Insert Figures 6a and 6b here]

In Figure 6c, we quantify these types of rankings by caste of patients. We see that, on average, 40% of high-caste patients have rankings of doctors consistent with both taste-based and statistical discrimination while 37% have rankings of doctors only consistent with statistical discrimination. For low-caste patients, these numbers are 31% and 51%, respectively. Interestingly, 24% of high-caste patients and 19% of low-caste patients do not have preference according to either the taste-based or statistical discrimination model.
Figure 6d offers a similar exercise but does not distinguish patients by caste. We find that 33% of patients both taste-based and statistically discriminate doctors, while 47% only statistically discriminate doctors and 20% do not behave according to either the taste-based or statistical discrimination models.

More generally, we see that a sizable fraction of patients (20%) do not seem to behave according to our model. One possibility is that they do not discriminate at all. Another one is that they do not necessarily prefer doctors with more years of experience. We investigate the former in a robustness check (Section 7.4) while we study the latter in the next sections because we have evidence of discrimination in Figures 4 and 5.

5 Experience may be negatively correlated with quality

The 20% of patients whose rankings of doctors that are consistent with neither taste-based nor statistical discrimination may choose less-experienced doctors over more-experienced doctors when the two doctors were from the same caste. To encompass the rankings of doctors by these 20% of patients, we will need to relax the assumption that quality increases with years of experience of doctor in the benchmark model. We first provide some evidence that, indeed, some patients may prefer less-experienced doctors.

It may be possible that some patients prefer lower experience doctors because they believe that they are younger and, therefore, more effective in treating them. Let us check if this is true for the 20% of patients whose rankings of doctors are consistent with neither taste-based nor statistical discrimination. Among these patients, we will compare their ranking when they can choose between two doctors whose experience gap is four years (four versus eight years) and when this gap is eight years (four versus 12 years). If younger doctors with lower experience are preferred to older doctors with more experience, then there should be more of the latter than the former.

Figure 7 shows that the share of patients whose rankings of doctors that are consistent with neither taste-based nor statistical discrimination increases when patients have to choose
between doctors with four years and twelve years of experience (right panel) and between four years and eight years of experience (left panel). In other words, when the gap in experience is greater (eight years), there are more patients belonging to the category “neither” than when the difference is only four years. Thus, it seems that the reason for some patients to prefer doctors with fewer years of experience is because they believe they are younger and more effective in treating them.

[Insert Figure 7 here]

5.1 Extending the model
We now extend our model to encompass those rankings in which doctors with fewer years of experience are preferred over those with more years of experience.

5.1.1 Taste-based discrimination
We now assume that there are two-types of patients in each caste $c^p = c^p_L, c^p_H$: those for which $q'(e) > 0$ (as before) and those for which $q'(e) < 0$. A way to justify this last assumption is that, in India, some people may prefer younger than older doctors even if the former have less experience than the latter. They may believe that younger doctors provide better quality service as they have received more up-to-date training than older doctors. Another way to justify this assumption is that some people may have had lower-quality service with high-experience doctors in the past than with low-experience doctors and thus may believe that $q'(e) < 0$.

The preference relations of a low-caste patient $c_L$ and a high-caste patients $c_H$ are still the same as in Section 2.1, but for some patients, $q'(e) > 0$, while for other patients, $q'(e) < 0$. Instead of two, there are now four possible rankings for each caste of patients that are compatible with the five axioms of preference relation and assumptions about homophily preference. These eight possible rankings that are consistent with taste-based discrimination are provided in the Online Appendix A.2.1.

5.1.2 Statistical discrimination
Assume the same statistical discrimination model as in Section 2.2. Now, assume that both $Cov(q_c, e_c) > 0$ (as before) and $Cov(q_c, e_c) < 0$ are possible. As above, some people may have

\[\text{Indeed, discussions with many participants who ranked less-experienced doctors higher within their own caste also indicate that these individuals generally believe younger doctors are better trained and equipped with better know-how, and they are more likely to prescribe more efficacious medicines.}\]
had lower-quality service with high-experience doctors in the past than with low-experience
doctors, for doctors from caste group $c$. The experience may then lead to the belief that $\text{Cov}(q_c, e_c) < 0$. In that case, it is easily verified that, contrary to Section 2.2, there will
not only be six possible rankings but 24 rankings, which are listed in the Online Appendix
A.2.2. Therefore, there will be 16 (and not two as above) rankings that are compatible only
with statistical discrimination.

5.2 Refining empirical results

We now implement the same exercise as in Figures 6a, 6b, 6c, and 6d but with our new model,
which offers more ranking possibilities (eight instead of four for rankings compatible with
both taste-based and statistical discrimination and 24 instead of six for rankings compatible
with statistical discrimination). In Figure 8a, we look at the choices of high-caste patients
while, in Figure 8b, we focus on low-caste patients. On the left-hand side of each figure, we
have the four cases ($\times 2$) of taste-based and statistical discrimination together, and, on the
right-hand side, we have the 16 cases of only statistical discrimination.

If we compare panels (A) and (B) of both figures, we see that many patients behave
according to both theories, but a substantial part of them, behave according to only statistical
discrimination. In that case, high-caste patients tend to rank higher high-caste doctors
(panel (B) in Figure 8a) while this is less true for low-caste patients (panel (B) in Figure
8b). Moreover, compared to Figures 6a and 6b, the picture is very different, meaning that
many patients believe that experience is not necessary positively correlated with quality.

[Insert Figures 8a and 8b here]

If we now look at Figure 8c, we see that 56% of high-caste patients (compared to 37% in
Figure 6c) statistically discriminate doctors while, for low-caste patients, it is 67% (compared
to 51% in Figure 6c). This confirms the fact that low-caste patients statistically discriminate
doctors more than high-caste patients.

[Insert Figure 8c]

Finally, Figure 8d provides a more general picture of discrimination. We see that 36%
(instead of 33% in Figure 6d) of patients both taste-based and statistically discriminate
doctors while 64% (instead of 47%) only statistical discriminate doctors. It seems that the
20% of patients that did not behave according to neither the taste-based nor the statistical
discrimination theories in Figure 6d are now behaving only as statistical discriminators.
It means that these individuals must believe or have preferences such that experience is negatively correlated with quality.

[Insert Figure 8d]

6 Refining the definition of statistical discriminators

6.1 Survey in the field

We are interested in knowing whether patients whose rankings are shown to be consistent with both theories of taste-based and statistical discrimination in the previous section can be further separated into those that are consistent with only statistical discrimination. To do so, we use information we collected through a survey administered to the 3,128 patients after the ranking exercise.

