Provider-Targeted "Nudges" and Primary Care Appointment Availability

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ABSTRACT

Racial and ethnic disparities in access to primary care appointments have been well-documented, but suggestions for how to reduce unequal access are in short supply. We develop a simple framework for examining the effects of provider-targeted interventions ("nudges"), and conducted two field experiments to evaluate them as a way to reduce disparities in access to primary care: (1) a cross-sectional study where providers in Texas were randomly assigned to receive a mailer describing recent research findings on discrimination in their health care market; and (2) a longitudinal randomized study where providers in Louisiana, Mississippi, and Alabama were mailed a letter that informed the provider of ongoing discrimination in their market, its illegality, and its consequences for affected patients. In both settings, research assistants placed calls to practices as, or on behalf of, White, Black, or Hispanic simulated prospective patients. The longitudinal study also included baseline measures allowing for difference-in-differences estimation. Both studies found that White patients had baseline higher levels of access that were partly reduced (in the case of the cross-sectional study) or fully reduced (in the case of the longitudinal study) due to the nudges. We find limited evidence, however, that these reductions were associated with similar increases in access to Black or Hispanic patients. These results suggest that simple provider-targeted nudges may be effective in reducing discrimination in access to primary care appointments, but existing advantage may not be completely eradicated as a result.

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1. INTRODUCTION

Health disparities are ongoing (Blair et al., 2013; Dovidio et al., 2002; Horn & Mendoza, 2014) and may have worsened with the COVID-19 pandemic among disadvantaged populations (Chowkwanyun & Reed, 2020; Mackey et al., 2021). Access to primary care is crucial to improving health and reducing disparities yet discrimination persists in this setting with non-White patients waiting longer for care (Ray et al., 2015; Wisniewski & Walker, 2020). Long wait times may lead to lower overall utilization (Eberly et al., 2020; Garcia et al., 2022; Hsiao et al., 2021; Manuel, 2018; Seo et al., 2019; Yang et al., 2020) and worse physical and mental health outcomes (Abe-Kim et al., 2007; Boudreau et al., 2004; Chen et al., 2022; Himelhoch et al., 2004; Javed et al., 2022).

Previous research on discriminatory attitudes in healthcare has employed survey data (Hausmann et al., 2008; Penner et al., 2010; Ryan et al., 2008) and surveys (Smelser & Baltes, 2001; Wright et al., 2012). Such research has assessed both explicit (Blair et al., 2013; Dovidio et al., 2002; Penner et al., 2010; Sabin et al., 2009; Sabin et al., 2008) and implicit bias (Chapman et al., 2013; FitzGerald & Hurst, 2017; Hall et al., 2015; Krieger et al., 2010; Maina et al., 2018; Sabin et al., 2009). Randomized field experiments add to this literature by separating the effects of race, ethnicity, and gender from other factors that contribute to disparities (Angerer et al., 2019; Bertrand & Duflo, 2017; Gaddis, 2015; Hansen et al., 2013; Neumark, 2018; Sharma et al., 2015). For example, field experiments suggest that providers favor patients based on class and insurance status in addition to race, ethnicity, and gender (Bisgaier & Rhodes, 2011; Kugelmass, 2016; Leech et al., 2019; Olah et al., 2013; Olin et al., 2016; Polsky et al., 2015; Rhodes et al., 2014; Sharma et al., 2018), a finding which holds in the primary care appointment setting as well (Sharma et al., 2015; Wisniewski et al., 2021; Wisniewski & Walker, 2020).

One potential remedy for explicit and implicit bias in the healthcare setting is to employ a "nudge" targeted at providers to remind them of the difficulty that minority patients face in accessing care, and that explicit or implicit bias in the provision of services is illegal. Thaler and Sunstein (2008) define a nudge as a small change in the choice architecture designed to bring about a desirable change in behavior (Thaler, R. H., & Sunstein, C. R. (2008)). Nudges have been employed previously in health settings to alter patient behavior and they appear to have public support (Reisch et al., 2017). Nudges to encourage patients to pursue lower-cost options for clinical office visits were modestly effective but nudges concerning the use of advanced imaging services were more effective (Whaley et al., 2014). Additionally, nudges have been shown to help increase cancer screening rates (Stone et al., 2002); vaccination rates (Findley et al., 2003; McCaul et al., 2002; Stone et al., 2002); the likelihood of medication adherence (Fenerty et al., 2012); and the uptake of influenza vaccines among the elderly provided the nudge was received earlier rather than later in the flu season (Chen et al., 2020).

Interventions that are tailored to individual recipients of a nudge appear to be more effective; though, recipients of these targeted mailings are sensitive to cost and past experience with the care prompted through the nudge (Walker, 2023). Other studies have not found nudges to be effective in the healthcare setting. Bourgeois et al. (2008) found no increase in the uptake of influenza vaccines among employees of a major corporation; there was no evidence of improvement in immunization compliance for schools receiving targeted communications about social norms concerning immunization (Leight & Safran, 2019); and no increase in the uptake of flexible spending accounts following an email campaign to encourage enrollment (Leight & Wilson, 2020).

In this study, we deployed nudges in the form of written communications with targeted physicians in two settings to evaluate the effectiveness of this method for improving access to primary care for disadvantaged patients. This type of nudge has been employed in the context of housing and education but to the best of our knowledge, has not yet been used to seek to reduce discrimination in access to primary care. The purpose of this study is to provide evidence on the usefulness of nudges directed at primary care physicians in reducing discrimination in access to primary care appointments.

In the first experiment, we piloted a mailer with a relatively informative tone (see Figure A1) sharing details of recent research that had measured discrimination in access to health care in the local Texas market. The study was cross-sectional in nature and providers were randomly assigned to receive the nudge or not. We then had research assistants call the practices and seek primary care appointments. Since many primary care appointments are scheduled by phone (Brandenburg et al., 2015) race, ethnicity, and gender may be signaled by the use of racially and ethnically distinctive names (Barlow & Lahey, 2018; Fryer Jr & Levitt, 2004; Gaddis, 2017) and/or by distinctive accents (Chin, 2010; Makoni et al., 2003). In this study, research assistants were assigned simulated patient profiles with racial and ethnic identities that matched their self-identified groups. We compared outcomes for practices which received the nudge with those that did not. In the second study, we piloted a mailer with a relatively more cautionary and directive tone (see Figure A2) that noted the existence of discrimination in the healthcare setting and alerted the recipient of the mailer to possible solutions. Providers in three states—Louisiana, Alabama, and Mississippi—were targeted for the nudge. Research assistants sought an appointment for a purported aunt or uncle whose racial/ethnic identity was signaled through the assignment of racially/ethnically distinctive names. Using data generated nationwide prior to,

and after, the nudge, we utilized a difference-in-differences framework to measure the relative impact of a research assistant calling a provider in the targeted state.

