ELSEVIER

Journal of Health Economics 22 (2003) 89–116

JOURNAL OF HEALTH ECONOMICS

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Prejudice, clinical uncertainty and stereotyping as sources of health disparities

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Received 1 August 2001; accepted 2 October 2002

Abstract

Disparities in health can result from the clinical encounter between a doctor and a patient. This paper studies three possible mechanisms: prejudice of doctors in the form of being less willing to interact with members of minority groups, clinical uncertainty associated with doctors' differential interpretation of symptoms from minority patients or from doctor's distinct priors across races, and stereotypes doctors hold about health-related behavior of minority patients. Within a unified conceptual framework, we show how all three can lead to disparities in health and health services use. We also show that the effect of social policy depends critically on the underlying cause of disparities.

Keywords: Prejudice; Stereotype; Health disparities

1. Introduction

A health care disparity exists when membership in a social group (race or gender, for example) is associated with health care treatment or outcomes in a way that is unjustified by the underlying need of the patient. The Institute of Medicine (2002) report *Unequal Treatment*: *Confronting Racial and Ethnic Disparities in Health Care* documents widespread disparities in health and in use of health services among racial/ethnic groups in the US.[1] A striking development in health policy in the US in the past few years has been the rapid

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[1] The definition of disparities just noted is similar to that used in the IOM report. Also, our analysis of the sources of discrimination parallels discussion in *Unequal Treatment*.

0167-6296/03/$ – see front matter
PII: S0167-6296(02)00098-X

emergence of a consensus that reducing disparities should be a major goal of public health and social policy.

Some disparities in health and health services can be attributed to "social factors" such as the higher likelihood of being uninsured for Blacks and Latinos (Monheit and Vistnes, 2000), transportation in inner cities (Heckman et al., 1998) or over representation of minorities in Medicaid health plans with restrictive payment policies (Tai-Seale et al., 2001). Empirical research has found disparities, however, even when these social factors are ruled out by controls or by design. In some "experiments" in which insurance, access, and other factors do not vary, black patients are treated differently than white patients.[2] In other words, disparities may arise from the interaction between doctor and patient. In this paper, we are concerned with disparities from this second source, the clinical encounter. In particular, we focus on disparities that originate in the physician's behavior, including any demand-side reaction to that behavior.[3]

One view of the origin of these disparities is that health care providers are simply prejudiced against members of minority groups and treat these patients with lower regard than Whites. Another commonly mentioned hypothesis is that providers hold preconceptions about patients that are conditioned on group membership. Doctors' "stereotypes" that minority patients are less likely to comply with treatment, for example, might generate disparities. Finally, in an earlier paper, we show how the presence of greater uncertainty in interpreting symptoms of disease for minority patients can itself be a source of disparate treatment, even among fair-minded providers (Balsa and McGuire, 2001).[4] All three of these explanations are a form of what social psychologists label "group categorization," that is, acting toward a person based in part on their membership in a social group like race or ethnicity.

In the sections that follow, we study doctors' group-based decisions of the following form: being less willing to interact with members of the minority group (prejudice), interpreting a symptom of illness as a less reliable indicator of severity for a minority patient or holding differential beliefs about the group's underlying severity (clinical uncertainty), and

[2] The literature documenting disparities is voluminous. The following is a quote from an excellent recent review of the literature on the added "risk" of being Black after controlling for insurance and socioeconomic status (Fiscella et al., 2000). We omit the 24 references cited by the authors: "Elderly Blacks, compared with Whites, are seen less often by specialists, receive less appropriate preventive care including mammography and influenza vaccinations, lower-quality hospital care, and fewer expensive, technological procedures. In general, Blacks receive less intensive hospital care, including fewer cardiovascular procedures, lung resections for cancer, kidney and bone marrow transplants, cesarean sections, peripheral vascular procedures, and orthopedic procedures. They have also been reported to receive less aggressive treatment of prostate cancer, fewer antiretrovirals for human immunodeficiency virus infection, antidepressants for depression, tympanostomy tubes, and admissions for chest pain, and lower-quality prenatal care." The next paragraphs in the article discuss evidence (less extensive) for Latinos and Asians.

[3] Some physician-side explanations, such as stereotypic beliefs, have parallels on the patient-side. A complete study of the sources of clinical disparities should include attention to these patient-side explanations.

[4] Our earlier paper, Balsa and McGuire (2001) analyzed the implications of greater uncertainty in doctors' interpretations of signals from minority patients and showed how this greater uncertainty can generate disparities. In the current paper we extend this analysis of decision-making under uncertainty to show that even when the degree of uncertainty is the same, differences in prior beliefs (even if these are accurate) can also cause disparities. We also add in this paper two other sources of disparities into consideration, and evaluate all sources in terms of efficiency and fairness. Finally, for each source, we analyze some general policy implications.

holding a belief that minority patients are less likely to comply with treatment recommendations (stereotyping). In conducting this analysis we rely heavily on the labor economics literature—the field of economics where issues related to discrimination have been treated most extensively.[5]

Within a unified framework, we link our analysis to policy and show that policies to address disparities will work differently depending on which mechanism is responsible. We consider information-based policies to reduce uncertainty or to break stereotypical patterns. We also consider enforcing "rule-based" policies that require, for example, that Blacks be treated the same as Whites. All policies have costs of implementation, of course, but in our discussion of policies, we focus on the potential benefits of information and rule-based approaches. Information-based policies, though ineffective when information is not the underlying problem, at least satisfy the medical creed, "first, do no harm." Rule-based policies run a greater risk of unintended consequences. Enforcing parity in treatment across racial groups without dealing with information problems that might be generating the disparities in the first place can degrade the value of health care for all social groups—a lose–lose proposition. One conclusion of our analysis is that social policy to reduce disparities arising from the clinical encounter should be based on evidence that differentiates among the possible routes of cause.

The power of the discriminatory practices analyzed in this paper, and the role and scope of policies suggested to combat them, depend greatly on how market forces interact with such practices in the long-run. In the labor literature, Becker (1971) acknowledged that competitive market forces would eliminate the differential wages across groups predicted by his taste discrimination theory. At the end of each section we study the long-run equilibria of the model presented and address its completeness, by questioning the determination of the key parameters in a health care context. For this purpose, we rely also on analogies to the labor literature.

Before we analyze disparities stemming from the clinical encounter, we first define a standard or benchmark of clinical decision-making that is both fair and efficient.

2. The benchmark: a benevolent doctor with complete information

In this section, we introduce a simple model of illness and treatment to define standards of fairness and efficiency. In later sections, we build on the model to study the role of racial or ethnic group-based decisions in disparities. Our analysis will be conducted using two racial groups, but it applies to ethnic as well as racially defined minorities.

Patients are members of one of two recognizable groups, Blacks and Whites, which we will refer to as race. Race is the potential basis of categorization by doctors. Each patient is also characterized by a severity of illness, denoted Z. A patient with a higher value of Z is more severely ill. Blacks and Whites may differ in the underlying distribution of severity. For Blacks, $Z \sim N(\mu_B, \sigma^2)$, and for Whites, $Z \sim N(\mu_W, \sigma^2)$. That is, the distribution of severity may have a different mean for Blacks and Whites (if $\mu_B < \mu_W$, Blacks are

[5] We have drawn most heavily from Becker (1971), Arrow (1973), Lundberg and Startz (1983) and Coate and Loury (1993a,b).

"healthier" on average, if $\mu_B > \mu_W$, the opposite is true). We assume here that the variance in the distribution of severity is the same for both groups.

Treatment is a simple yes/no decision made by the doctor. If a patient of severity Z is treated, he or she receives benefits $B = Z$. We interpret a negative value of Z as meaning that the treatment is not effective from the doctor's point of view (either because the patient is not sick enough to justify the treatment or because the patient is healthy but bears some risk, a risk that might vary for different people). Z can be viewed as the net benefit a patient gets from treatment. Conditional on medical severity, there are no racial preferences for the type of treatment received.[6] For "healthy" patients, treatment only has risks but no benefits, so Z is negative. Given a value of Z, race does not matter in how a patient benefits from treatment. We assume for now that there are no costs of treatment (in a later section, doctors and patients will each face a cost).

We can now define what we mean by a fair and efficient allocation. An allocation consists of an assignment of patients to treatment or not by the doctor. An allocation is *fair* if, given severity, the treatment decision does not depend on group membership. In other words, a fair allocation means that for any Z, assignment of a patient to treatment or not does not depend on race. An allocation rule is *efficient* if there is no alternative rule that makes everyone at least as well off and some individuals strictly better off. With complete information an efficient rule leads to a "first best" allocation. In the context of imperfect information, a rule is efficient if, given the information available, there exists no alternative decision rule that can improve the outcome for some patients without decreasing the value of health care for others. We will call the "second best" efficient in a setting with imperfect information.