6.1.1 Description of the survey

In addition to the demographic information reported in Table 1, we asked the patients in our field experiment whether they “strongly disagreed,” “disagreed,” “neither disagreed nor agreed,” “agreed,” or “strongly agreed” with a set of statements about their attitudes toward different caste groups. Four of these attitude questions are useful for us to identify the relative taste each individual has for high-caste and low-caste persons. These four questions are as follows: (i) “It really upsets me if anyone says anything negative about people from Backward Caste”; (ii) “I have very positive attitudes towards people from Backward Caste”; (iii) “It really upsets me if anyone says anything negative about people from General Caste”; (iv) “I have very positive attitudes towards people from General Caste”. We code “strongly disagree” as 1 point, “disagree” as 2 points, “neither disagree nor agree” as 3 points, “agree” as 4 points, and “strongly agree” as 5 points. We then compute the total points for the first two questions (i) and (ii) (this score is denoted by $S_{cL}^p$), which measures a person’s taste towards low-caste individuals, and the total points for the last two questions, (iii) and (iv), which measures the person’s taste towards high-caste individuals (this score is denoted by $S_{cH}^p$).

Figure 9 reports the mean values of these answers by the caste of patients. The top panel shows that high-caste patients tend to have more positive attitudes towards high-caste than low-caste persons. The bottom panel shows that low-caste patients tend to have more positive attitudes towards low-caste than high-caste persons. Figure 9 also shows that these
relatively stronger attitudes toward same caste (homophily) are independent of the rankings of doctors that are consistent with both theories or only with statistical discrimination.

6.1.2 Refining the results

We now use our survey about the relative attitudes towards low-caste and high-caste individuals to classify whether a patient’s caste preference in the field experiment is consistent with the patient’s caste preference in the survey. Assuming that taste is not context specific, if a low-caste person has $S_{p_L} < S_{p_H}$, i.e., he/she has a higher score in the last two questions, meaning that he/she prefers high-caste persons over low-caste ones, then this person cannot taste-based discriminate against a high-caste doctor. If this person’s ranking of doctors in the field experiment is consistent with both theories, we will now classify him or her as a statistical discriminator. Similarly, if a high-caste person has $S_{p_H} > S_{p_L}$, then this person cannot taste-based discriminate against a low-caste doctor (assuming that taste is not context specific). If this person’s ranking of doctors in the field experiment is consistent with both theories, we will now classify him or her as a statistical discriminator.

In Figures 10a and 10b, we reclassify individuals as statistical discriminators when their rankings in the field experiment are compatible with both theories and who have more positive attitudes toward individuals from the other caste than their own. Figure 10a displays the results by caste of patients while Figure 10b displays the results for all patients and correspond, respectively, to Figures 8c and 8d, which perform the same ranking without reclassification.

We see that the share of statistical discriminators relatively increases more for high-caste patients than for low-caste patients. Indeed, for high-caste patients, it increases from 56% (left panel in Figure 8c) to 68% (left panel in Figure 10a) while, for low-caste patients, it increases from 67% (right panel in Figure 8c) to 71% (right panel in Figure 10a). When we combine patients of all castes, we see in Figure 10b that, independent of caste, the share of statistical discriminators increases from 64% to 70%.

6.2 Lab-in-the-field experiment

In late October 2017, we invited a random subset of the initial field-experiment subjects in 30 randomly selected villages to participate in a lab-in-the-field experiment. The purpose of the
lab-in-the-field experiment was to allow separate identification of taste-based discrimination and statistical discrimination for the sets of rankings that are consistent with the predictions of both theories. We examine whether behaviors of discriminators are consistent with the presence of animosity. In total, 482 subjects participated in the lab-in-the-field experiment.

6.2.1 Description of the experiment

The lab-in-the-field experiment was conducted as follows. Each subject participated in four dictator games. In each dictator game, each subject, who had an endowment of 100 Rupees, decided how much he/she wanted to keep from this endowment (a number between 0 and 100 (inclusive) Rupees), given that what is not kept went to a randomly drawn individual from a particular group of subjects. The four games corresponded to four different groups of subjects: high caste, low caste, above poverty line, and below poverty line. If the subject is a low-caste (high-caste) individual, we reminded the subject that the low-caste partner was from the same low-caste group. The anonymous partner was randomly drawn from our field experiment and the allocation was later given to them.

At the beginning of each game, an envelope with the group identity of an anonymous partner written on the envelope was drawn from a set of four envelopes. The subject was then given the group identity of the anonymous partner and the envelope with 100 Rupees (10 × Rs10 notes). The experimenter then instructed the subjects to go to a quiet corner to allocate whatever amount they wished for themselves and put the remaining money in the envelope they wanted to give to the anonymous partner. They were also informed that, once they finished the task, they would drop the envelope in a bag full of similar-looking envelopes that the experimenter placed in a different corner. By letting them drop each of the envelopes in a bag full of similar-looking envelopes away from the scrutiny of the experimenter, we ensured minimal experimenter demand effect.

The third and fourth columns in Table 1 display the characteristics of these 482 subjects and show that they are statistically similar to the original 3,128 subjects who participated in the initial field experiment. More importantly, for the lab-in-the-field sample of 482 individuals, we find the same results obtained in Figures 8c and 8d for the whole sample of 3,128 individuals (see the Online Appendix C for the replication results). Thus, these 482 subjects who participated in the lab-in-the-field experiment behave, on average, exactly as the 3,128 subjects who participated in the field experiment. In particular, 36% of them both taste-based and statistically discriminate doctors while 64% of them only statistically

\[\text{In the inside of each envelope, each subject’s unique id is written, so the amount can be linked to their responses in the field experiment.}\]
discriminate doctors.

Figure 11 displays the mean amounts of giving in our lab-in-the-field experiment. We note a lot of variation in the giving behavior of individuals, which depends on the caste they belong to and on their behavior in the field. In particular, high-caste individuals tend to give more to low-caste individuals while low-caste individuals tend to give more to low-caste individuals. So, it seems that high-caste individuals taste-based discriminate less than low-caste individuals. Moreover, the patterns of giving behavior are similar for individuals who have rankings of doctors consistent with both theories and individuals who have rankings of doctors only consistent with statistical discrimination.