2. CONCEPTUAL FRAMEWORK

The classic framework for examining access to physicians faced with different types of patients was developed by Sloan, Mitchell, and Cromwell (1978). In their model, patients covered by different types of insurance yield different marginal revenues and are accepted at different rates by physicians. The model has been employed to motivate empirical studies of differences in physician availability across patient groups (e.g., Sharma et al., 2015; Polsky et al., 2015; Sharma et al., 2018; Wisniewski and Walker, 2020; Wisniewski et al., 2022; Wisniewski et al., 2023). Recent work has extended this framework to examine the implications of differences in patient preferences across physicians who differ on an observable characteristic such as gender (Walker et al., 2024). In this paper, we use a reinterpretation of the Sloan, Mitchell, and Cromwell (1978) model to examine the implications of a nudge designed to reduce disparities between patients from historically advantaged and disadvantaged groups.

Consider a representative physician *i* who accepts new patients from groups X and Y during a single period (e.g., month, year, etc.). Let $Q_j^i \geq 0$ for $j \in \{X, Y\}$ denote the number of new patients physician *i* accepts from group *j* and let $Q^i \equiv Q_X^i + Q_Y^i$. The marginal cost (MC) to the physician of accepting and treating a new patient is denoted as $MC^i\ (Q^i\ ) > 0$ where $\frac{dMC^i}{dQ^i} \geq 0$. Assume $Q_{Max}^i > 0$ which represents the physician's maximum capacity for new patients such that $MC^i\ (Q_{Max}^i) = \infty$.

The marginal benefit (MB) to the physician from accepting and treating new patients includes additional revenue as well as any non-monetary benefit that the physician derives from treating

the patient. The MB of treating additional group *j* patients is denoted as $MB_j^i(Q_j^i) \geq 0$ where $\frac{dMB_j^i}{dQ_j^i} < 0$. For simplicity, and without loss of generality in our analysis of nudges, we initially set $MB_X^i(Q) = MB_Y^i(Q)$ for all Q (i.e., MB functions are identical for the two types of patients). The physician's combined MB from all new patients is denoted as MB^i (Q^i). Figure 1 illustrates this baseline situation (for simplicity, we only show marginal costs that are either constant or infinite) where physician *i* accepts Q^i new patients divided equally between groups X and Y.

Physician marginal costs and the impact of a nudge

Suppose that group X patients have been historically advantaged relative to group Y patients. In our framework, researchers and policymakers who seek to address this disparity using a nudge will want to design an intervention that increases $MB_Y^i(Q)$ for all Q. Its effect on the number of new patients accepted by the physician depends on the slope of the physician's MC curve at its intersection with MB^i (Q^i). Figure 2 illustrates the effect of a nudge for constant MC with a non-binding capacity constraint. The nudge increases acceptance of new group Y patients while the number of accepted new group X patients remains unchanged because these cost conditions imply a perfectly elastic supply of appointments.

Figure 3 illustrates the case pre-nudge where the MC of treating a new patient is constant but the physician is already at capacity. Figure 4 illustrates the case post-nudge where the physician is at capacity and the nudge increases $MB_Y^i(Q)$. The total number of new patients that the physician accepts is unchanged but the nudge results in a reallocation with the increase experienced by group Y patients offset by a decrease of equal magnitude for group X patients. In the case where MCs are increasing rather than constant or infinite, a nudge that increases $MB_Y^i(Q)$ increases acceptance of new group Y patients and decreases acceptance of new group X

patients by a smaller number than the increase in new group Y patients with the outcome a function of the elasticity of supply (not shown).

Implications for Empirical Research

The model described above provides several useful insights for interpreting the empirical outcomes of nudges intended to address disparities in health care access: (1) If an improvement in access for a disadvantaged group following a nudge (1) is entirely offset by decreased access for other groups, then the health care system is at capacity or (2) is largely offset by decreased access for other groups, then the MC of additional patients in excess of pre-nudge acceptance numbers is very high or (3) occurs without decreasing access for other groups, then MC is constant or rising only slowly.

Our analysis also indicates that policymakers must be cautious when designing nudges to address disparities to ensure that they do not cause decreases in access for historically advantaged groups without commensurate increases in access for disadvantaged groups. For example, a nudge that reduced the benefits from accepting new patients from advantaged groups ($MB_X^i(Q)$) instead of increasing $MB_Y^i(Q)$ will lead to a decrease in acceptance of group X patients that will not be entirely offset by an increase in acceptance of group Y patients.

In our two field experiments, we examine changes in physicians' acceptance of new patients from any group following a nudge. Changes in acceptance rates aggregated across all groups provide information about physicians' marginal cost curves. If offsetting changes in acceptance rates across different groups are observed with no aggregate increase in acceptance rates then the primary care system is capacity constrained. In contrast, if increased acceptance rates for some groups are not fully offset by decreases for other groups then the system has the

capacity to absorb new patients. Finally, increases in acceptance for the group targeted for a positive nudge are more than fully offset by decreases for the historically advantaged group comprise evidence that the nudge was viewed by physicians as discouraging acceptance for the advantaged group rather than encouraging acceptance for the disadvantaged group. In this case, physicians may view the nudge as permission to avoid operating at very high marginal costs (working through lunch or staying late, for example) in order to accommodate historically advantaged patients.

3. METHODS

Cross-Sectional Physician Sample and Audit Methods

The Texas Medical Board database lists all active licensed physicians in the state. We included all primary care specialties as well as endocrinology. Endocrinologists are involved in diabetes care and the burden of disease for diabetes falls disproportionately on racial and ethnic minorities (CDC, 2024). Among the sample, 44.6% specialized in internal medicine, 26.5% specialized in family practice, 22.2% specialized in gynecology, 3.5% specialized in endocrinology, and 3.1% specialized in general practice. The data includes self-reported physician race and ethnicity which were included in our analyses as control variables and, additionally, used to assess the extent to which sensitivity to a nudge varies by physician race and ethnicity. Four research assistants created pseudonyms that matched their racial, ethnic, and gender identities and used these identities when calling randomly assigned providers seeking the next available new patient appointment. Callers utilized a script where, if asked the reason why they were seeking care, they noted a dull stomach pain (for general practitioners and gynecologists) or high blood glucose (for endocrinologists). Callers remained on hold for up to five minutes and, if they got through to a practice, made note of whether an appointment was

offered, the date of the appointment (if applicable), and whether questions about insurance were asked.

Longitudinal Physician Sample and Audit Methods

The American Medical Association's Physician Masterfile (the "Masterfile") is a national comprehensive list of Medical Doctors (MDs) and Doctor of Osteopathic Medicine (DOs) (American Medical Association, 2020, Association of American Medical Colleges, 2020). This study utilized an unstratified randomized sampling of physicians from the Masterfile. Among the sample, 47% had a primary specialty in family medicine, 49% in internal medicine, 3% in general practice, 1% in general preventive medicine, and 0.3% in urgent care medicine. Physician demographic characteristics, including geographic distribution, are similar to those of licensed, active primary care physicians in the US (Young et al., 2019). For the nudge post-period cohort, included physicians were drawn from physician lists provided by the state boards of medicine for Mississippi, Alabama, and Louisiana.