In the benchmark allocation the doctor is benevolent in the choice of treatment and has complete information about the patient's health needs. Race is always observable. The doctor is benevolent if, given the information available, the doctor makes his treatment recommendation so as to maximize the patient's expected benefits from treatment. (The doctor has no profit or other personal motives.) Complete information refers to the doctor being able to accurately observe the severity Z of each patient (the doctor is a perfect diagnostician).

A benevolent doctor with complete information about severity assigns patients to treatment if and only if the benefits of treatment to the patient are positive. Fig. 1 illustrates the benchmark case in which only patients with $Z \geq 0$ get treatment. The allocation is efficient because there is no way of changing the distribution of treatment without worsening the health care outcomes of one or more patients. The allocation is fair because for any given severity, race doesn't matter in the doctor's decision about treatment. A Black or White with severity Z gets the same treatment assignment and outcome. Different numbers of Blacks and Whites may get treatment, but this does not constitute a disparity. Given need or severity, Blacks and Whites are treated the same. If $\mu_B < \mu_W$, for example, fewer Blacks will have values of $Z \geq 0$, and a smaller share of Blacks will be treated. This is purely due, however, to their lower average severity of illness (see Fig. 1).

[6] Representing the benefits of treatment as a function of severity only disregards individual heterogeneity in evaluation of treatment. If "other factors," for example, time preferences influence valuation and these factors are associated with race, disparities in relation to disease severity would be exacerbated or ameliorated by patient preferences. There is some evidence that patient preferences account for part of the differences between Blacks and Whites (e.g. Ayanian et al., 1999) but the Institute of Medicine (2002) in their report regards them to be a small part of the story.

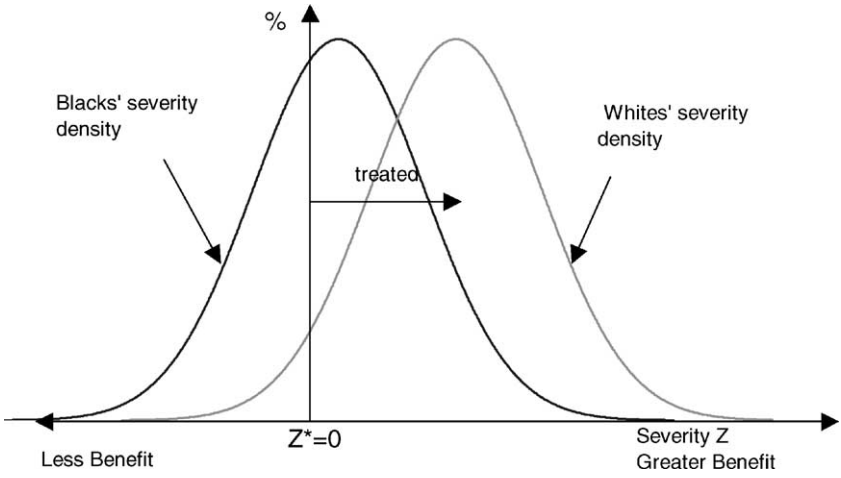

Fig. 1. The benevolent doctor with complete information treats patients with a positive benefit.

3. Prejudice

The most straightforward explanation for clinical disparities is that physicians hold a bias or a "prejudice" against members of other ethnic groups. The literature in social psychology regards prejudice as a negative attitude or affect (Fiske, 1998). This attitude is distinct from cognitively-based stereotypes which can be held with no ill-feeling. Pettigrew and Meertens (1995) suggest that blatant prejudice comes from perceived threats to one's group, in terms of the group's relative position, jobs and welfare. Whether these threats are real or just perceived is another issue. A consistent finding of social identity research is that people tend to favor ingroup members in the distribution of rewards, even when these groups are arbitrarily categorized. Even if an outgroup member conveys no real "threats" to the subject, the mere existence of a group is sufficient to wake in the subject feelings of familiarity (disruption) with ingroup (outgroup) members.

Physician's bias or prejudice is one of the most common interpretations of disparities found at the medical encounter. In Schulman et al. (1999) doctors were presented with recorded interviews of actor patients who differed in sex, race, age, level of coronary risk, type of chest pain and the results of an exercise stress test. Physicians were asked to estimate the patient's likelihood of having a clinically significant coronary disease and whether to refer the patient to cardiac catheterization. Results showed that Black women were referred for catheterization 79% of the time, versus 91% of the time for black mean and white women and men. Differences remained significant even after controlling for symptoms, physicians' estimates of the probability of coronary disease and patient's clinical characteristics. The study conjectured that these differences might be due to "bias or subconscious perceptions" on the part of the physician.

In economics, the concept of prejudice was first explored by Becker (1971) who defined it as a "taste" for discrimination and constructed a model of the labor market in which employers were prejudiced against members of the minority group. This distaste was represented

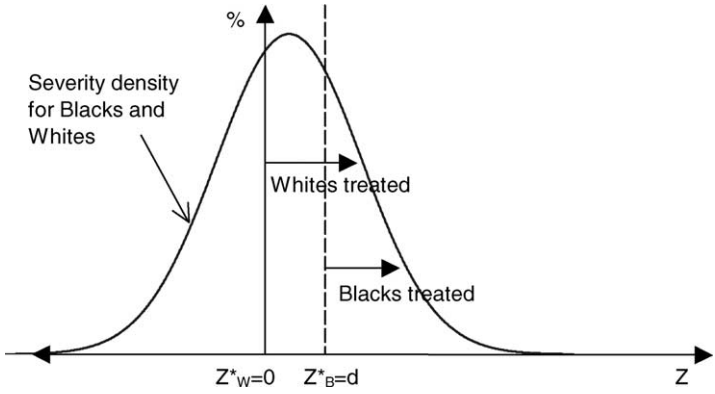

Fig. 2. A prejudiced doctor assigns treatment to Blacks at a lower rate than Whites.

as a (psychological) cost in the objective function of the prejudiced individual. In the following subsection, we follow Becker, and assume that doctors bear an exogenous cost when interacting with minority group members. We address long-term implications of the model and model completeness in Section 3.2.

3.1. Taste discrimination is unfair

The white doctor experiences a psychological cost, or distaste, when dealing with a patient of a different race. We denote this cost as d. Assume $d = 0$ for white patients but $d > 0$ for black patients. As before, benefits from treatment are given by Z, but now the doctor maximizes the patient's benefit net of this psychological cost. Treatment is again a 0,1 decision and the doctor's strategy is to choose a threshold Z^* that determines the cut-off between patients who do and do not get treatment.

The obvious implication of this analysis is that Blacks will be under-treated. Fig. 2 illustrates the simplest case, in which Blacks and Whites have the same distribution of severity. While all Whites with $Z \geq 0$ will be assigned to treatment, only Blacks with $Z \geq d$ will receive care. This allocation is unfair because for some severity levels, black patients are receiving a different treatment recommendation than white patients.[7]

Whether the allocation is efficient or not depends on how we view the "psychological cost" experienced by the prejudiced doctors. If this cost is accepted as legitimate, it has to be taken into account when measuring society's total welfare. Then, the allocation resulting from taste discrimination is efficient because no other allocation can improve the situation of Black patients without having a detrimental effect on either White patients' health or on doctors' welfare. Alternatively, if "prejudice" is not accepted as a legitimate preference or cost, the allocation resulting from taste discrimination is inefficient, since Black patients' situation can be improved by imposing a requirement upon doctors that they treat both races the same way.

[7] d could also be interpreted as a price with determinants on the demand as well as the supply side of the market. We will be picking up this issue below in Section 3.2, where we study the long-term effects of prejudice on the equilibrium price and quantity of health care services.

3.2. Health care markets and the long-term effects of prejudice

In the previous section, we treated prejudice as a "psychological cost" born by the doctor when treating a patient of a different race or ethnic group. Models that treat taste discrimination as a parameter in preferences are criticized on the bases of logical incompleteness (Arrow, 1998). A new strand in economics seeks to explain the appearance of these "transaction costs" between members of different groups by introducing the concept of choice of identity. In Akerlof and Kranton (2000), individuals suffer a loss of utility if their actions confront the prescriptions that define their identity or if others' actions confront these prescriptions (ingroups give the person a higher utility than outgroups). Persons choose both their identities and their actions to maximize the expected payoffs, given the probability of encounters with outgroup and ingroup members. Choice of identity and consequent actions may be a reaction to the dominant class rejection. Social interaction within the community and sense of rejection determine the prevalence of black identities.[8]

Even while representing taste discrimination with a parameter in the physician's preferences, a more complete model would be one that took into account not only the supply, but also the determinants of the demand for health services. The variable d would denote an equilibrium price that takes into account both the psychological cost or "prejudice" experienced by the doctor and the elasticity of demand for the service. A model like this would predict, for example, that lower levels of discrimination should be observed in services that allow for a better assessment of quality ex-ante (e.g. the quality of an obstetrician may be easier to assess than the quality of a thoracic surgeon, therefore a patient should be better able to choose an unprejudiced physician in the case of the former service).