[Insert Figure 11 here]

6.2.2 Results

We first use List’s (2004) method to classify whether a patient’s caste preference in the field experiment is consistent with the patient’s caste preference in the lab-in-the-field experiment. If a low-caste person gives more to a high-caste person than to a low-caste person in the lab-in-the-field experiment, this person cannot taste-based discriminate against high-caste doctors (assuming taste is not context specific). As a result, if this person both taste-based and statistically discriminate in the field, then we will now classify him or her as a statistical discriminator. Similarly, if a high-caste person gives more to a low-caste person than to a high-caste person in the lab-in-the-field experiment, this person cannot taste-based discriminate against low-caste doctors. As a result, if this person both taste-based and statistically discriminate in the field, we will now classify him or her as a statistical discriminator.

We then reclassify all individuals whose behavior was compatible with both taste-based and statistical discrimination in the field experiment and who give more to individuals from the other caste than from their own caste in the lab-in-the-field experiment as statistical discriminators. All other individuals keep the same classification. We replicate Figures 8c and 8d with this new definition. Figures 12a and 12b display the results. The pattern is now different as the percentage of statistical discriminators increases but mainly for high-caste patients. Indeed, for the latter, the percentage of statistical discriminators increases from 56% to 77% while, for low-caste patients, this increase is from 67% to 70%. When we put all patients together, we see in Figure 12b that, independent of caste, the percentage of statistical discriminators increases from 64% to 72%.

[Insert Figures 12a and 12b here]
6.2.3 Refinement of List’s (2004) method

We have seen in Figure 8 that both high-caste and low-caste subjects tend to give more to individuals from a low-caste background and to individuals living below the poverty line. Since low-caste individuals are more likely to live below the poverty line, it is plausible that the tendency for all individuals to give more to low-caste individuals reflects preferences to help people in need of financial assistance. Thus, in order to have a more accurate classification of caste preference, it is important to control for the tendency to give more to the poor.

To classify whether a patient’s caste preference in the *field experiment* is consistent with the patient’s caste preference in the *lab-in-the-field experiment*, we refine List’s (2004) method. For that, we estimate the following equation:

\[
G_{p_{H,i}}^P - G_{p_{L,i}}^P = \alpha_0 + \alpha_1 G_{APL,i}^P + \alpha_2 G_{BPL,i}^P + \beta' X_i^p + \varepsilon_i^p
\]

where \(G_{p_{H,i}}^P\) and \(G_{p_{L,i}}^P\) are the amounts given to the high- and low-caste patient \(i\), \(G_{APL,i}^P\) and \(G_{BPL,i}^P\) are the amounts given to APL (above the poverty line) and BPL (below the poverty line) individuals, and \(X_i^p\) is a set of characteristics of patient \(i\), which include gender, religion, poverty status, and education.

We then estimate the equation by caste of patient and area to obtain the residuals \(\hat{\varepsilon}_i^p\) to define whether a patient’s caste preference in the field experiment is consistent with the patient’s caste preference in the lab-in-the-field experiment.

For a high-caste patient, if the residual is below zero, i.e., \(\hat{\varepsilon}_i^p < 0\), this person cannot taste-based discriminate against high-caste doctors under the assumption that taste is not context specific. This is because the negative residual informs us that this high-caste person gives relatively more to a low-caste person than a high-caste person even after considering the person’s tendency to give more to the poor (who are more likely to be low-caste). The excess giving implies that this high-caste patient does not have a distaste for low-caste individuals. Similarly, for a low-caste patient, if the residual is above zero, i.e., \(\hat{\varepsilon}_i^p > 0\), this person cannot taste-based discriminate against high-caste doctors under the assumption that taste is not context specific.

As a result, if each of these persons’ ranking of doctors are consistent with both taste-based and statistical discrimination in the field experiment, this person is now reclassified as a statistical discriminator given the incompatibility of preferences in the two experiments.

---

21In our full sample, low-caste individuals are 33 percent more likely to live below the poverty line than high-caste individuals.
Using the results of these estimations, we replicate Figures 12a and 12b. Figures 13a and 13b display the results. We find that the percentage of statistical discriminators slightly decreases from 77% to 73% for high-caste patients while, for low-caste patients, it increases from 70% to 85%. The percentage of statistical discriminators considerably increases for low-caste patients because, after controlling for the greater tendency to give to the poor, they do not give more to low-caste individuals. When we combine all patients, we see in Figure 13b that the percentage of statistical discriminators increases from 72% to 80%.

[Insert Figures 13a and 13b here]

6.3 Summary of results

We now summarize how the share of patients whose rankings of doctors are consistent with the two theories of discrimination changes as we alter the way we classify their behavior according to the various theoretical predictions. The results are summarized in Figure 14.

[Insert Figure 14 here]

The top left panel in Figure 14 shows that, when we do not allow the experience of doctors to be negatively correlated with their quality of service, 47% of patients exhibit preferences only consistent with statistical discrimination, 33% of patients exhibit preferences that are consistent with both taste-based and statistical discrimination, and 20% of patients exhibit preferences that are consistent with neither theories. The top right panel in Figure 14 shows that, when we allow the experience of doctors to be both positively and negatively correlated with their quality of service, the share of patients exhibiting preferences that are only consistent with statistical discrimination increases to 64%, while the share of patients exhibiting preferences consistent with both theories slightly increases to 36%. The bottom left panel in Figure 14 shows that when we assume taste is not context specific and use caste preferences that patients reveal in attitudinal questions in the survey to redefine taste-based discrimination, the share of patients exhibiting preferences only consistent with statistical discrimination increases to 70%. Finally, the bottom right panel in Figure 11 shows that when we use patients’ giving behaviors in the lab-in-the-field experiment to redefine taste-based discrimination, the share of patients exhibiting preferences only consistent with statistical discrimination increases to 80%. Thus, using our novel methodology, we find that 47% to 80% of patients statistically discriminate physicians on the basis of caste in Uttar Pradesh, India.

22They are available upon request.
6.4 Characteristics of the discriminators

In Table 2, we show if the mean characteristics for the various types of discriminators differ by caste. The definitions of statistical discriminators are based on the definition after re-classifying rankings consistent with both theories into only statistical discrimination using the survey information about relative positive attitudes towards different castes. There are some differences in the mean characteristics of the two types of discriminators. For example, among high-caste discriminators, Hindu and females are more likely to have rankings consistent with both theories than with only statistical discrimination. On the other hand, among low-caste discriminators, those living in urban areas and below poverty line are more likely to have rankings consistent with both theories than with only statistical discrimination.