Simulated patients were assigned profiles with a name, gender (male or female), and insurance type (private insurance through an employer, Medicaid, traditional Medicare, or self-pay). Simulated patients were assigned ethnically distinctive: Black names (Tanisha and Darnell Jackson, Kareem and Latonya Jackson, and Latoya and Rasheed Washington); Hispanic names (Jose Garcia-Gonzalez, Juan Martinez-Hernandez, Margarita Rodriguez-Lopez, Maria Garcia-Gonzalez, Roberto Rodriguez-Lopez, and Rosa Martinez-Hernandez); and White names (Anne and Brad Baker, Greg and Laurie O'Brian, and Kristen and Todd Walsh) based on the literature on racially and ethnically distinctive first and last names (Bertrand and Mullainathan, 2003; Lavender, 1988). We randomly assigned one simulated patient to each of our sample physicians.

Research Assistants (RAs) made up to four call attempts to each physician's office. Appointment offers are defined as the provision of an appointment date, or date range, with confirmation that at least one plan from the patient's insurance type is accepted. During a call, the RA stated that they were helping a recently relocated aunt or uncle (the simulated patient) to find a doctor and documented details from the call including questions or remarks made by the scheduler, and the details of any appointment offers (the duration in minutes and number of wait days until the appointment). Using the device of a young person calling on behalf of an older relative makes calls from college-aged students more plausible to the practices and permits the caller to profess ignorance on the specifics of the patient's insurance or health status, if asked.

Institutional Oversight

The Institutional Review Board at the corresponding authors' institution approved and oversaw both study designs. Both studies minimized the risks to physicians, their office staff, and patients by requesting appointment information without making actual appointments. We determined appointment availability, physician eligibility, and reachability in a single call to reduce the burden on practices.

Nudge Interventions

Providers in the cross-sectional study were randomly assigned to receive (or not) a mailer sharing results about a study identifying discrimination in primary care appointment access (see Figure A1). Providers practicing in Louisiana, Alabama, and Mississippi in the longitudinal study were targeted for a nudge intervention comprising a mailed letter which noted ongoing monitoring for discrimination, the consequences of discrimination, and its illegality (see Figure A2).

Cross-Sectional Empirical Approach

To examine the association between appointment outcomes for simulated patients across practices receiving a provider-focused nudge and those not receiving the nudge, we specified a basic linear regression:

$$Y_{ijkt} = \alpha + \boldsymbol{\beta}\ \underline{\mathbf{Nudge}_j} + \gamma_1 \text{Black Caller}_i + \gamma_2 \text{Hispanic Caller}_i + \lambda_1 \text{Black Doctor}_j + \lambda_2 \text{Hispanic Doctor}_j + \lambda_3 \text{Asian Doctor}_j + \lambda_4 \text{Other Doctor}_j + \tau_t + \delta_j + \theta_k + \varepsilon_{ijkt} \quad [A]$$

Where Y_{ijkt} is the call outcome (appointment offer or wait to appointment) varying by caller i reaching provider j in state k at time t. β measures the associations of the nudge on the outcome, γ_n measure the associations of different ethnicities with the outcome in comparison to White callers, and λ_n measure the associations of different provider ethnicities with the outcome in comparison to White doctors. Finally, α is the intercept; τ_t accounts for time fixed effects (i.e., call time of day, day of week, and month of year); δ_j covers provider specialty; θ_k accounts for location (3-digit Zip code) fixed effects; and standard errors are clustered on caller.

We further examine the effects of a nudge on call outcomes by interacting the nudge variable with patient-signaled race and ethnicity, specified as follows:

$$Y_{ijkt} = \alpha + \boldsymbol{\beta_1}\ \underline{\mathbf{Nudge}_j\ \mathbf{*\ Black}_i} + \boldsymbol{\beta_2}\ \underline{\mathbf{Nudge}_j\ \mathbf{*\ Hispanic}_i} + \boldsymbol{\beta_3}\ \underline{\mathbf{Nudge}_j\ \mathbf{*\ White}_i} + \gamma_1 \text{Black Caller}_i + \gamma_2 \text{Hispanic Caller}_i + \lambda_1 \text{Black Doctor}_j + \lambda_2 \text{Hispanic Doctor}_j + \tau_t + \delta_j + \theta_k + \varepsilon_{ijkt} \quad [B]$$

where all variables are defined as for equation [A] with the exception of the nudge variable which is here separated into β_n for three variables interacted on patient race/ethnicity.

Finally, we incorporate doctor race and ethnicity interactions to assess the extent to which provider characteristics influence receptivity to a nudge:

$$Y_{ijkt} = \begin{array}{l} \alpha + \boldsymbol{\beta_1}\ \underline{\textbf{Nudge}_j\ \textbf{*}\ \textbf{Group}_i\ \textbf{*}\ \textbf{White Doctor}_j} + \boldsymbol{\beta_1}\ \underline{\textbf{Nudge}_j\ \textbf{*}\ \textbf{Group}_i\ \textbf{*}\ \textbf{Black Doctor}_j} \\ + \boldsymbol{\beta_1}\ \underline{\textbf{Nudge}_j\ \textbf{*}\ \textbf{Group}_i\ \textbf{*}\ \textbf{Hispanic Doctor}_j} + \boldsymbol{\beta_1}\ \underline{\textbf{Nudge}_j\ \textbf{*}\ \textbf{Group}_i\ \textbf{*}\ \textbf{Asian Doctor}_j} \\ + \boldsymbol{\beta_1}\ \underline{\textbf{Nudge}_j\ \textbf{*}\ \textbf{Group}_i\ \textbf{*}\ \textbf{Other Doctor}_j} \\ + \gamma_1\ \text{Black Caller}_i + \gamma_2\ \text{Hispanic Caller}_i + \tau_t + \delta_j + \theta_k + \varepsilon_{ijkt} \end{array} \quad [C]$$

where all variables are defined as for equations [A] and [B] with the exception of the nudge variables which are here separated into β_n for interacted variables both on patient and provider race/ethnicity, denoted as "Group_i" (i.e., Black, Hispanic, and White patients) for brevity. The variables for doctor race/ethnicity are omitted since they are collinear with these interaction variables.

To assess the randomization process for calls, we conducted t-tests across several outcomes and covariates (appointment offers and wait days for an appointment; the share of Black, Hispanic, and White patients; and the share of doctors by race or ethnicity (Black, Asian, White, and any other race). We then conducted a joint F-test to determine whether the vector of variables are jointly different between the nudge and non-nudge calls.