Apart from being criticized for its incompleteness, Becker's model of taste discrimination failed to catch on because it couldn't explain long-run wage differences between white and minority employees. The argument was that unprejudiced employers could enter the market and offer higher wages for the minority employees. Entry would continue until the marginal cost of black labor equaled that of white labor. In the long-run segregation could be an outcome, but not differences in wages. Prejudiced employers would hire only white employees and unprejudiced employers would hire both black and white employees.[9] The extrapolation of this argument to the health care market is not straightforward. Due to several attributes of the health care market, segmentation (prejudiced providers treating only white patients and unprejudiced treating both minority and white patients) is less likely to be an outcome in health care markets than in labor markets. Firstly, information is far from perfect in the health care sector. Patients usually know less about their condition than the doctor does, and have to trust the physician's judgment regarding treatment. This asymmetry of information, together with the fact that many medical services cannot be tested before

[8] It does not really matter for the equilibrium whether the perceived problems reflect real problems between groups or those that are merely imagined because of the mismatch of ingroup and outgroup members' attitudes.

[9] Hellerstein et al. (2002) test whether competitive market forces reduce or eliminate sex discrimination in the labor market. They find that among plants with high levels of product market power, those employing more women are more profitable, consistent with sex discrimination in the short run. They cannot show, however, that competitive market forces penalize discriminatory agents in the long run.

use, reduces the force of competition. Additionally, physicians usually compete through quality or quantity, less often through prices. Not only is it harder for a patient (than for an employee) to identify she/he is being discriminated against, but the chances to find out an unprejudiced provider are also much lower.

Although entry from non-prejudiced physicians might not be sufficient to eliminate differential treatment patterns, some degree of segregation may still occur in the health care market due to doctor and or patient preferences about matching with someone of their own race or ethnicity. Racial matching (minority doctors seeing proportionately more patients of their own race or ethnicity) has been extensively documented in the empirical health literature. After controlling for residential composition of the population, Komaromi et al. (1996) find a large and significant effect of doctor race on the racial profile of patients. Stinson and Thurston (2002) find that in ZIP codes where fewer people speak English, Hispanic doctors have more Hispanic patients than non-Hispanic patients. Other studies focused on the benefits of racial matching conclude that patients express higher satisfaction with the care received when treated by a physician of their same race/ethnicity (Cooper-Patrick et al., 1999); obtain more preventive care (Saha et al., 1999) and stay in treatment longer (Takeuchi et al., 1995; Sue et al., 1991).

4. Clinical uncertainty

We now set aside prejudice, and consider a second possible source of disparity in treatment. The doctor's decision-making process is nested in uncertainty, a long-standing theme in health economics (Arrow, 1963; Eisenberg, 1986; Phelps, 2000). Upon encountering a patient, the doctor collects information in order to decide which is the likely cause of the problem and what actions to take to improve the patient's health. Doctors cannot observe disease and its severity, but can only observe signals, or symptoms, of the underlying problem. The doctor must depend on inferences about severity based on what symptoms he can see and what else he observes about the patient (race, in our analysis). We assume that the doctor is Bayesian in his decision-making: after observing a signal, the doctor uses this signal to update his prior about the expectation of the patient's severity. The higher the doctor's uncertainty, the higher the weight placed by the doctor on the prior and the lower the weight placed on the signal or symptom.

Uncertainty by itself can generate disparities. In this section we show that despite the physician's benevolence, lack of complete information can result in an unfair outcome. In the first application, which we denote the "Miscommunication" model, a doctor may have more difficulty interpreting symptoms from Blacks than from Whites, perhaps because the doctor is White, and can communicate better with members of his own group. Phelps (1972) coined the term "statistical discrimination" to describe the labor market disparities that would result from an employer having a harder time assessing the productivities of black as compared to white workers. In an earlier paper (Balsa and McGuire, 2001), we applied some of these insights originating in labor economics to a health care context. In the second application, which we call the "Rational Profiling" model, the doctor's ability to communicate with black patients is as good as his ability to communicate with white patients. However, the doctor believes that the underlying distribution of severity differs

across races, and hence is willing to use the "category" race as an aid to improve his diagnosis when making an inference about the underlying severity of the patient.[10]

Both applications share a basic framework. As in the benchmark case, severity is normally distributed, $Z \sim N(\mu_i, \sigma^2)$, where $i \in \{B, W\}$. The difference here is that the doctor doesn't observe severity but only a signal of this severity which we denote by S. $S = Z + \varepsilon$, where $\varepsilon \sim N(0, \sigma^2_{\varepsilon_i})$ and distributed independent of Z. The variance of the noise, $\sigma^2_{\varepsilon_i}$ is a measure of the degree of uncertainty present between the doctor and the patient and may also differ across races. Doctors must make a decision about treatment based on the *expected benefits* of treatment. The benevolent (unprejudiced) doctor recommends treatment when the expected benefits of treatment are positive. The doctor uses Bayes' rule to update his priors given the signal he observes. For a patient with signal value S, the resulting expected benefit is equal to:

$$(1 - \beta_i)\mu_i + \beta_i S, \quad \text{where} \quad \beta_i = \frac{\sigma^2}{\sigma^2 + \sigma^2_{\varepsilon_i}} \tag{1}$$

Note that β_i is a measure of the quality of the signal. The noisier is the signal (the larger is $\sigma^2_{\varepsilon_i}$), the lower β_i, and the less weight the doctor puts on the signal itself relative to the severity mean, μ_i.

4.1. Miscommunication leads to disparities

Overt and subtle forms of miscommunication and misunderstanding can lead to misdiagnosis, conflicts over treatment and poor adherence to a treatment plan. In mental health care, for example, many studies show that symptom presentation varies across racial and ethnic groups and can differ from what most clinicians are trained to expect. African Americans and Asians are more likely to somatize psychological distress than Whites (Robins and Regier, 1991; Heurtin-Roberts et al., 1997; Tseng, 1975; Chun et al., 1996). Screening instruments used to detect mental disorders in Latinos may measure distress more than disorder (Vega and Rumbaut, 1991; Cho et al., 1993) and predict the presence of a disorder differently when the patient is interviewed in English as opposed to Spanish (Marcos et al., 1973; Malgady and Costantino, 1998). Cooper and Roter (2001) in a detailed study of physician-patient interactions find communication around depression is worse for minorities than for Whites.

We analyze the miscommunication hypothesis using a simple case. We assume that doctors have no trouble seeing severity for white patients, but for black patients, noise intervenes between severity and the expression of the symptom. To isolate the effects of miscommunication, we assume that severity is distributed identically for Blacks and Whites ($Z \sim N(\mu, \sigma^2)$). For Whites, the symptom the doctor observes, S, is identical to the

[10] An approach based on uncertainty is also subject to the criticism that the underlying source of the differential uncertainty is not identified, and may include bias on the part of physicians. For example, if white physicians are prejudiced against interacting with members of minority groups, they may be more uncertain about minority patients' health status, but here, uncertainty is the result of the underlying cause: bias. Furthermore, uncertainty may change as physicians learn about patients, and the degree physicians invest in learning may itself be determined within markets. While it is important to acknowledge these possibilities, it does not detract from our point that discriminatory treatment can follow from greater uncertainty, whatever the underlying cause of this greater uncertainty turns out to be. In this section we take the same approach as does the literature on statistical discrimination in labor markets, and assume that the uncertainty is given.

patient's severity, Z (the signal perfectly indicates severity). For Blacks, $S = Z + \varepsilon$, where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ and $\sigma_\varepsilon^2 < \infty$. Only for a black patient does the symptom include noise, captured by the ε term.

Seeking to maximize each patient's expected health outcome, the doctor's strategy consists of selecting a threshold severity level, S^*, and recommending treatment to all those patients with severity high enough to exceed that threshold. The doctor determines the threshold by setting (1) equal to 0. For Whites, since $\beta = 1$ (or $\sigma_{\varepsilon W}^2 = 0$), the doctor recommends treatment whenever $S(= Z) \geq 0$. In the case of Blacks, the doctor's strategy consists of recommending treatment whenever the observed signal, S, exceeds the threshold S_B^*:

$$S_B^* = \frac{-(1-\beta)\mu}{\beta} \tag{2}$$

All Whites who have a positive benefit from treatment get treated, and all Whites with a negative benefit from treatment do not get treated (this is as before in the benchmark case). For Blacks, noise prevents the benevolent doctor from matching treatment to benefit with such precision. Doctors must make a decision only on what they see, the signal. Some Blacks with a high true severity will have a very low value of ε and fall below the signal threshold. Some Blacks with low true severity will emit a misleadingly high value of the signal because their ε is high. The criterion represented by Eq. (2) is the best choice of signal cut-off for Blacks given the noise content of the signal. Even with the cut-off optimized in terms of Blacks' expected benefit, treatment for Blacks is subject to mistakes.