[Insert Table 2 here]

7 Robustness checks

7.1 Preferences for attributes other than caste and experience

In the taste-based discrimination model, we assume that a patient has only preferences for the caste closeness of a doctor, Φ, and the quality of health care, q(e), but nothing else. In reality, patients are likely to have preferences for other attributes of a doctor. A good example is the gender of a doctor. Now imagine that, in our experiment, patients are shown only two of the three attributes in their consumption bundle x. Given that they also have preferences for the gender of a doctor, it is plausible to think that they may use the doctor’s experience to infer the doctor’s gender because female doctors are increasingly more represented in the medical profession in India (Bhadra, 2011). This possibility is similar to the Heckman’s (1998) critique about using experiments to detect taste-based discrimination. Note that, to put aside the possibility of caste-based statistical discrimination, we still assume that these patients do not use the doctor’s caste to help make inferences. In this case, differences in the predicted gender of a doctor across patients will influence how they rank the four doctors. The possible rankings under taste-based discrimination for the case when patients try to infer the unobserved attribute from an observed attribute in x ∈ R^3_+ may thus include more than the eight possible rankings we have highlighted above for the case when x ∈ R^2_+.

If the share of (uniquely) statistical discriminators does not vary significantly when additional correlated attributes are taken into consideration, then our results are unlikely to be biased due to taste-based discriminators using observable attributes of a doctor to infer other
unobservable attributes of the doctor for which they have preferences. We thus examine if the findings for male and female patients differ between the case when all the four doctors are females and the case when all the four doctors are males. Figure 15a reports the results for male patients and male doctors, Figure 15b reports the results for male patients and female doctors, Figure 15c reports the results for female patients and male doctors, and Figure 15d reports the results for female patients and female doctors. The share of discriminators who have preference rankings consistent with only statistical discrimination is similar regardless of whether they are presented with female or male doctors. Therefore, our results are robust to the possibility that taste-based discriminators use a doctor’s experience to make inferences about other unobserved attributes of the doctor.\(^{23}\)

\[\text{[Insert Figures 15a, 15b, 15c and 15d here]}\]

### 7.2 Patients may strategically manipulate the rankings of doctors

It is plausible that patients may strategically manipulate the rankings of doctors as in the matching literature, such as for the choice of schools.\(^{24}\)

We believe that such an issue is not as relevant in our specific context. Our subjects were not making decisions in the setting with which the matching literature is typically concerned. First, our subjects were given a short amount of time to choose from a set of doctors that they never heard or visited before (doctors with fictitious names). The information given about these doctors was also very limited (surnames, experience, and gender). Second, our subjects were making decisions for a one-off experience that was expected to last no more than 15 minutes. Third, subjects were not informed about the exact probability of each doctor being chosen. These features contrast the situations of school choice that the matching literature studies, where parents have rich information about the schools available, the number of slots available relative to the number of applicants, have substantial amount of time to make decisions, and an understanding as to where their child will eventually end up attending the school for many years to come.

However, even if it is very unlikely, we investigate the sensitivity of our results to the possibility that patients strategically manipulate the top-two ranked doctors by putting

\[^{23}\text{In the Online Appendix D, instead of the gender of the doctor, we consider his or her age, an unobserved attribute that is also correlated with experience as younger doctors are on average less experienced. We show that our findings are similar when the high-experience doctors have 12 years of experience and when they have 8 years of experience.}\]

\[^{24}\text{For overviews of the matching literature, see Roth and Sotomayor (1990) and Sönmez and Ünver (2011).}\]
their most preferred doctors as the second most-preferred doctors. For that, we swap the order of the two top-ranked doctors among patients who show rankings only consistent with statistical discrimination.

In Figure 16, we report the results for the four different methodologies used in this paper (before reclassification, the reclassification using the survey method, the reclassification using the List’s method, and the reclassification using the refinement of the List’s method). Quite naturally, the share of statistical discriminators decreases and is now between 44% and 71%, which is still substantial. For example, if we compare these results with those obtained with the “real” ranking of doctors after the reclassification using the survey method (Figure 10b), we see that the share of statistical discriminators decreases from 70% to 53%. Similar results are obtained for the other cases.

[Insert Figure 16 here]

7.3 Patients may not care much about the lower-ranked doctors

It is also plausible that some patients may only care about their most-preferred choices (the first-two doctors that they rank) and do not care much about their less-preferred choices (the last two doctors that they rank). As a result, they may randomly rank these less-preferred doctors. Because the ranking of the last two doctors affect whether someone is a statistical discriminator or if he/she is both a taste-based and a statistical discriminator, we need to verify how these labels are affected when we change the ranking of the last two doctors. For that, we swap the two bottom-ranked doctors for rankings only consistent with statistical discrimination and turn them into rankings consistent with both theories to assess the sensitivity of our results to this type of randomization.

Figure 17 reports the results for the four different methodologies we adopt in this paper. We see that the number of statistical discriminators decreases. For example, if we compare the results for the case before reclassification (Figure 8d), we see that the share of statistical discriminators decreases from 64% to 41%. Similar results are obtained for the other cases where, after we swap the last two ranked doctors, the share of statistical discriminators varies from 51% to 70%. These results give us confidence that, even if the share of statistical discriminators is reduced, there are still many patients who do statistically discriminate doctors.

[Insert Figure 17 here]
7.4 Accounting for non-discriminators

Given the evidence of discrimination in Figures 4 and 5, in order to determine the minimum share of statistical discriminators, we have assumed that all patients were discriminating. To assess the sensitivity of our findings to the assumption that all patients discriminate, we now consider two alternative approaches. First, we assume that the 20% of patients who prefer doctors with fewer years of experience (i.e., those with $q'(e) > 0$ or the “neither” group in Figure 6d) are non-discriminators. Second, we perform some numerical simulations where we randomly choose the share of non-discriminators and check how the other patients discriminate against doctors. In both cases, we determine the share of patients who only statistically discriminate.

7.4.1 Non-discriminating patients prefer doctors with fewer years of experience

We assume that the 20% of patients who behave according to neither theories in Figure 6d are now non-discriminators. We implement the same analysis as above using the three other methodologies (the reclassification using the survey method, the reclassification using the List’s method, and the reclassification using the refinement of the List’s method) but keeping these individuals as non-discriminators instead of considering them as discriminators with preferences such that $q'(e) < 0$. The results are displayed in Figure 18.

We see that the percentage of patients who only statistically discriminate is still very high, i.e., between 47% and 63%. If we express it as a percentage of discriminators only, it is between 59% and 79%. For example, if we compare the results for the case of reclassification using the survey method (Figure 10b), we see that the share of statistical discriminators decreases from 70% to 53% (or 63% of discriminators).