Longitudinal Empirical Approach

To examine the association between appointment outcomes for simulated patients before and after a provider-focused nudge, we specified a difference-in-differences model to utilize pre-nudge period data across the US. This was specified as follows:

$$Y_{ijkt} = \alpha + \boldsymbol{\beta_1}\ \underline{\textbf{Nudge}_k\ \textbf{*}\ \textbf{Post}_t} + \beta_2\ \text{Black}_i + \beta_3\ \text{Hispanic}_i + \lambda_i + \tau_t + \delta_j + \theta_k + \varepsilon_{ijkt} \quad [D]$$

Post_t and Pre_t are indexed on the date when the letters to physicians were mailed. This specification allows for the inclusion of state fixed effects, which account for time-invariant differences between states, including the nudge-targeted cohort. Y_{ijkt} is the call outcome varying by caller i reaching provider j in state k at time t. β_1 measures the associations of the nudge on the outcome. $B_{1\text{-}2}$ measures the associations of race and ethnicity on the outcome. Finally, α is the intercept; λ_i

captures caller fixed effects; τ_t accounts for time fixed effects (i.e., call day of week and month of year); δ_j covers provider level covariates (i.e., MD vs. DO degree, binary gender, and age as of 2019); θ_k controls for state fixed effects; and standard errors are clustered on state. The model was run using all US states as the control group and also using only southern states (Texas, Oklahoma, Arkansas, Louisiana, Mississippi, Tennessee, Kentucky, West Virginia, Maryland, Virginia, DC, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, and Delaware) as the control group.

To evaluate the association of the nudge with the patient subgroups, we specified the following interaction model:

$$\begin{aligned} Y_{ijkt} = \; & \alpha + \boldsymbol{\beta_1\, \underline{Nudge_k * Black_i * Post_t}} + \boldsymbol{\beta_2\, \underline{Nudge_k * Hispanic_i * Post_t}} + \boldsymbol{\beta_3\, \underline{Nudge_k * White_i * Post_t}} \\ & + \beta_4\, Nudge_k * Black_i * Pre_t + \beta_5\, Nudge_k * Hispanic_i * Pre_t + \beta_6\, Nudge_k * White_i * Pre_t \\ & + \beta_7\, Black_i + \beta_8\, Hispanic_i + \lambda_i + \tau_t + \delta_j + \theta_k + \varepsilon_{ijkt} \end{aligned} \quad [E]$$

Where β_n measures the associations of the nudge with different ethnicities. Outcome measures and all other variables are defined as for equation [D]. Finally, we estimated an event study corresponding to the above difference-in-differences specifications separately for Black, Hispanic, and White patient subgroups, using the following estimating equation that omits the year prior to the nudge intervention to allow for pre-trend and post-effect estimation:

$$Y_{ijkt} = \sum_{t=-1}^{+1} (\boldsymbol{\alpha_{ijt}\, \underline{Nudge_k * Year(t)}}) + \beta_2\, Black_i + \beta_3\, Hispanic_i + \lambda_i + \tau_t + \delta_j + \theta_k + \varepsilon_{ijt} \quad [F]$$

Where all variables are defined as for equation [A]

4. RESULTS

Cross-Sectional Study

We collected 119 observations for providers targeted with the nudge and 368 observations for providers not targeted with the nudge. Among the control group, 64% of callers

received an appointment offer with an average wait time of 14.7 days. No t-tests were statistically significantly different between the nudge and control cohorts and the joint F-test was also not statistically significant (see Table 1).

From Table 2, the nudge overall does not cause statistically significant differences in access suggesting that the primary care system had little spare capacity to expand appointment availability. However, Hispanic patients were offered 30.5 percentage points fewer appointments (95% CI: -0.412 to -0.197, p<0.01) that were 10.6 days later (95% CI: 4.9 to 16.3, p=0.01) compared to White patients. In contrast, Black patients were not offered fewer or later appointments compared to White patients. When disaggregating results by caller race and ethnicity, nudges are associated with less access for White callers on the order of 3.3 percentage points (95% CI: -0.048 to -0.018, p=0.01) while no other nudge interaction terms are statistically significant (Table 3).

Referring to Table 4, when considering doctor race/ethnicity and patient race/ethnicity interactions, we find several effects. Black patients in the control practices are offered 15.9 percentage points fewer appointments (95% CI: -0.298 to -0.021, p=0.04) that are 10.9 days later (95% CI: -3.3 to 25.2, p=0.09) and Hispanic patients are offered 30.8 percentage points fewer appointments (95% CI: -0.434 to -0.182, p<0.01) that are 10.8 days later (95% CI: 5.8 to 15.9, p=0.01) compared to White patients. There are heterogeneous effects by doctor race/ethnicity and patient race/ethnicity combinations, with White doctors offering Black and Hispanic patients more appointments, on the order of 35 percentage points (95% CI: 0.174 to 0.526, p=0.01) and 29.4 percentage points (95% CI: 0.094 to 0.493 p=0.02), respectively. White doctors also offer earlier access to White and Hispanic patients on the order of 2.9 days (95% CI: -5.5 to -0.3, p=0.04) and 7.0 days (95% CI: -11.7 to -2.3, p=0.02), respectively. Black doctors, in contrast,

offered 31.3 percentage points fewer appointments to Hispanic patients (95% CI: -0.706 to 0.080, p=0.09) and offered appointments to White patients 23.5 days further in the future (95% CI: 11.5 to 35.6, p=0.01) in response to the nudge. Asian doctors offered White and Hispanic patients fewer appointments following a nudge on the order of 16.3 percentage points (95% CI: -0.299 to -0.026, p=0.03) and 12.7 percentage points (95% CI: -0.252 to -0.002, p=0.05), respectively. Asian doctors offered Hispanic patients appointments 3.9 days later in following a nudge (95% CI: 0.6 to 7.2, p=0.03).

Longitudinal Study

In total, 3,742 successful calls were made, comprising 300 calls to practices in one of the three treatment states and 3,442 calls to practices in the control group states (including 1,132 to the Southern control group). From Table 5, for the national control group in the pre-period, 59% of callers were told that their insurance was accepted, 32% were informed that the requested physician was not accepting new patients, 45% were offered an appointment with the requested physician, and 57% were offered an appointment with any physician. The average wait time was 36 days with an average appointment duration of 39 minutes.

Overall, the nudge is not associated with differences in aggregate levels of access indicating again that the primary care system had little spare capacity to expand appointment availability (Table 6). However, differences emerge for changes in access by patient race/ethnicity following a nudge. In the pre-intervention period, White patients in the treatment states were 21 percentage points more likely to be offered any appointment (95% CI: 0.14 to 0.29, p<0.01) compared to other patient groups. After the nudge, White patients in the treatment states were 21 percentage points less likely to be offered any appointment (95% CI: -0.30 to -0.12, p <0.01). Before the nudge, Black patients in the treatment states were 12 percentage points

less likely to be offered any appointment (95% CI: -0.26 to 0.01, p = 0.07) than White callers in the national control states. Following the nudge, Black patients were 17 percentage points more likely to be offered any appointment (95% CI: 0.02 to 0.33, p=0.03) but were offered appointments 20.97 days later (95% CI: -2.23 to 44.17, p = 0.08) (Table 7).