The noisy signal reduces the value of the medical encounter to Blacks. For a white patient with severity Z, the expected benefit is: Z if $Z \geq 0$ and 0 otherwise. For a black patient with severity Z, the expected benefit is:

$$Z \Pr(S > S_B^* | Z) = Z\, \Phi\left(\frac{Z}{\sigma_\varepsilon} + \frac{\sigma_\varepsilon}{\sigma^2}\mu\right) \tag{3}$$

where $\Phi(\cdot)$ is the standard normal distribution. For the black patient, $0 < \Phi(\cdot) < 1$, implying that Blacks with any Z always face a risk of being misdiagnosed and mismatched to treatment. If $Z > 0$, the expected benefit from treatment is lower for the black patient, since there is a positive probability that the doctor will deny him treatment when he would have benefited from it. If $Z < 0$, the expected benefit is also lower, since there is a positive probability that the patient will end up being assigned to treatment that turns out to be harmful. The force driving this result is the weaker information content of the signal of severity in the case of Blacks.

While there is a clear disparity in terms of expected outcome in the case of a noisy signal, the picture in terms of disparities in service use is less one-sided. From Eq. (2) we can observe that Blacks will be more likely to be assigned to treatment than Whites whenever the treatment is beneficial to the average patient ($\mu > 0$) and will be less likely to be assigned to treatment in the opposite case. Even though Blacks might in some circumstances get more treatment with a noisy signal, it is still a mismatch of treatment to need. See Balsa and McGuire (2001) for further consideration of this issue.

Fig. 3 describes a case in which treatment is not beneficial to the average patient. The upper graph shows, for any given signal, the benefit the doctor expects the patient to get from treatment. The slope of the expected benefit function with respect to S is smaller for minorities due to the higher noise in the signal for this group of patients. The optimal

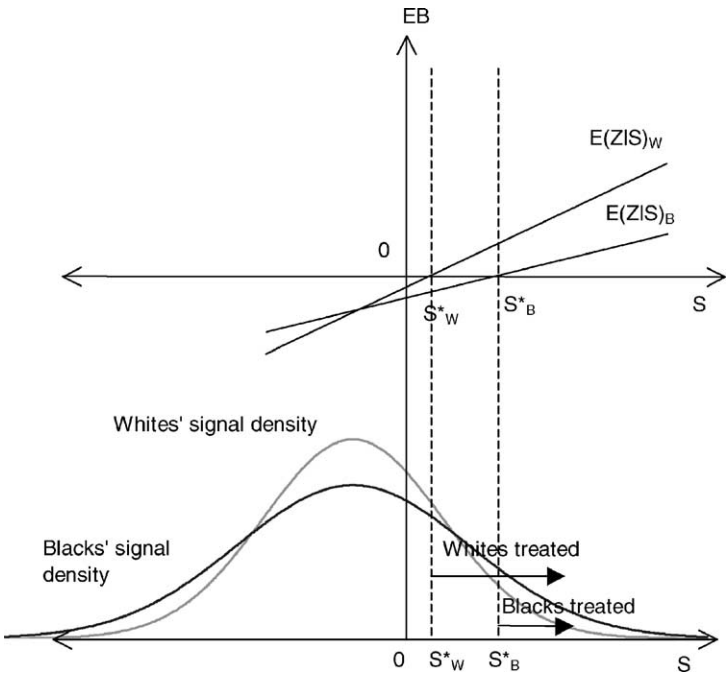

Fig. 3. Miscommunication can lead to disparities.

thresholds for each group equalize the expected benefits to zero. The lower graph describes the distribution of the signal for Blacks and Whites and the fraction of patients recommended treatment, given the optimal thresholds. For some ranges of *S*, Whites and Blacks with the same signal receive different treatment recommendations.

Consider now the fairness and efficiency of the doctor's decisions. The allocation described by Eq. (2) is unfair: race matters to the outcome. Comparing two persons with the same characteristics (only *Z* here), the expected outcome is worse for a Black than for a White. The allocation described by Eq. (2) is, however, efficient given the information available: the expected benefits are maximized for both Blacks and Whites and there is no way of changing the allocation without worsening the health outcomes of black patients, white patients, or both.

A further implication of miscommunication is that minorities might react to the lower value of medical care by demanding fewer health services. The model above can be easily extended to include a search cost of treatment that varies across patients. With such a cost, Blacks will go less to the doctor or comply less with treatment recommendations than Whites because they expect lower benefits from treatment (Balsa and McGuire, 2001).

4.2. Rational profiling or the use of race-related information to improve diagnosis

Physicians usually make diagnosis and treatment decisions in a context of uncertainty. Given imperfect information about the patient's health status, doctors have to rely on

"easy-to-observe" variables, as age, gender, culture, ethnicity and other life circumstances to improve their inference about the patient's condition. Although the presence of "biological" differences due to race is controversial, there is evidence that members of different races have distinct prevalence rates for certain conditions and respond differently to some drug treatments (Chen et al., 2001; Exner et al., 2001). For example, some depression drugs are metabolized more slowly by African Americans than Whites, and should therefore be administered in lower doses (Lin et al., 1997). The prevalence of some diseases, such as hypertension is greater among some racial/ethnic groups than others (Benson and Marano, 1998). While rational profiling has been criticized for leading to negative stereotypes (Schwartz, 2001), using prior evidence in medical decisions can optimize doctors' choices. For instance, doctors aware that older patients are more likely to be hypertensive than younger patients may be more likely to repeat a blood pressure test in the former group of patients and assign scarce diagnosing resources more efficiently.

In our model, we represent rational profiling by assuming that the means of the underlying severity distributions differ by race; specifically $Z \sim N(\mu_B, \sigma^2)$ for Blacks and $Z \sim N(\mu_W, \sigma^2)$ for Whites, where $\mu_B < \mu_W$. The doctor is aware of these different means. Again, however, the doctor cannot observe Z, but only a symptom or signal of severity, S. The signal $S = Z + \varepsilon$, where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$, but this time the distribution of the noise is identical for Blacks and Whites. The doctor will be impelled by what we refer to as "rational profiling" to treat Blacks and Whites with the same severity differently. Differences in mean severity are meant to capture differences in the likely benefit of therapy.

As before, the threshold chosen by the benevolent physician is $S_i^* = -(1-\beta)\mu_i/\beta$, where β is the same for both groups of patients. The difference between each group's thresholds is given by:

$$S_B^* - S_W^* = \frac{1-\beta}{\beta}(\mu_W - \mu_B) \tag{4}$$

While the optimal threshold in a framework with complete information would be $Z^* = 0$ for both groups, because of uncertainty, the doctor will find it optimal to set a lower threshold for the group with a higher mean severity (i.e. set a lower threshold for Whites than for Blacks). The more noise, the bigger the difference between the thresholds. Again, the expected value of treatment for a patient with severity Z is given by Eq. (3). When doctors discriminate by race for rational profiling reasons, white patients do not always fare better than black ones. In the miscommunication framework, the likelihood that a doctor misdiagnoses the patient's condition is always higher for Blacks, no matter if the patient is "healthy" ($Z < 0$) or "sick" ($Z > 0$). When rational profiling reasons are behind disparities, and $\mu_B < \mu_W$, the doctor is more likely to misdiagnose black patients who are "sick" (not assign treatment when the patient would benefit from it), but less likely to misdiagnose black patients who are "healthy." Whites that should not receive treatment are more likely than Blacks in the same situation to be erroneously recommended for care.

The doctor's discrimination equalizes the marginal expected benefits from treatment across the different racial groups. See Fig. 4. The upper graph shows, for any given signal S, the benefits the doctor expects white patients and black patients to receive from treatment. Since the doctor is Bayesian and weighs both the observed signal and the prior about the

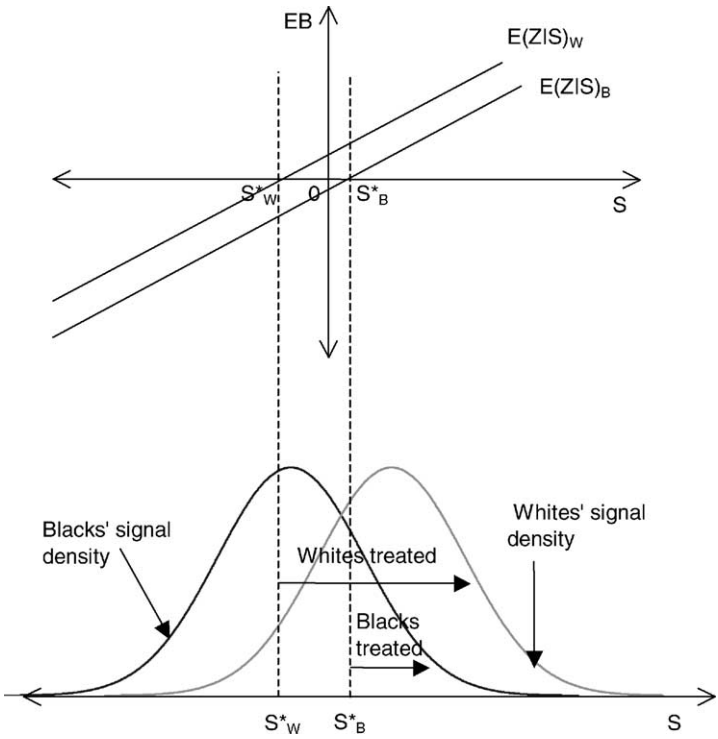

Fig. 4. Using race as a category to improve diagnosis.