[Insert Figure 18 here]

7.4.2 Simulating the share of non-discriminators

We now perform the last robustness check by running simulations where we assume that a fraction of individuals in our field experiment do not discriminate doctors on the basis of caste and then determine whether the rest of the patients behave according to only statistical discrimination or to both taste-based and statistical discrimination. Specifically, we select a random subset of individuals according to the assumed share of discriminators in each round of the simulation and perform 1,000 rounds of simulation for each assumed share of discriminators. The results are displayed in Table 3, where, in the first column, the
share of individuals who are not discriminators is assumed to be 5%, then 25% (column 2) and then 50% (column 3). Each row of Table 3 corresponds to a methodology (before reclassification, reclassification using the survey method, reclassification using the List’s method, and reclassification using the refinement of the List’s method).

The percentage of patients who only statistically discriminate does not change much as we vary the assumed share of discriminators. Whether we consider 50% or 95% discriminators, more than 60% of them are only statistically discriminating against doctors, independent of the methodology we use. As in our main analysis, the more we refine our reclassification strategy, the higher is the percentage of patients who only statistically discriminating against doctors. Thus, our results regarding the minimum share of statistical discriminators are robust to allowing a fraction of patients who are not discriminators.

8 Conclusion

Although the predictions of the two main discrimination theories are often identical, it is important to distinguish the two sources of discrimination and understand the scope of statistical discrimination in explaining the extent to which minority, historically disadvantaged, or under-represented groups endure discrimination.

This paper examines the extent of caste-based statistical discrimination in the health care market in India by conducting a field experiment in Uttar Pradesh that elicits patients’ rankings of physicians of different castes and years of experience. Using information about patients’ rankings of doctors of different castes and years of experience, castes of patients, and measures about patients’ attitudes towards different caste groups collected from survey questions and an incentivized lab-in-the-field experiment, our novel methodology allows us to determine the minimum share of statistical discriminators and the maximum share of taste-based discriminators.

We find that, irrespective of caste, at least 47% to 80% of patients statistically discriminate against doctors, especially low-caste doctors. This is a lower bound since, for the other category, we are not able to distinguish taste-based and statistical discriminators. This means that caste-based statistical discrimination of patients against doctors is sizable in India. More importantly, our novel methodology provides an improved method to empirically distinguish taste-based and statistical discrimination at the individual level, and the method can be applied in many other settings to understand discrimination along different dimensions, such as race, ethnicity, gender, religion, age, etc.
The findings have important implications for the use of affirmative action (AA) policies. On the one hand, the finding that patients statistically discriminate against doctors on the basis of caste provides justification for the use of caste-based AA policies to address discrimination. On the other hand, given that the majority of patients are statistical discriminators, our findings highlight that policy makers need to be cautious about how AA policies are implemented (Coate and Loury, 1993). For example, since AA policies in college admissions benefit low-caste students to gain entry into selective majors and occupations, these policies may reinforce the negative perception that low-caste doctors are less qualified and thus backfire since individuals may statistically discriminate even more low-caste doctors on the basis that they are less qualified than high-caste doctors. As a result, there are two countervailing effects of AA policies: it increases the investment in education of low-caste individuals but may reinforce the negative stereotype people have against low-caste doctors. These issues are complex, and we do not know if the large fraction of statistical discriminators in our field experiment are a reaction to the AA policies implemented in India or just reflect the individuals’ beliefs in terms of low-caste doctors.

More generally, we believe that our methodology could be used to test the extent of ethnic-based statistical discrimination in other countries than India, including the United States, which will help to draw some conclusions in terms of AA policies in those countries.

References


## Table 1: Descriptive statistics

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Field Sample (n = 3,128)</th>
<th>Lab-in-the-field Sample (n = 482)</th>
<th>Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>High caste – General category (GC)</td>
<td>0.27</td>
<td>0.44</td>
<td>0.26</td>
</tr>
<tr>
<td>Low caste –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Backward Classes (OBC)</td>
<td>0.49</td>
<td>0.50</td>
<td>0.50</td>
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<tr>
<td>Scheduled Castes (SC)</td>
<td>0.24</td>
<td>0.42</td>
<td>0.24</td>
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<tr>
<td>Scheduled Tribes (ST)</td>
<td>0.00</td>
<td>0.06</td>
<td>0.01</td>
</tr>
<tr>
<td>Age</td>
<td>37.8</td>
<td>14.3</td>
<td>38.5</td>
</tr>
<tr>
<td>Hindu (or not)</td>
<td>0.80</td>
<td>0.40</td>
<td>0.76</td>
</tr>
<tr>
<td>Urban resident (or not)</td>
<td>0.34</td>
<td>0.48</td>
<td>0.33</td>
</tr>
<tr>
<td>Male (or not)</td>
<td>0.51</td>
<td>0.50</td>
<td>0.53</td>
</tr>
<tr>
<td>At least college educated (or not)</td>
<td>0.11</td>
<td>0.32</td>
<td>0.09</td>
</tr>
<tr>
<td>Below poverty line (or not)</td>
<td>0.34</td>
<td>0.47</td>
<td>0.34</td>
</tr>
<tr>
<td>High caste – General category (GC)</td>
<td>38.5</td>
<td>15.0</td>
<td>38.7</td>
</tr>
<tr>
<td>Age</td>
<td>38.5</td>
<td>15.0</td>
<td>38.7</td>
</tr>
<tr>
<td>Hindu (or not)</td>
<td>0.81</td>
<td>0.39</td>
<td>0.75</td>
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<tr>
<td>Urban resident (or not)</td>
<td>0.31</td>
<td>0.46</td>
<td>0.37</td>
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<tr>
<td>Male (or not)</td>
<td>0.49</td>
<td>0.50</td>
<td>0.58</td>
</tr>
<tr>
<td>At least college educated (or not)</td>
<td>0.17</td>
<td>0.38</td>
<td>0.12</td>
</tr>
<tr>
<td>Below poverty line (or not)</td>
<td>0.25</td>
<td>0.43</td>
<td>0.30</td>
</tr>
<tr>
<td>Low caste – OBC/SC/ST</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>37.6</td>
<td>14.0</td>
<td>38.5</td>
</tr>
<tr>
<td>Hindu (or not)</td>
<td>0.79</td>
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<td>0.77</td>
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<tr>
<td>Urban resident (or not)</td>
<td>0.36</td>
<td>0.48</td>
<td>0.32</td>
</tr>
<tr>
<td>Male (or not)</td>
<td>0.51</td>
<td>0.50</td>
<td>0.51</td>
</tr>
<tr>
<td>At least college educated (or not)</td>
<td>0.09</td>
<td>0.29</td>
<td>0.16</td>
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<tr>
<td>Below poverty line (or not)</td>
<td>0.37</td>
<td>0.48</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Notes: The bottom two panels report statistics for high-caste patients and low-caste patients separately. All statistics for Uttar Pradesh were sourced from NSS 68th Round, 2011-12, except the below poverty line figure came from World Bank (2016).
### Table 2: Mean characteristics of different types of discriminators