When restricting the analysis to Southern control states, Black patients pre-nudge in treatment states were 25 percentage points less likely to be offered any appointment (95% CI: -0.40 to -0.11, p<0.01), but were offered appointments 39 days earlier (95% CI: -56.6 to -21.7, p<0.01) than White patients in control states. Hispanic patients were offered appointments 22.7 days earlier (95% CI: -47.1 to 1.6, p=0.07) while White patients were offered 12 percentage points more appointments (95% CI: 0.04 to 0.21, p=0.01) that were 36.3 days earlier (95% CI: -44.7 to -27.9, p<0.01) compared with White patients in Southern control states. The treatment effects following a nudge that were observed using the national control states hold up for White and Black patients in Southern states at -14 percentage points (95% CI: -0.29 to 0.00, p=0.06) and 23 percentage points (95% CI: 0.03 to 0.43, p=0.03), respectively (Table 8).

Event studies were employed to evaluate the pre-intervention trends underlying these estimates for call outcomes. Trends for appointment offers do not appear parallel for any group; although, the patterns varied. The trends for White and Hispanic callers are such that the post-period effects may be underestimates of the actual effects since the non-parallel trends work against the potential treatment effects. In contrast, the non-parallel trends for appointment offers among Black callers work to create an estimated effect that instead appears to be a continuation of these differences in pre-trends (Figures 5-7, Panel A). The wait to appointment estimates do appear to be parallel (Figures 5-7, Panel B).

5. DISCUSSION

Nudges to encourage healthy behaviors and receipt of care have mixed effects in health care generally, and, prior to this study, had not been evaluated as a way to potentially reduce racial and ethnic disparities in access to care. In this study, we pilot an intervention designed to reduce disparities in which providers are sent letters referring to ongoing monitoring of discriminatory practices, the effect of such discrimination on patients, and its illegality. We find that this simple intervention has the potential to change provider behavior and reduce disparities in access to primary care. To the best of our knowledge, this is the first nationally representative and randomized field experiment that seeks to reduce unequal access to primary care appointments.

It is noteworthy that, following a nudge, groups of patients *were* offered more appointments following the intervention but these appointments were delayed further into the future. Appointments that are not timely are more likely to be missed leading to adverse health outcomes or reliance on more expensive alternatives such as emergency room visits (Ansell et al., 2017). It is possible that practices offer appointments far in the future as a way of managing workload and that far-off appointment offers might be regarded as a soft rejection rather than a serious offer of an appointment.

Limitations

This study has several limitations. We are not able to assess whether a reduction in disparities in scheduling improves patient outcomes during the entire process of receiving medical care. We are not able to assess the effectiveness of a one-time intervention, such as the ones employed in this study, in reducing disparities in the long term. It is possible that practices will eventually revert to their customary ways of allocating scarce appointments. Offers of appointment in these studies may

represent the upper limit of appointment offers since the provision of more information about the simulated patients, particularly insurance status, may result in some of the offered appointments being ultimately unavailable.

Conclusions

Efforts to act on the provider side as a way to reduce disparities in access to care show promise. This paper describes two experiments in which providers were targeted with written communications (a nudge) reminding them of the importance of offering appointments in a way that does not discriminate based on race and ethnicity. We found that, overall, this type of intervention has the potential to reduce disparities in access to primary care and other appointments. Further investigation of ways to encourage the provision of a welcoming environment at the point at which patients initially seek medical care are an important avenue for future investigation.

6. TABLES AND FIGURES

Table 1: Cross-Sectional Study: Summary Statistics

	Nudge	Control	T-Test
Appointment Offer	0.630 (0.485)	0.639 (0.481)	0.87
Wait Days	14.1 (17.0)	14.7 (16.3)	0.79
Black Patient	0.151 (0.360)	0.177 (0.382)	0.52
Hispanic Patient	0.168 (0.376)	0.163 (0.370)	0.90
White Patient	0.681 (0.468)	0.660 (0.474)	0.68
Black Doctor	0.126 (0.333)	0.098 (0.297)	0.38
Asian Doctor	0.328 (0.471)	0.326 (0.469)	0.97
Doctor of Other Race	0.092 (0.291)	0.082 (0.274)	0.71
White Doctor	0.454 (0.500)	0.495 (0.501)	0.44
N	119	368	F-Test = 0.94

Notes: F-Test excludes insurance asked and wait days, as well as White patients and White doctors as reference groups.

Table 2: Cross-Sectional Study: Overall Effects of Nudges

	Appointment Offer	Wait Days
Nudge	0.007	0.6
	(-0.107 to 0.121)	(-0.7 to 2)
	p=0.85	p=0.25
Black Patient	-0.095	10.5
	(-0.255 to 0.064)	(-0.8 to 21.8)
	p=0.15	p=0.06
Hispanic Patient	-0.305***	10.6***
	(-0.412 to -0.197)	(4.9 to 16.3)
	p<0.01	p=0.01
Black Doctor	0.113	6.2
	(-0.133 to 0.358)	(-9.6 to 22.1)
	p=0.24	p=0.30
Asian Doctor	0.058	-2.4
	(-0.039 to 0.155)	(-6.2 to 1.3)
	p=0.15	p=0.13
Other Non-White Doctor	0.035	-0.1
	(-0.215 to 0.285)	(-9.5 to 9.3)
	p=0.69	p=0.98
Control Mean (SD)	0.639 (0.481)	14.7 (16.3)
	487	305

Notes: * p<0.10 ** p<0.05 *** p<0.01.
Estimates were generated using equation [A].
In an alternative specification where White Patient is included and the Black and Hispanic Patient groups are instead the omitted reference group, the point estimate is 0.213 (95% CI: -0.048 to 0.474, p=0.08).

Table 3: Cross-Sectional Study: Interacted Effects of Nudges

	Appointment Offer	Wait Days
Any Nudge * Black	0.189	1.3
	(-0.206 to 0.585)	(-4.3 to 6.8)
	p=0.23	p=0.52
Any Nudge * White	-0.033***	0.7
	(-0.048 to -0.018)	(-1.6 to 2.9)
	p=0.01	p=0.42
Any Nudge * Hispanic	0.010	-1.0
	(-0.032 to 0.053)	(-8.0 to 6.0)
	p=0.49	p=0.69
Black Patient	-0.142	10.4*
	(-0.342 to 0.059)	(-1.4 to 22.1)
	p=0.11	p=0.07
Hispanic Patient	-0.311***	10.9***
	(-0.438 to -0.183)	(5.5 to 16.3)
	p<0.01	p=0.01
Black Doctor	0.117	6.3
	(-0.141 to 0.375)	(-10.1 to 22.6)
	p=0.25	p=0.31
Asian Doctor	0.063	-2.4
	(-0.048 to 0.175)	(-6.5 to 1.8)
	p=0.17	p=0.17
Other Non-White Doctor	0.043	-0.1
	(-0.178 to 0.264)	(-10.0 to 9.9)
	p=0.58	p=0.99
Control Mean (SD)	0.639 (0.481)	14.7 (16.3)
N	487	305

Notes: * p<0.10 ** p<0.05 *** p<0.01.
Estimates were generated using equation [B].