severity distribution, expected benefits of Whites (whose prior is higher) are shifted by a constant above those of Blacks. The threshold that maximizes each group of patients' expected benefit is that which makes the expected benefit function equal to zero. The lower graph shows the fraction of Whites and Blacks receiving treatment given the threshold signal chosen by the doctor. We can see that, with the chosen thresholds, some white and black patients with the same severity (and also the same signal) are treated differently. Concretely, a white patient with a signal between S_W^* and S_B^* is recommended treatment whereas a black patient in the same severity interval is not.[11]

The outcome of racial profiling is unfair, because race matters in the decision. Otherwise identical Blacks and Whites, including those emitting the same symptom-signal, are treated differently. But the allocation rule is efficient. Social welfare is maximized given the information available. If the doctor were to employ a common threshold for Blacks and Whites, the doctor would misdiagnose more patients in each group and the value of medical care would be reduced for the average black and white patient.

[11] These conclusions depend partially on the assumption of a constant variance of Z across groups. If, instead, a constant coefficient of variation were assumed, the conclusion that more noise increases the difference between the thresholds would still be valid, though the sign of the difference (who receives more and who receives less) would differ.

The "rational profiling" mechanism generates disparities even if the doctor is benevolent and even if the doctor's priors about the distribution of the underlying severity in the two populations are accurate. It is natural to ask, however, how inaccurate physician beliefs might lead to disparities. We consider this under the name of "stereotyping" in Section 5.

4.3. Learning, matching and other long-run issues related to clinical uncertainty

As in the prejudice model, completeness is also a weak spot in the miscommunication model of Section 4.1. In particular, the origin of the differences in doctor's perceptions of blacks' and whites' signals remains unexplained. Differential information by race is also an assumption in most labor models of statistical discrimination. Such an assumption is motivated by appealing to pre-market exposure to one group through family or segregated neighborhoods. An exception is Lundberg and Startz (2002), who examine how racial differences in information might arise endogenously from strategic behavior in a search model with learning. In their model, heterogeneous and imperfectly informed agents (doctors, in our case) learn about their counterparts' (patients) quality from experience. Because of the small size of the minority group, agents are more likely to invest in the relatively more valuable information about the larger group and therefore exclude the minority group. This result is generated solely by assuming that agents believe that learning is race-specific. Alternatively, differential information by race could be rooted in physician bias. If a doctor is prejudiced against interacting with members of minority groups, the doctor will probably be more uncertain about minority patients' signals about health status. While it is true that a more complicated model that addressed the endogeneity of information could be constructed on the basis of any of the above hypotheses, the relevant point in our analysis is that, no matter how this uncertainty originated in the first place, uncertainty by itself generates differences.

A second aspect is whether the market is able to eliminate, in the long-run, discrimination resulting from uncertainty. In Balsa and McGuire (2001), we recognize that uncertainty may change as physicians learn about patients, and the degree physicians invest in learning may itself be determined within markets. If communication is a problem for one or both parties in an exchange, they will have an interest in improving it. Patient and doctor could "invest" in order to better understand the other party.[12] Because of learning, discrimination due to miscommunication should be lower in hospitals with large minority clientele, in services that occur with more frequency, when doctors are aged and when the relationship between doctor and patient has been sustained for a longer period. Still, because of the smaller size of the minority group, we should not expect the investments to completely equalize the doctor's ability to communicate with members of different races. Furthermore, the gap will be even more difficult to bridge if learning and communication are more costly between doctors and minorities than between doctors and Whites. If miscommunication is generated by bias, as we acknowledged before, then the arguments given in Section 3.2 apply.

[12] For instance, a patient could bring a relative along on a visit to improve her understanding of the doctor or the physician could invest by willing to spend a longer time with patients with whom there is a communication problem. The physician could also change the nature of information collection and substitute more "objective" tests for patient self-reports where possible.

Segregation or "racial matching" is likely to be an outcome in the long-run when differential information lies behind the differences in treatment and communication problems are costly to fix. In the learning model described above, Lundberg and Startz (2002) derive equilibria characterized by racial segregation of transaction patterns. They argue that "if learning about signal-quality relationships is believed to be race-specific, then small initial differences in the quality of information (including those due solely to group size) can lead to segregation and potentially, to a self-reinforcing cycle of ignorance and avoidance." Again, as we analyzed for prejudice, because of the frictions of the health care market and also due to the much smaller number of minority physicians in relation to Whites, segregation is unlikely to be perfect and differences in treatment are likely to persist.

5. Stereotypes

We now isolate a third possible source of disparities within the clinical encounter: stereotypes about minority patients held by physicians. Stereotyping is a term used by social psychologists to refer to "the process by which people use social categories (e.g. race, gender) in acquiring, processing, and recalling information about others" (Dovidio, 1999, p. 804). Williams and Rucker (2000) argue, based largely on studies outside of health care, that negative stereotypes about minorities are an important explanation for health care disparities. There is evidence that many white Americans attribute negative stereotypes to Blacks (Davis and Smith, 1990), and that negative stereotypes translate into discriminatory behavior of Whites towards Blacks in housing, education, and other areas (Hilton and von Hipple, 1996). In a health care context, van Ryn and Burke (2000, p. 814) argue that "Physicians may be especially vulnerable to the use of stereotypes in forming impressions of patients since time pressure, brief encounters, and the need to manage very complex tasks are common characteristics of their work." These authors studied physician beliefs about patients in 618 medical encounters. After controlling for patient socio-economic status and other factors, they found that physicians believe Blacks are more likely to abuse drugs or alcohol, less likely to comply with medical advice, and less likely to participate in rehabilitation therapy.

Stereotypes can arise and be sustained for different reasons. In contemporary social psychology, the prevailing approach to stereotypes is cognitive, viewing stereotypes as a way to "simplify and organize social information" (Dovidio, 1999), an element of what everyone does to avoid paralysis in a complex world. Beliefs about outgroups tend to be negative and exaggerated, stemming from individuals' propensity to associate favorable characteristics to their own ingroup (Ashmore and Del Boca, 1981).

Stereotypes can evoke reactions in the target group that confirm the original negative belief, a phenomenon Loury (2001) believes to be central to racial issues in the US. This approach fits well with the economic approach to stereotypes that requires that a belief held by a (rational) economic actor be confirmed in market equilibrium (Arrow, 1973). In this section, we show how a negative stereotype about Blacks—"Blacks can't be relied upon to comply with treatment recommendations"—can become a self-fulfilling prophecy and lead to disparities in treatment. We thus do not consider stereotypes as a device an individual

or group uses to enhance personal and ingroup esteem at the expense of others. Analysis of stereotypes from this perspective would put no restriction on beliefs in terms of the information available to the individual. Stereotypes satisfying a need for self-esteem could be a basis for the "prejudice" that we studied in Section 3 above.

Stereotypes are not easily distinguishable from prejudice empirically. We are not aware of any work in health economics concerned with identifying stereotypes from other sources of discrimination. In labor economics, however, Moro (2001) addresses the question of whether observed time series variation in the black–white wage gap in the US may reflect movements across multiple equilibria rather than changes in fundamentals.

We assume that doctors observe severity accurately (thus setting aside problems of communication that are worse for Blacks than Whites) and that doctors value the net benefit of treatment the same for both groups (setting aside prejudice). To make a role for stereotypes, we must enrich the model of the medical encounter. We assume that the benefit of treatment depends on decisions by the doctor and the patient, as well as on the severity of the patient's condition. The doctor makes a decision to take effort to be conscientious in treatment of a patient, and the patient makes a decision about whether to comply with the doctor's recommended treatment regimen. Conscientiousness and compliance both contribute positively to outcome. Although doctors can observe severity, they must make a decision about the effort they choose to put in prior to observing whether patients comply. Patients do not directly observe whether or not doctors have been conscientious with them. This is a setting in which stereotypes—beliefs held by the doctor—can turn a situation of a priori equality into one of ex post disparity. In what follows, Blacks and Whites will be completely identical in all respects. A "stereotype" is a belief doctors hold about the likelihood that patients will comply with recommendations. We do not explain where these beliefs come from, but we do show that negative beliefs about Blacks can be self-fulfilling. We discuss model completeness at the end of this section.[13]

5.1. *Stereotypic beliefs can cause disparities*

We show how stereotypes can generate disparities by an example. Benefits from treatment depend on the patient's severity, Z, and on the doctor's effort and the patient's willingness to cooperate with the diagnosis/treatment process. Let e^{d} be doctor's effort and e^{p} be the degree of patient's cooperation. Doctor's effort e^{d} can take the values of $\{0,1\}$ and patient's effort $e^{\mathrm{p}} \in \{e_L, 1\}$, where $0 < e_L < 1$. We modify the benefits from treatment to allow for doctor's and patient's effort to have an impact on treatment outcomes. A patient with severity Z whose level of cooperation is e^{p} derives a gross benefit from treatment of $Ze^{\mathrm{p}}e^{\mathrm{d}}$ when the doctor's level of effort is e^{d}. Additionally, both doctor and patient have to incur certain costs when making high effort and when cooperating, respectively. We denote the doctor's cost of high effort as c^{d} and the patient's cost of cooperating as c^{p} (we normalize the costs of low effort/no cooperation to zero). The doctor maximizes the patient's gross

[13] While rational profiling also involves the "use of social categories in acquiring, processing and recalling information about others", for a negative stereotype to exist, some externality is required in addition to rational profiling. That is, a priori untrue beliefs cannot be held by rationally profiling doctors unless a negative externality makes these prophecies self-fulfilling.