<table>
<thead>
<tr>
<th></th>
<th>(1) Both theories</th>
<th>(2) Statistical only</th>
<th>(3) Difference (1) - (2)</th>
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</thead>
<tbody>
<tr>
<td>High caste</td>
<td>0.290</td>
<td>0.258</td>
<td>0.032</td>
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<tr>
<td></td>
<td>[0.454]</td>
<td>[0.437]</td>
<td>(0.018)*</td>
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<tr>
<td>Age</td>
<td>38.071</td>
<td>37.699</td>
<td>0.372</td>
</tr>
<tr>
<td></td>
<td>[13.925]</td>
<td>[14.400]</td>
<td>(0.550)</td>
</tr>
<tr>
<td>Hindu</td>
<td>0.844</td>
<td>0.779</td>
<td>0.065</td>
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<tr>
<td></td>
<td>[0.363]</td>
<td>[0.415]</td>
<td>(0.015)**</td>
</tr>
<tr>
<td>Urban</td>
<td>0.363</td>
<td>0.337</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>[0.481]</td>
<td>[0.473]</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Male</td>
<td>0.482</td>
<td>0.518</td>
<td>-0.036</td>
</tr>
<tr>
<td></td>
<td>[0.500]</td>
<td>[0.500]</td>
<td>(0.020)*</td>
</tr>
<tr>
<td>College</td>
<td>0.124</td>
<td>0.110</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>[0.330]</td>
<td>[0.313]</td>
<td>(0.013)</td>
</tr>
<tr>
<td>BPL</td>
<td>0.367</td>
<td>0.330</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>[0.482]</td>
<td>[0.470]</td>
<td>(0.019)**</td>
</tr>
</tbody>
</table>

Notes: Types of discriminators defined after reclassification using survey information about relative attitudes towards different castes. Standard deviations reported in brackets and standard errors reported in parentheses. ***p<0.01; ** p<0.05; * p<0.10.
<table>
<thead>
<tr>
<th>(Assume 95% )</th>
<th>(Assume 75% )</th>
<th>(Assume 50% )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before reclassification</strong></td>
<td>0.638</td>
<td>0.637</td>
</tr>
<tr>
<td><strong>Reclassification using survey info</strong></td>
<td>0.702</td>
<td>0.702</td>
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<tr>
<td><strong>Reclassification using List’s method</strong></td>
<td>0.720</td>
<td>0.720</td>
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<tr>
<td><strong>Reclassification using refinement method</strong></td>
<td>0.797</td>
<td>0.795</td>
</tr>
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</table>

**Notes:** Mean share of rankings consistent with only statistical discrimination is computed on the basis of 1000 repetitions of simulation. Standard deviation of the share of rankings reported in the bracket.
Figure 1: Low-caste patients’ preferences for and rankings of doctors with different levels of caste closeness and quality of health care

Figure 2: High-caste patients’ preferences for and rankings of doctors with different levels of caste closeness and quality of health care
Figure 3: Rankings of doctors with different levels of caste closeness and expected quality of health care when patients statistically discriminate.
Figure 4: Mean rank by doctor type – Pooling patients of all caste groups

Notes: Higher mean rank means less preferred. Doctor caste-type is denoted by caste and experience. HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience.

Figure 5: Mean rank by doctor type and caste of patients

Notes: Higher mean rank means less preferred. Doctor caste-type is denoted by caste and experience. HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience.
Figure 6a: Distribution of rankings for high-caste patients, assuming experience is positively correlated with quality

Notes: HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience. For example, the ranking order “HH,LH,HL,LL” means that high-caste high-experience doctor is the most preferred, low-caste high-experience doctor is the second most preferred, and so on.

Figure 6b: Distribution of rankings for low-caste patients, assuming experience is positively correlated with quality

Notes: HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience. For example, the ranking order “HH,LH,HL,LL” means that high-caste high-experience doctor is the most preferred, low-caste high-experience doctor is the second most preferred, and so on.
Figure 6c: Distribution of rankings by caste of patients, assuming experience is positively correlated with quality

Notes: The taste-based model assumes distaste for out-group doctor (e.g., a low-caste patient has a distaste for high-caste patients, and a high-caste patient has a distaste for low-caste patients). High experience signals better quality of healthcare service.

Figure 6d: Distribution of rankings for all patients, assuming experience is positively correlated with quality

Notes: The taste-based model assumes distaste for out-group doctor (e.g., a low-caste patient has a distaste for high-caste patients, and a high-caste patient has a distaste for low-caste patients). High experience signals better quality of healthcare service.
Figure 7: Distribution of rankings for 8-vs-4 years and 12-vs-4 years of experience, assuming experience is positively correlated with quality

Figure 8a: Distribution of rankings for high-caste patients, when experience can be positively or negatively correlated with quality

Notes: HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience. For example, the ranking order "HH,LH,HL,LL" means that high-caste high-experience doctor is most preferred, low-caste high-experience doctor is second most preferred, high-caste low-experience doctor is the third most preferred, and low-caste low-experience doctor is the least preferred.
Figure 8b: Distribution of rankings for low-caste patients, when experience can be positively or negatively correlated with quality

Notes: HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience. For example, the ranking order “HH,LH,HL,LL” means that high-caste high-experience doctor is most preferred, low-caste high-experience doctor is second most preferred, high-caste low-experience doctor is the third most preferred, and low-caste low-experience doctor is the least preferred.

Figure 8c: Distribution of rankings for low- and high-caste patients, when experience can be positively or negatively correlated with quality

Notes: The taste-based model assumes distaste for out-group doctor (e.g., a low-caste patient has a distaste for high-caste patients, and a high-caste patient has a distaste for low-caste patients). High experience may signal better or worse quality of healthcare service.
Figure 8d: Distribution of rankings for all patients, when experience can be positively or negatively correlated with quality

![Graph showing distribution of rankings for all patients.](image)

Notes: The taste-based model assumes distaste for out-group doctor (e.g., a low-caste patient has a distaste for high-caste patients, and a high-caste patient has a distaste for low-caste patients). High experience may signal better or worse quality of healthcare service.