Table 4: Cross-Sectional Study: Effects of Nudges by Provider Race and Ethnicity

	Appointment Offer	Wait Days
White Doctor * Black Patient * Nudge	0.350*** (0.174 to 0.526) p=0.01	2.7 (-15.8 to 21.2) p=0.68
White Doctor * White Patient * Nudge	0.022 (-0.042 to 0.085) p=0.36	-2.9** (-5.5 to -0.3) p=0.04
White Doctor * Hispanic Patient * Nudge	0.294** (0.094 to 0.493) p=0.02	-7.0** (-11.7 to -2.3) p=0.02
Black Doctor * Black Patient * Nudge	0.092 (-1.059 to 1.244) p=0.82	-9.8 (-48.9 to 29.3) p=0.48
Black Doctor * White Patient * Nudge	-0.052 (-0.299 to 0.196) p=0.56	23.5*** (11.5 to 35.6) p=0.01
Black Doctor * Hispanic Patient * Nudge	-0.313* (-0.706 to 0.080) p=0.09	N/A (no observations)
Asian Doctor * Black Patient * Nudge	0.076 (-1.160 to 1.311) p=0.86	2.7 (-4.4 to 9.7) p=0.31
Asian Doctor * White Patient * Nudge	-0.163** (-0.299 to -0.026) p=0.03	-0.8 (-4.6 to 3.1) p=0.57
Asian Doctor * Hispanic Patient * Nudge	-0.127** (-0.252 to -0.002) p=0.05	3.9** (0.6 to 7.2) p=0.03
Other Doctor * Black Patient * Nudge	-0.649 (-1.681 to 0.384) p=0.14	N/A (no observations)
Other Doctor * White Patient * Nudge	0.163 (-0.316 to 0.642) p=0.36	-0.6 (-19.4 to 18.2) p=0.92
Other Doctor * Hispanic Patient * Nudge	0.091 (-0.116 to 0.298) p=0.26	-11.5 (-55.4 to 32.4) p=0.47
Black Patient	-0.159** (-0.298 to -0.021) p=0.04	10.9* (-3.3 to 25.2) p=0.09
Hispanic Patient	-0.308*** (-0.434 to -0.182) p<0.01	10.8*** (5.8 to 15.9) p=0.01
Black Doctor	0.154 (-0.191 to 0.499) p=0.25	2.0 (-12.3 to 16.2) p=0.69
Asian Doctor	0.118 (-0.048 to 0.284) p=0.11	-3.4 (-10.3 to 3.5) p=0.22
Other Doctor	0.051 (-0.176 to 0.279) p=0.53	-1.0 (-14.5 to 12.5) p=0.83
Control Mean (SD)	0.639 (0.481)	14.7 (16.3)
N	487	305

Notes: * p<0.10 ** p<0.05 *** p<0.01.
Estimates were generated using equation [C].

Table 5: Longitudinal Study: Summary Statistics

	Treated	+ Southern Controls	+ National Controls
Insurance Accepted	0.541 (0.501)	0.568 (0.500)	0.590 (0.492)
No New Patients	0.198 (0.400)	0.299 (0.458)	0.319 (0.466)
Requested Appointment Offered	0.414 (0.495)	0.439 (0.497)	0.450 (0.498)
Any Appointment Offered	0.495 (0.502)	0.549 (0.498)	0.572 (0.495)
Wait to Appointment (Days)	18.4 (25.4)	36.1 (47.7)	36.1 (51.6)
Appointment Duration (Minutes)	37.1 (16.6)	37.3 (13.5)	39.2 (44.9)
N for Entire Sample (for Appointment Offers)	300	1,132	3,442

Notes: Standard Deviations (SDs) in parenthesis.

Table 6: Longitudinal Study: Overall Change in Call Outcomes (Pre/Post Interaction Controls)[a]

	Any Appt Offered[d]	Wait to Appointment
Post-Nudge	-0.062	0.8
	(-0.207 to 0.082)	(-12.5 to 14.0)
p-value	p=0.39	p=0.91
Pre-Nudge	0.072	1.1
	(-0.035 to 0.178)	(-10.3 to 12.6)
p-value	p=0.18	p=0.84
Black	-0.016	-2.4
	(-0.07 to 0.038)	(-8.4 to 3.5)
p-value	p=0.56	p=0.42
Hispanic	0.034	1.8
	(-0.009 to 0.077)	(-4.2 to 7.8)
p-value	p=0.11	p=0.55
Pre-Period Non-Nudge Mean	0.572 (0.495)	36.1 (51.6)
N	3,742	1,679

Notes: * p<0.10 ** p<0.05 *** p<0.01.
Estimates were generated using equation [D].
a: All estimates are percentage-point differences except for appointment duration which is in minutes. 95% confidence intervals are in parentheses. The reference group are White * Non-Nudge. The analysis controlled for simulated patient characteristics (race/ethnicity, gender, insurance type), characteristics of the requested physician (gender, MD/DO), as well as fixed effects for state, the research assistant making the call, and the day of the week when the call was made. Robust standard errors were clustered by state.
b: Information on insurance acceptance was not requested from physicians' offices that provided insurance-unrelated reasons for lack of appointment availability (e.g., not accepting new patients).
c: Potential appointment date (or date range) offered with requested physician, and at least one plan of the patient's insurance type was accepted.
d: Potential appointment date (or date range) offered with requested physician or alternate provider in the same practice, and at least one plan of the patient's insurance type was accepted.
e: Amount of time (minutes) the physician or alternate provider offered typically spends with patient for a physical exam. Not requested from physicians' offices that did not provide a potential appointment date or date range.

Table 7: Longitudinal Study: Change in Call Outcomes by Patient Race/Ethnicity and Nudge (Pre/Post Interaction Controls)[a]

	Any Appt Offered[d]	Wait to Appointment
Post-Nudge * Black	0.17**	20.97*
	(0.02, 0.33)	(-2.23, 44.17)
p-value	0.03	0.08
Post-Nudge * Hispanic	-0.11	-9.07
	(-0.28, 0.07)	(-27.98, 9.83)
p-value	0.23	0.34
Post-Nudge * White	-0.21***	-1.32
	(-0.30, -0.12)	(-10.48, 7.83)
p-value	<0.01	0.77
Pre-Nudge * Black	-0.12*	-6.62
	(-0.26, 0.01)	(-20.83, 7.59)
p-value	0.07	0.35
Pre-Nudge * Hispanic	0.10	6.36
	(-0.04, 0.24)	(-12.68, 25.40)
p-value	0.17	0.51
Pre-Nudge * White	0.21***	-2.08
	(0.14, 0.29)	(-11.03, 6.87)
p-value	<0.01	0.64
Black	-0.01	-3.38
	(-0.07, 0.05)	(-9.73, 2.98)
p-value	0.75	0.29
Hispanic	0.04	1.46
	(-0.01, 0.08)	(-5.06, 7.99)
p-value	0.104	0.66
Pre-Period Non-Nudge Mean	0.572 (0.495)	36.1 (51.6)
N	3,742	1,679

Notes: * p<0.10 ** p<0.05 *** p<0.01.
Estimates were generated using equation [E].
a-e: see notes in Table 6.