Table 1
Doctor Stereotypes Lead to Multiple Equilibria

Patient	Doctor	
	High effort	Low effort
Cooperate	$(Z - c^{p}), (Z - c^{d})$	$(-c^{p}), (0)$
Don't cooperate	$(Ze_L), (Ze_L - c^{d})$	$(0), (0)$

benefit from treatment net of his own cost of effort. White and black patients are identical in terms of severity, costs and benefits from treatment. The stereotype we analyze is the doctor's belief that "Whites cooperate in treatment, but Blacks do not cooperate."

The patient's payoffs are given by the gross benefits from treatment net of the costs of cooperation. The Table 1[14] describes the game's payoffs for a patient with severity Z.

We assume that $(Z - c^{d}) > 0$ but $(Ze_L - c^{d}) < 0$, part of what needs to be true here for a stereotype to be sustained. It is worthwhile for the doctor to be conscientious if the patient cooperates with treatment $(Z - c^{d}) > 0$ but it is not worthwhile if the patient does not cooperate $(Ze_L - c^{d}) < 0$. Similarly, on the patient's side, for the stereotype to be sustained, the optimal strategy for the patient must be to cooperate if his cost of cooperation is sufficiently low and the doctor puts high effort $Z - c^{p} - Ze_L > 0$, and not to cooperate otherwise $(-c^{p} < 0)$. Both (cooperate, high effort) and (don't cooperate, low effort) are Nash equilibria of the simultaneous game described above. Payoffs like the ones shown above are plausible and can sustain different equilibria for black and white patients. Disparities result if white patients end up in the (cooperate, high effort) equilibrium but black patients end up in the (don't cooperate, low effort).[15] Note that in spite of the fact that black and white patients are identical in all respects, and doctors are without prejudice, the doctor's stereotype of the non-compliant black patient is confirmed by the doctor's experience in equilibrium.

An allocation resulting in disparities because of stereotypes (a "coordination failure" in the language of game theory) is both unfair and inefficient. It is unfair because identical patients (same severity, same costs) are being treated differently. It is inefficient because Blacks for whom it would be efficient to cooperate—those Blacks with low costs of cooperation—are driven into non-cooperation by the doctor's beliefs.

5.2. *Long-run stereotypes*

In the analysis above, doctor and patient's strategies are discrete. More subtle (and realistic) forms of stereotypic beliefs, like those reported by van Ryn and Burke (2000) that Blacks are "less likely" to comply, can also be sustained in equilibrium with the restriction

[14] The first expression in each cell stands for patient's payoffs and the expression after the comma stands for doctor's payoffs.

[15] Another application of the same idea is the following. Say doctors have two kinds of treatments to assign patients to, one of them more expensive but also more effective than the other. If the effectiveness of the superior treatment depends on patients' compliance, and doctors believe Blacks to be less compliant than Whites, then they might end up assigning Blacks at a lower rate to the superior treatment.

that doctor's beliefs must be confirmed by experience. Coate and Loury (1993a) develop a more realistic and subtle analysis of stereotypes in the labor market, with continuous strategies. They analyze in a dynamic framework the interactions between employers and white and black employees when productivity cannot be directly observed. In their model, workers play first by investing or not in training, subject to their expected returns, and employers make their job assignment decisions after observing an imperfect measure of the worker's productivity. The authors conclude that an equilibrium in which identical Blacks and Whites are assigned to differential tasks can be a stable one. Coate and Loury's analysis of stereotypes in the labor market can be directly extrapolated to health care by relabelling the agents' strategies and using the payoffs in Section 5.1. In the health care setting, the patient's decision to cooperate or not with the doctor is equivalent to the worker's strategy to invest or not in education. Similarly, the doctor's decision to put high effort or low effort in the treatment corresponds to the employer's decision to assign the worker to a high or a low skill task. In this translated model, the physician's prior beliefs can place minority workers in a range in which the effects of complying with treatment on treatment outcome might be lower than for Whites.

Modeling our stereotyping game as in Coate and Loury's analysis has the advantage of showing the dynamics that allow stereotypes to be sustained in a multiple equilibria setting. However, Coate and Loury also do not explain where the stereotypes come from in the first place. We believe a model restricted to the analysis of the health care market is unlikely to be able to explain the source of stereotypes. Economics may have to take a back seat to social psychology when it comes to the origin of stereotypes. Stereotypes like "Whites can't be trusted" or "Blacks are unreliable" tend to be general and can therefore be regarded as having an origin outside the medical encounter. Furthermore, separating inaccurate and negative stereotypes from accurate generalizations is easy only in abstract discussions. Probably a model of endogenous group formation with human capital externalities and a historical initial difference would be the right one when trying to explain the origin of stereotypes. While we are aware of no paper in economics dealing with the origin and persistence of stereotypes, there is significant research on human capital externalities and their incidence on residential and work segregation, and the persistence of discrimination, even in the absence of prejudice. Because residential segregation and human capital externalities may perpetuate stereotypes, papers on these lines may shed light on the formation and persistence of stereotypes (Lundberg and Startz, 1998; Borjas, 1995; Benabou, 1996). If stereotypes are perpetuated by residential segregation, then there are incentives for segregation or "racial matching" in the medical encounter.[16] Again, informational frictions in the health care market would prevent segregation from being perfect. If, on the other hand, stereotypes are perpetuated at medical schools, then both minority and white physicians are likely to treat patients in the same way and segregation would not be an outcome. The role of health care market frictions in molding the stereotyping equilibrium may be even stronger. Because a stereotyping equilibrium requires that patients are informed in some degree about the doctor's choice set and their own severity, the informational imperfections of the health care market may make the stereotyping equilibrium less sustainable.

[16] Because of their low number, actions taken by minority physicians are not likely to eliminate stereotypes.

6. Implications for policy

Two general types of policies have been proposed to address disparities. The first consists of improving the information available to agents in their decision-making processes. We call this approach an "information-based" policy. Promoting cultural competency, interpreter services, recruitment and retention policies, training, coordinating with traditional healers, use of community health workers and inclusion of family members (Brach and Fraser, 2000) all belong to this type of policy. The other proposed intervention to deal with disparities is to require that the same criteria for treatment be applied to Blacks and to Whites, based on an argument of civil rights: Blacks are entitled to the same treatment as Whites. A rule for literal "equality" in rates would not be feasible to implement. What would be feasible would be a rule that puts the burden of proof on a provider (a hospital, say) to demonstrate that if rates of treatment are different, there is a medical reason to justify the difference. The legal burden of proof falls this way in the context of potentially discriminatory practices in labor markets.[17] We refer to such a policy as a "rule-based" policy because it requires doctors' assignment of patients to treatment to satisfy a certain rule. Title VI of the 1964 Civil Rights Act prohibits discrimination for some "neutral" purpose (e.g. clinical decision-making in response to uncertainty) if it has a "disparate impact" on racial/ethnic groups.[18] We show in this section that while rule-based policies are the obvious solution to disparities caused by prejudiced doctors, when information problems are at least partly behind clinical disparities, the analysis is more complex.

6.1. Information can help reduce disparities stemming from miscommunication but rules run a risk

We begin by analyzing the consequences of policy in the case of miscommunication. We show that when disparities are due to a less informative interaction between minorities and the doctor, the policy to implement is one that helps improve the information content of minority patients' signals. Enforcing rules in the doctor's decision-making, without changing the information available to the doctor, will have detrimental results for both black and white patients.

Mismatches of treatment to needs decrease as the noise in the signal falls. This follows directly from Eq. (3) in Section 4.1. Improving doctors' ability to interpret symptoms from minority patients (moving communication more towards the white level) increases expected outcomes. Improving doctors' communication skills, implementing language programs, or even modifying clinical tests to better pick up key information from ethnic and racial minority patients are among the policies that have been suggested (Caudle, 1993).