Figure 9: Mean Positive Attitudes Scores towards Different Castes by Caste of Patients and Theory-Consistent Type

![Graphs showing mean positive attitudes scores for different castes by caste of patients and theory-consistent type.](image)
Figure 10a: Distribution of rankings for low- and high-caste patients, when experience can be positively or negatively correlated with quality, and when patients having more positive attitudes towards out-group are recoded as statistical only.

Figure 10b: Distribution of rankings for all patients, when experience can be positively or negatively correlated with quality, and when patients having more positive attitudes towards out-group are recoded as statistical only.
Figure 11: Mean Amount Given to Different Groups by Caste of Patients and Theory-Consistent Type

Figure 12a: Distribution of rankings for low- and high-caste patients, when experience can be positively or negatively correlated with quality, and when patients giving more to out-group are recoded as statistical Lab-in-the-field Sample
Figure 12b: Distribution of rankings for all patients, when experience can be positively or negatively correlated with quality, and when patients giving more to out-group are recoded as statistical Lab-in-the-field Sample

Figure 13a: Distribution of rankings for low- and high-caste patients, when experience can be positively or negatively correlated with quality, and when patients giving more to out-group conditioning on characteristics are recorded as statistical Lab-in-the-field Sample
Figure 13b: Distribution of rankings for all patients, when experience can be positively or negatively correlated with quality, and when patients giving more to out-group conditioning on characteristics are recorded as statistical Lab-in-the-field Sample.

Figure 14: Summary of main results.
Figure 15a: Male Patients – Male Doctors

Figure 15b: Male Patients – Female Doctors
Figure 15c: Female Patients – Male Doctors

Figure 15d: Female Patients – Female Doctors
Figure 16: Summary of main results
Changing the order of the two top-ranked doctors among patients who show rankings only consistent with statistical discrimination

Notes: We swap the order of two-top ranked doctors among patients who show rankings only consistent with statistical discrimination, but we do not swap the order of the two-top ranked doctors among patients who show rankings consistent with both theories.
Figure 17: Summary of main results
Changing the order of the two bottom-ranked doctors among patients who show rankings only consistent with statistical discrimination

Notes: We swap the two-bottom ranked doctors among patients who show rankings only consistent with statistical discrimination, but we do not swap the two-bottom ranked doctors among patients who show rankings consistent with both theories.
Assuming those with experience negatively correlated with quality as non-discriminators.
Online Appendix

A  Rankings of doctors

A.1  Rankings of doctors when experience is positively correlated with quality

A.1.1  Taste-based discrimination

We present a simple additively separable utility function for patients of caste $c = c_L, c_H$ to summarize the four possible rankings under taste-based discrimination when experience is assumed to be positively correlated with quality. We note that these rankings are true for any utility function that satisfies the five axioms of consumer choice specified in Section 2.1.

The utility function for a low-caste patient $c_L^p$ choosing a doctor of caste $c = c_L, c_H$ is given by:

$$U (\Phi(c_L^p, c), q) = q(e) - \theta_H$$  \hspace{1cm} (A.1)

where $q'(e) > 0$ (higher experience doctors provide better-quality health service) and $\theta_H > 0$ if the doctor is from a high-caste and zero otherwise. The indicator $\theta_H$ indicates whether there is any distance between the doctor’s caste group and the patient’s caste group.

The possible rankings for a low-caste patient $c_L^p$ choosing a doctor of caste $c = c_L, c_H$ are:

$c_L e_H \succ c_L e_L \succ c_H e_H \succ c_H e_L$
$c_L e_H \succ c_H e_H \succ c_L e_L \succ c_H e_L$

In the first ranking, we need to give the condition for which $c_L e_L \succ c_H e_H$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_H > q(e_H) - q(e_L)$$  \hspace{1cm} (A.2)

For the second ranking, we need to give condition for which $c_H e_H > c_L e_L$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_H < q(e_H) - q(e_L)$$  \hspace{1cm} (A.3)
The utility function for a high-caste patient $c_H^c$ choosing a doctor of caste $c = c_L, c_H$ is given by:

$$U(\Phi(c_H^c, c), q) = q(e) - \mathbf{1}_{1\theta_L}$$

where $\mathbf{1}_{1\theta_L} = \theta_L > 0$ if the doctor is from a low-caste and zero otherwise.

The possible rankings for a high-caste patient compatible with (A.4) are:

$$c_H^e H > c_H^e L > c_L^e H > c_L^e L$$

$$c_H^e H > c_L^e H > c_H^e L > c_L^e L$$

In the first ranking, we need to give the condition for which $c_H^e L > c_L^e H$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_L > q(e_H) - q(e_L)$$

For the second ranking, we need to give the condition for which $c_L^e H > c_H^e L$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_L < q(e_H) - q(e_L)$$

To summarize, with taste-based discrimination assuming that $q'(e) > 0$, there are 4 possible rankings. The possible rankings for a low-caste patient compatible with (A.1) are:

$$c_L^e H > c_L^e L > c_H^e H > c_H^e L$$

$$c_L^e H > c_H^e H > c_L^e L > c_H^e L$$

The possible rankings for a high-caste patient compatible with (A.4):

$$c_H^e H > c_H^e L > c_L^e H > c_L^e L$$

$$c_H^e H > c_L^e H > c_H^e L > c_L^e L$$

A.1.2 Statistical discrimination

Assume that $Cov(q_e, e_c) > 0$. With statistical discrimination, there are 6 possible rankings and it does not depend on the caste of the patient. These 6 rankings compatible with (1) in Section 2.2 are given by:

$$c_H^e H > c_H^e L > c_L^e H > c_L^e L$$

A2
A.2 Rankings of doctors when experience can be positively or negatively correlated with quality

A.2.1 Taste-based discrimination

In that case, there are 8 possible rankings. (i) Consider low-caste patients with preferences given by (A.1). If experience is positively correlated with quality, i.e. \( q'(e) > 0 \), then we have:

\[
\begin{align*}
    c_H e_H &> c_L e_H > c_H e_L > c_L e_L \\
    c_H e_H &> c_L e_H > c_L e_L > c_H e_L \\
    c_L e_H &> c_H e_H > c_L e_L > c_H e_L \\
    c_L e_H &> c_L e_L > c_H e_H > c_H e_L
\end{align*}
\]

(ii) Consider low-caste patients with preferences given by (A.1). If experience is negatively correlated with quality, i.e. \( q'(e) < 0 \), then we have:

\[
\begin{align*}
    c_L e_L &> c_L e_H > c_H e_L > c_H e_H \\
    c_L e_L &> c_H e_L > c_L e_H > c_H e_H
\end{align*}
\]