Table 8: Longitudinal Study: Change in Call Outcomes by Patient Race/Ethnicity and Nudge (Pre/Post Interaction including Southern Control States Only)[a]

	Any Appt Offered[d]	Wait to Appointment
Post-Nudge * Black	0.23*	18.36
	(0.03, 0.43)	(-8.55, 45.26)
p-value	0.03	0.17
Post-Nudge * Hispanic	-0.09	-8.22
	(-0.34, 0.16)	(-36.11, 19.67)
p-value	0.47	0.54
Post-Nudge * White	-0.14*	1.91
	(-0.29, 0.00)	(-14.14, 17.95)
p-value	0.06	0.80
Pre-Nudge * Black	-0.25***	-39.16***
	(-0.40, -0.11)	(-56.57, -21.74)
p-value	<0.01	<0.01
Pre-Nudge * Hispanic	0.03	-22.72*
	(-0.15, 0.21)	(-47.08, 1.64)
p-value	0.70	0.07
Pre-Nudge * White	0.12**	-36.30***
	(0.04, 0.21)	(-44.69, -27.91)
p-value	0.01	<0.01
Black	0.05	-0.46
	(-0.02, 0.12)	(-10.61, 9.68)
p-value	0.15	0.92
Hispanic	0.06	-0.55
p-value	(-0.03, 0.16)	(-8.59, 7.49)
	0.19	0.89
Pre-Period Non-Nudge Mean	0.549 (0.498)	36.1 (47.7)
N	1,432	616

Notes: * p<0.10 ** p<0.05 *** p<0.01.
Estimates were generated using equation [E].
a-e: see notes in Table 6.

Figure 1: Physician Acceptance of New Patients before Nudge Favoring Group Y patients with Constant Marginal Costs and Non-Binding Capacity Constraint

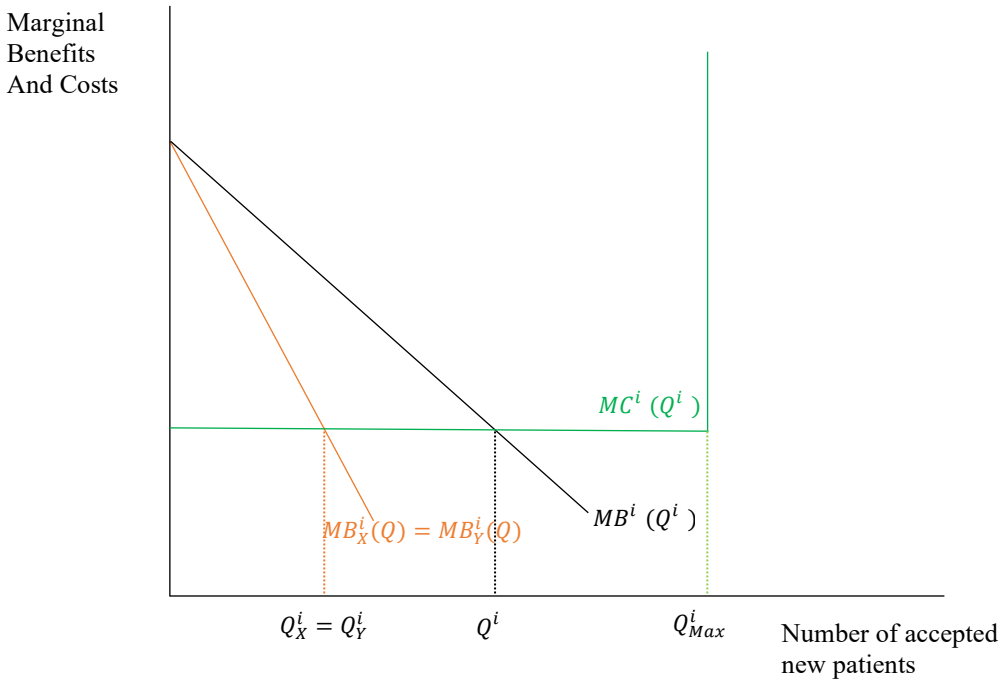


Figure 2: Physician Acceptance of New Patients after Nudge Favoring Group Y Patients with Constant Marginal Costs and Non-Binding Capacity Constraint

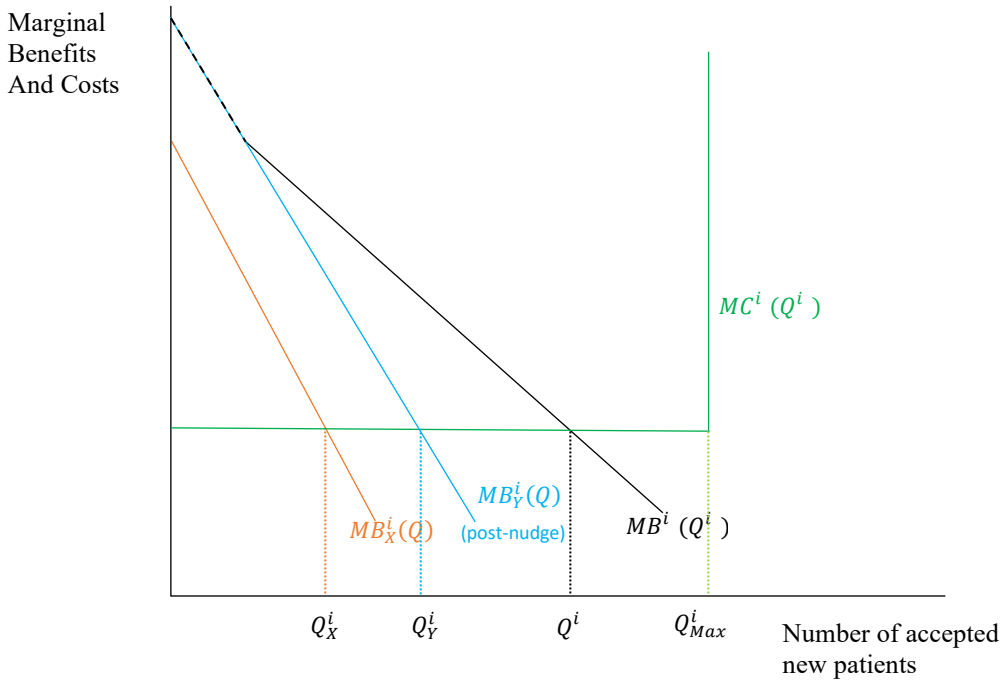


Figure 3: Physician Acceptance of New Patients Prior to Nudge Favoring Group Y patients with *Constant Marginal Costs and Binding Capacity Constraint*