[17] See Epstein (1992) for discussion of the application of the Civil Rights Act to labor markets. Bloche (2001) contains a general discussion of the value and limitations of rule-based policies in the context of health care disparities. See Perez (2002) and Rosenbaum (2002) for advocacy for a civil rights approach to contending with disparities.

[18] Title VI prohibits discrimination on the basis of race, color or national origin by recipients of "federal financial assistance." While limited in scope by the requirement of federal assistance, Title VI has a broad impact in health care given the enormous role that federal financial assistance plays in the health system (Rosenbaum et al., 2000).

A rule-based policy, on the other hand, will not only fail to improve the situation of black patients, but will probably have negative implications for the average health outcome for both groups. If severity is distributed identically for Blacks and Whites, a rule-based policy that requires doctors to assign black patients to treatment at the same rate as Whites, is equivalent to requiring that doctors apply the same signal threshold (to qualify for treatment) for patients of either group.

To analyze the welfare implications of such a policy we must construct for each group the expected benefits from treatment given a certain threshold. For Blacks, this expression is:

$$EB(\tilde{S}, \beta_i) = \left[1 - \Phi\left(\frac{\tilde{S} - \mu}{\sigma_{S_i}}\right)\right]\mu + \beta_i \sigma_{S_i} \phi\left(\frac{\tilde{S} - \mu}{\sigma_{S_i}}\right) \tag{5}$$

where $\tilde{S}$ is an arbitrarily chosen threshold and $\sigma^2_{S_i}$ the variance of the signal ($\sigma^2_{S_i} = \sigma^2 + \sigma^2_{\varepsilon_i}$).[19] For Whites, welfare is measured by replacing β_i in Eq. (5) with 1 and $\sigma^2_{S_i}$, with σ^2. Black patients' welfare is maximized when the physician chooses $S^*_B = -(1 - \beta_B)\mu/\beta_B$ while white patients' welfare is maximized when $S^*_W = 0$. It is easy to show that each group's welfare function is concave at the optimum.[20] Thus, any common threshold must make at least one group worse off. The best single cut-off under a rule-based policy maximizes the expected benefit to the population as a whole.[21] This compromise makes both groups worse off. Fig. 5 illustrates the effect of choosing a common threshold in the case in which Blacks and Whites share the same distribution of severity but there is noise in the signal. Choosing the best common threshold S^*_{BW} decreases the expected benefit to both groups below that obtainable if separate thresholds, S^*_B and S^*_W, can be used.

Consider the fairness and efficiency of a rule-based policy. As just noted, such a policy is inefficient for both groups. A rule-based policy will on average reduce the value of the health care encounter for Blacks and Whites. Nor is a rule-based policy fair. A rule-based policy achieves parity in the application of symptom criteria, but this is not the same fairness as we have defined it above. A rule-based policy that optimizes the choice of a signal threshold for the whole population still leaves Whites better off. Indeed, for any rule-based threshold that is a compromise between that for Blacks and Whites, Whites are better off. It is possible to achieve a "fair" policy in the sense of equalizing expected benefits given a signal, by

[19] Note that $EB(\tilde{S}) = \int_{\tilde{S}}^{\infty} [\{1 - \beta\}\mu + \beta S](1/\sigma_S)\phi((S - \mu)/\sigma_S)\, \mathrm{d}S$ which after some manipulation, involving the use of the truncated normal distribution, can be expressed as Eq. (5).

[20] Welfare function is concave at the optimum:

$$\frac{\partial^2 EB(S^*_i, \mu)}{\partial \tilde{S}^2_i} = -\phi\left(\frac{\mu}{\sigma_S \beta_i}\right) < 0.$$

[21] Let λ be the fraction of Whites in the population. Under a rule-based policy, the doctor will set S^* so that it maximizes:

$$(1 - \lambda)\left\{\left[1 - \Phi\left(\frac{\tilde{S} - \mu}{\sigma_{S_B}}\right)\right]\mu + \beta_B \sigma_{S_B} \phi\left(\frac{\tilde{S} - \mu}{\sigma_{S_B}}\right)\right\} + \lambda\left\{\left[1 - \Phi\left(\frac{\tilde{S} - \mu}{\sigma_Z}\right)\right]\mu + \sigma_Z \phi\left(\frac{\tilde{S} - \mu}{\sigma_Z}\right)\right\}$$

The optimal threshold can be shown to be: $S^*_{BW} = -(1 - \lambda)(1 - \beta_B)\mu/(1 - \lambda)\beta_B + \lambda$, a compromise between the optimal level for Whites (0) and the optimal level for Blacks in the discriminatory equilibrium.

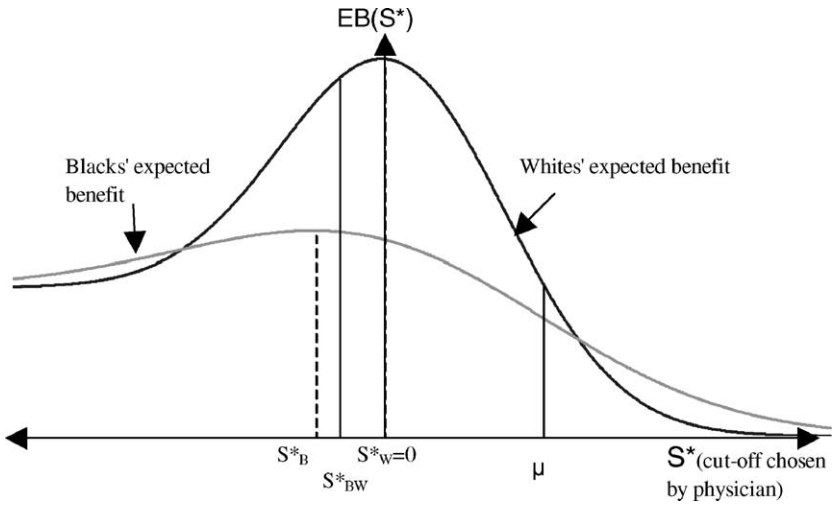

Fig. 5. A noisy signal means Blacks' efficient cut-off differs from Whites'.

moving the signal threshold far enough away from the regions in which the maxima occur (see Fig. 5), but this is destructive for both groups. In sum, when disparities are caused by increased clinical uncertainty in reading the symptoms from Blacks, a rule-based policy is never efficient. A rule-based policy is never fair except in the case of a policy strictly dominated in efficiency terms.[22]

6.2. The limited scope of information-based policies at combating prejudice and stereotypes

Ignorance and unfamiliarity as sources of stereotypes and prejudice have received ample attention in the social psychology literature (Fiske, 1998). The underlying proposition is that infrequency of contact fosters ignorance, which promotes anxiety and frustration, assumed dissimilarity and stereotyping, together leading eventually to prejudice. Information, in the form of sustained personal experience countering the stereotype, has been shown in some cases to change beliefs (Fiske, 1998). If this were the case in health care, multicultural education that stressed understanding of group differences might eliminate stereotypes or alleviate prejudice by promoting empathy and understanding between doctors and minority patients. However, social psychologists acknowledge that the scope of informational policies in the fight against prejudice and stereotypes is limited, even when lack of information and ignorance are recognized as the main causes of biased or prejudiced behavior. People don't always use information objectively. Negative information is more powerful than positive information; its rarity and unexpectedness give it more weight. Additionally, it is unclear how a policy aimed at changing the experience of doctors on a

[22] A rule-based policy will also be inefficient when disparities are generated because of rational profiling. Each group's welfare function is concave at the optimum threshold chosen by the doctor.

large scale would be implemented.[23] We showed in Section 5 (stereotypes) that doctors' beliefs can relegate Blacks to a "bad equilibrium"—one that is inefficient in comparison to the equilibrium for Whites, and one that is unfair. The problem is that the bad equilibrium can be a stable equilibrium: black patients are acting in their self-interest, given doctors' beliefs and actions, when they show less cooperation. Stability of the equilibrium implies that black patients' rational response to a unilateral favorable change in beliefs of doctors would work to reestablish the initial bad equilibrium, unless the change is very large (and thus hard to achieve). A small change will appear futile and fail to dislodge the equilibrium. The negative stereotypes will tend to be restored. The implication of our analysis is that information-based policies may need to convince both doctors and black patients to change their beliefs about the other party, and that these changes would have to be non-incremental to succeed in establishing a new pattern of interaction. Information-based policies in just one area of social interaction—health care—are very unlikely to be powerful enough by themselves to make a difference when prejudice or stereotyping are on the basis of the discriminatory behavior.

It seems clear that if doctor prejudice/stereotypes are among the causes of disparities, some form of rule-based policy is necessary to address the problem. A rule-based policy will be enforceable if it depends on a verifiable activity.[24] Suppose the rule to be satisfied by any doctor is that the fraction of black patients assigned to a particular type of treatment should be equal to the fraction of white patients assigned to that treatment. This is analogous to an "equal opportunity" policy in labor markets, analyzed by Lundberg (1991), where employers are required to promote the same share of black and white workers to higher grade jobs. The doctor faces now a restricted problem: the doctor has to make a decision about treatment subject to an equal opportunity constraint.