(iii) Consider high-caste patients with preferences given by (A.4). If experience is positively correlated with quality, i.e. \( q'(e) > 0 \), then we have:

\[
\begin{align*}
    c_H e_H &> c_L e_H > c_L e_L > c_L e_L \\
    c_H e_H &> c_H e_L > c_L e_H > c_L e_L
\end{align*}
\]

(iv) Consider high-caste patients with preferences given by (A.4). If experience is negatively correlated with quality, i.e. \( q'(e) < 0 \), then we have:

\[
\begin{align*}
    c_H e_L &> c_L e_L > c_H e_H > c_L e_H \\
    c_H e_L &> c_H e_H > c_L e_L > c_L e_H
\end{align*}
\]
A.2.2 Statistical discrimination

Assume that both $Cov(q_c, e_c) > 0$ and $Cov(q_c, e_c) < 0$ are possible for a doctor of caste $c = c_L, c_H$. All of the patients statistically discriminate using (1) in Section 2.2. Then, in that case, all rankings are possible and there are therefore 24 possible rankings, which are given by:

(i) When doctors $c_H e_H$ are ranked first:

\[
\begin{align*}
    &c_H e_H > c_H e_L > c_L e_H > c_L e_L \\
    &c_H e_H > c_H e_L > c_L e_L > c_L e_H \\
    &c_H e_H > c_L e_H > c_H e_L > c_L e_L \\
    &c_H e_H > c_L e_H > c_L e_L > c_H e_L \\
    &c_H e_H > c_L e_L > c_H e_L > c_L e_H \\
    &c_H e_H > c_L e_L > c_L e_H > c_H e_L
\end{align*}
\]

(ii) When doctors $c_H e_L$ are ranked first:

\[
\begin{align*}
    &c_H e_L > c_H e_H > c_L e_H > c_L e_L \\
    &c_H e_L > c_H e_H > c_L e_L > c_L e_H \\
    &c_H e_L > c_L e_H > c_H e_L > c_L e_L \\
    &c_H e_L > c_L e_H > c_L e_L > c_H e_L \\
    &c_H e_L > c_L e_L > c_H e_L > c_L e_H \\
    &c_H e_L > c_L e_L > c_L e_H > c_H e_L
\end{align*}
\]

(iii) When doctors $c_L e_H$ are ranked first:

\[
\begin{align*}
    &c_L e_H > c_H e_H > c_H e_L > c_L e_L \\
    &c_L e_H > c_H e_H > c_L e_L > c_H e_L \\
    &c_L e_H > c_H e_L > c_H e_H > c_L e_L \\
    &c_L e_H > c_H e_L > c_L e_L > c_H e_L \\
    &c_L e_H > c_L e_L > c_H e_L > c_H e_L \\
    &c_L e_H > c_L e_L > c_H e_L > c_H e_L
\end{align*}
\]
(iv) When doctors $c_{L \leq L}$ are ranked first:

\[
\begin{align*}
  c_{L \leq L} & > c_{H \geq H} > c_{H \geq L} > c_{L \leq H} \\
  c_{L \leq L} & > c_{H \geq L} > c_{H \geq H} > c_{L \leq H} \\
  c_{L \leq L} & > c_{H \geq L} > c_{H \geq H} > c_{L \leq H} \\
  c_{L \leq L} & > c_{L \leq H} > c_{H \geq H} > c_{L \leq H} \\
  c_{L \leq L} & > c_{L \leq H} > c_{H \geq H} > c_{L \leq H} \\
  c_{L \leq L} & > c_{L \leq H} > c_{H \geq H} > c_{L \leq H}
\end{align*}
\]

B Maps

Figure B.1 shows the location of Kanpur Nagar district in the state of UP while Figure B.2 displays all the locations where the experiment was conducted in Kanpur Nagar district. The areas covered in our study include Ratanpur, Lodhar, Kursauli, Maksudabad, Tikra, Singhpur, Hora, Paigupur, Pachor, Mandhana, Kukradev, Tikkanpurwa, Bairy, Mharajpur, Loharkheda, Pargahi, Guraha, Sandeela, Shadipur, Naurangabad, Baikunthpur, Sakshupurwa, Iswariganj, Hradaypur, Parapratappur, Chandula and Pokharpurwa and urban areas, namely, Naramau, Karsaitpur, Madarpur, Indra Nagar, Kalyanpur Khud, Devi Shai Nagar, Sahab Nagar, Jai Prakash Nagar, Loharanbhatta, Fazalganj, Barasirohi, Mirjapur and Maswanpur.

[Insert Figures B.1 and B.2 here]

C Replication of the experiment using the 482 lab-in-the-field participants

Figures C.1 and C.2 replicate the results obtained in Figures 5c and 5d for the 482 lab-in-the-field participants. We see that the results are similar.

[Insert Figures C.1 and C.2 here]
D Preference for unobserved doctor’s age

In Section 7.1, we examine whether our results are robust to the consideration of gender, which is correlated with experience. We here consider whether our results are also robust to the consideration of age, an unobserved attribute that is also correlated with experience (as younger doctors are on average less experienced). For example, a doctor with 12 years of experience is likely to be older than a doctor with 8 years of experience. If the share of (uniquely) statistical discriminators does not vary significantly when patients are presented with doctors with four years and 12 years of experience and when they are presented with doctors with four years and eight years of experience, then our results are unlikely to be biased from taste-based discriminators using experience of a doctor to make inferences about the doctor’s age. In Figure D.1, we report the results for the four different methodologies used in this paper when patients have to choose between doctors with four years and eight years of experience. In Figure D.2, we report the results when patients have to choose between doctors with four years and 12 years of experience. Both figures show similar shares of patients with preference rankings consistent with statistical discrimination only. Therefore, our findings are robust to potential preferences for other attributes that are correlated with experience.

[Insert Figures D.1 and D.2 here]
Figure B.1: Location of Kanpur Nagar, Uttar Pradesh on the Map of India
Figure B.2: Locations where the field experiments were conducted
Figure C.1: Distribution of rankings for low- and high-caste patients
Experience can be positively or negatively correlated with quality
Replication of Figure 5c using Lab-in-the-field sample

Figure C.2: Distribution of rankings for low- and high-caste patients
Experience can be positively or negatively correlated with quality
Replication of Figure 5d using Lab-in-the-field sample
Figure D.1: Distribution of rankings when high-experience doctors have 8 or 4 years of experience

Figure D.2: Distribution of rankings when high-experience doctors have 12 or 4 years of experience