Consider the implications of a rule-based policy in the stereotyping model analyzed in Section 5. When doctors have identical beliefs about black and white patients the equal opportunity constraint is not binding. Since an equilibrium with identical beliefs is always a possible outcome of the unconstrained problem (in Section 5.1, both groups could end up in the cooperate, high effort equilibrium if doctors believed that all patients were cooperative) and because it satisfies automatically the constraint of the restricted problem, it is also a possible outcome of the problem with an equal opportunity policy. However, if beliefs are different for each group, then the constraint is binding in the restricted problem. If λ is the number of white patients in the population, a pure strategy for the doctor will be to provide "high effort" treatment to every patient if $\lambda(Z - c^{\mathrm{d}}) + (1-\lambda)(Ze_L - c^{\mathrm{d}}) > 0$ and to provide "low effort" treatment to everyone if that expression is negative.

In the simple game described in Section 5.1, an equilibrium that entails identical beliefs about groups is the only possible equilibrium once the policy is introduced. Then, a temporary policy will produce the permanent benefit of ensuring that doctors will respond equally to both groups in a new equilibrium (and no further enforcement will be necessary). In this case, if the equilibrium for Blacks is initially Pareto dominated and λ is sufficiently high, a

[23] As far as we know, there is very little work in the social sciences that addresses the problem of how to redress inefficiencies and inequities associated with the coordination failure caused by stereotypes. Our comments here should be regarded as speculative.

[24] Rule-based policies have been subject to formal analysis in the labor literature (Coate and Loury, 1993a,b).

policy that enforces the same outcome for both groups can change the incentives to cooperate for black patients and progressively change the doctor's beliefs about this group. A rule-based policy will then improve economic welfare by shifting the Black equilibrium from low beliefs to high beliefs.[25]

Coate and Loury (1993a) analyze the implications of a rule-based policy (affirmative action) in a stereotypic equilibrium in which the employers (physicians) are Bayesian and infer from a signal the likelihood that the employee (patient) has invested (cooperated). Although affirmative action is shown there to improve welfare for minorities, its effect on the underlying stereotypes held by employers is not straightforward. The authors show that there are circumstances under which affirmative action policies not only fail to eliminate negative beliefs but may worsen them. This may occur if preferences induce employers (doctors) to "patronize" the favored workers (patients), which in turn undercuts their incentives to acquire necessary skills (to cooperate with treatment). In that case, the efficiency effects of a rule-based policy will not be clear, and even worse, the policy may encourage the race-conscious behavior of doctors (if stereotypes get even more negative with the policy). A rule-based policy, while solving some fairness and efficiency issues, causes other efficiency problems to get worse.[26] Complementing these policies with information-based actions may be a way to attack the issue at its root by ensuring stereotypes are also being eliminated.

7. Conclusions

How the interaction between doctor and patient contributes to disparities is not well-understood. The crudest and simplest case is when a doctor indulges a prejudice against minorities and authorizes less treatment for a minority than for a white patient. The emphasis in the empirical literature on disparities documenting lower rates of health care use would seem to accord with this underlying hypothesis of what is going on between provider and patient. This case is (conceptually at least) also a simple one in terms of policy: rule-based actions are the way to go.

A major goal of this paper, drawing from the rich literature in labor economics, was to point up another set of possibilities for the way disparities might come about in the clinical exchange, consistent with the doctor or other health care provider having an equal regard for the health of white and minority patients. Having difficulty understanding symptom reports from minority patients, or holding beliefs about minorities that lead the doctor to make different decisions for minorities, are distinct from prejudice and lead to disparities through more subtle mechanisms. Greater clinical uncertainty and stereotypes are at base

[25] When prejudice is behind disparities, enforcing a policy that requires the same rates of assignment to treatment for both groups will result in an improvement of health care conditions for minorities and in a fair outcome. The ideal rule would require that doctors set the same threshold for Whites than for Blacks, at $Z = 0$. Welfare for black patients would improve then at no cost for white patients. However, it is likely that Z is hard to monitor by a regulator. In that case, the only policy that might be enforced is one that requires equal treatment rates for both groups. Although such a policy would improve welfare for Blacks, the improvement would be smaller than that obtained with the ideal rule and come at a cost of a decreasing welfare for Whites.

[26] A further implication of an "equal opportunity" policy is that it can increase inefficiencies if there are real underlying differences between the two groups. Efficiency would decrease then due to the restrictions imposed to the use of group membership information in the doctor's decision-making process.

information problems. Designing effective policy in these cases is more difficult. For one thing, policy must recognize that doctors and patients may be "doing the best they can" given the information available to them. Information interventions may be more on target and safer when uncertainty is the culprit. Rule-based policies, such as requiring doctors to act in a race-blind fashion, when race conveys information that can help the doctor decide what to do for the patient, can make matters worse for the patients the policy is designed to help.

We acknowledge that we are only able to make general comments about policy with the conceptual approach employed in this paper. Our analysis is better suited to identifying cautions than for prescribing actions. All three things may be going on at once—and others besides. The mixture of causes is likely to differ in different clinical areas, geographic areas, and types of health care systems, calling attention to the importance of empirical research.

While there is essentially no dispute in the literature that racial and ethnic disparities exist,[27] there is unfortunately almost no empirical literature sorting out the contribution of the factors at work in the clinical encounter—prejudice, uncertainty and stereotypes. Research clearly establishes the saliency of the role of uncertainty in clinical decision-making. Patients seek help, present symptoms, and respond to recommendations differently (Bursztajn, 1990; Goff et al., 1998). How people experience and report pain, for example, varies greatly and systematically with patient characteristics (Bonham, 2001). There have been many creative experiments, using vignettes (Weisse et al., 2001; Rathore et al., 2000), subliminal messages flashed on computer screens (Abreu, 1999), or observations of medical training (Finucane and Carrese, 1990) to study the presence of bias and stereotyping among medical professionals (bias and stereotypes are not distinguished in the studies just noted). What is missing in the literature, in our view, is the empirical connection between these phenomena and differential treatment of racial/ethnic minorities. The Institute of Medicine (2002) recently reviewed the literature on the causes of health care disparities, and recognized the gap: "Indirect evidence indicates that bias, stereotyping, prejudice and clinical uncertainty on the part of health care providers may be contributory factors to racial and ethnic disparities in health care .... However, few studies have attempted to assess these mechanisms, and therefore direct evidence bearing on the possible role of these factors, especially prejudice, is not yet available (p. 140)."

Almost without exception, empirical research on disparities seeks to document "how much less" minorities are getting. We want to encourage empirical research of another type. Based on explicit formulations (hypotheses) about the mechanisms that might be responsible for disparities, research should test the relative importance of the various ways disparities can come about from the clinical encounter. In our earlier paper (Balsa and McGuire, 2001) we set out a number of testable implications of increased clinical uncertainty. For example, if physicians' decisions about minorities are more influenced by "priors" rather than information collected in a clinical encounter, the recommendations made to minority patients should differ from those made to white patients reporting the same symptoms (Balsa and McGuire, 2002). Expanding this framework to include testing for the presence and effect of stereotypes is also warranted. There is a literature on "racial

[27] The Institute of Medicine (2002) is an excellent recent source. Appendix B contains a summary of the results of over 600 studies, organized by disease area. The IOM report is available on the web via http://www.nap.edu.

matching" between physicians and patients concerned with whether patients (or doctors) prefer contact with their own race, and if this match has any effect on treatment (Chen et al., 2001; Cooper-Patrick et al., 1999; Saha et al., 1999). While communication could well be part of the story, attempting to interpret this literature or conduct new studies of this type to investigate bias and stereotyping is one fruitful direction to pursue.

The utility of this line of research is two-fold. First, disparities in health care services may not (mostly) be a matter of "less." With the exception of the simple prejudice mechanism, the implications of the other mechanisms may be more or less in terms of quantity of services. The importance of disparities in services is that minorities may have health care services poorly matched to their needs. This is a more general problem than simply getting less. Put it this way: minorities getting no less than Whites on average does not rule out disparities. A focus on the question of matching needs to services is a more general and pertinent framework than simply the getting-the-same-quantity framework.

Second, this type of research is what policy makers need. The research to date on disparities does not differentiate among the various mechanisms. As we argued here, making a good choice about what to do about disparities should be based on a good idea of what causes the disparities. The broad distinction in causes is between information and prejudice, corresponding to a broad distinction in policy between information-based and rule-based interventions. In our view, assessing how much of disparities can be set down to misinformation, and therefore responsive to policies to improve information and communication, is the most immediately useful thing empirical research can do for policy.

Acknowledgements

Support from PO1 MH59876 from the National Institute of Mental Health is gratefully acknowledged. We thank Margarita Alegría, David Cutler, Peter Guarnaccia and Kevin Lang for helpful comments.

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