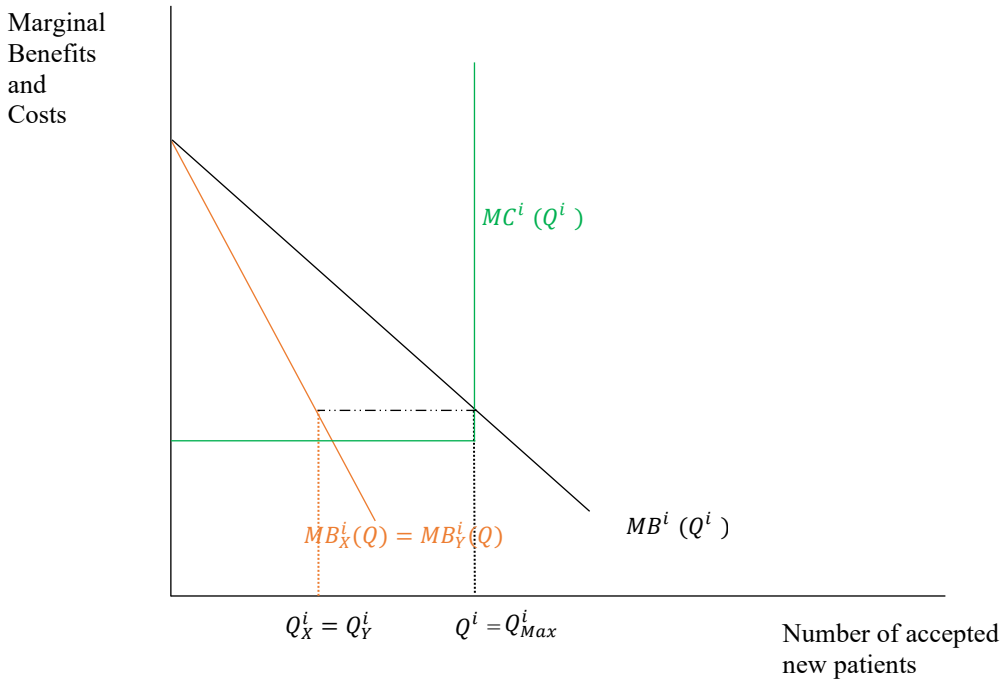


Figure 4: Physician Acceptance of New Patients after Nudge Favoring Group Y Patients with Binding Capacity Constraint

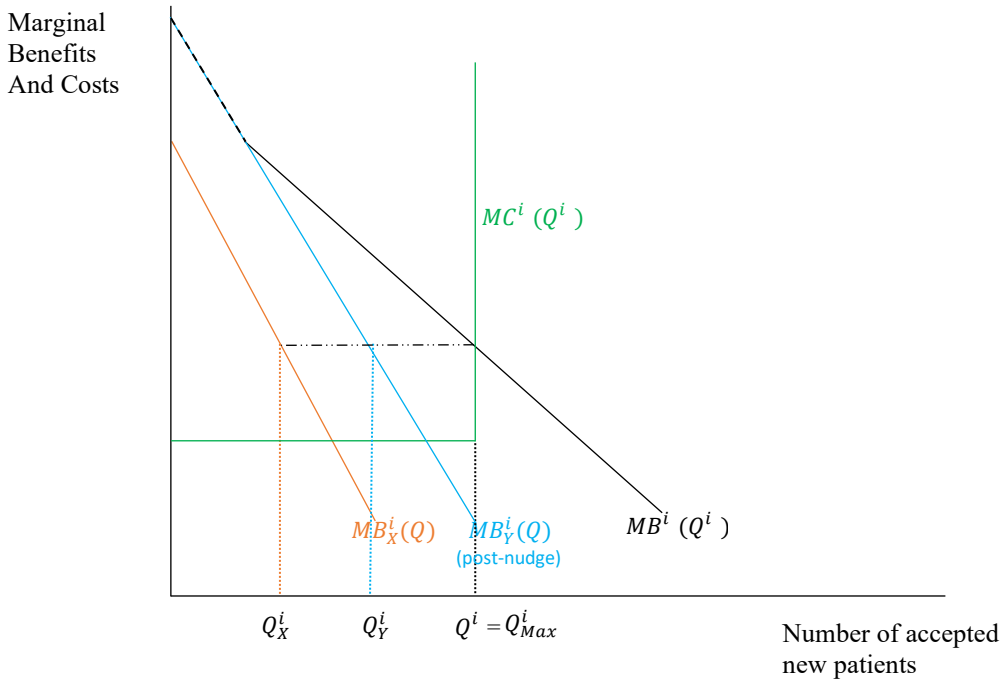
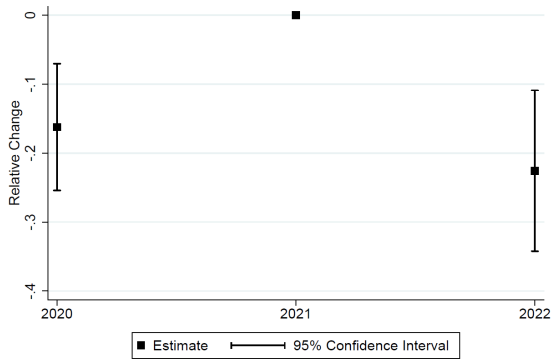
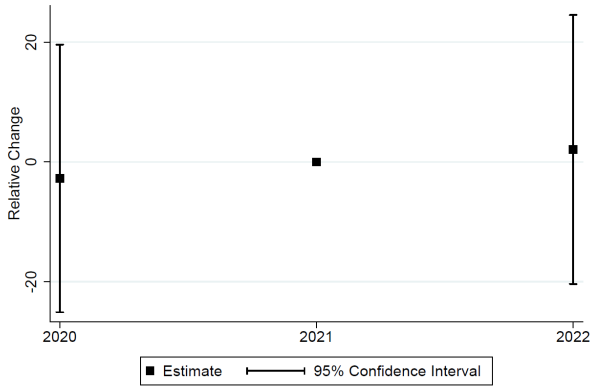


Figure 5: Event Studies Evaluation (White)

Panel A: Any Appt Offered[d]



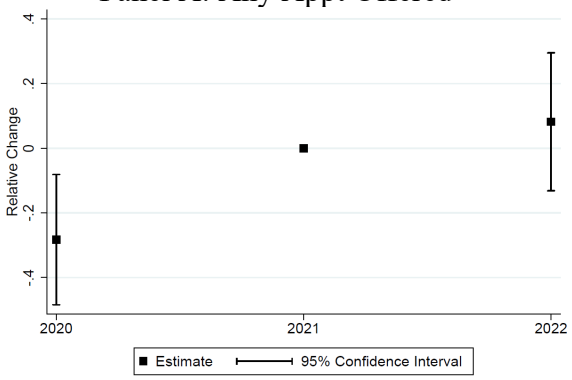
Panel B: Wait to Appointment



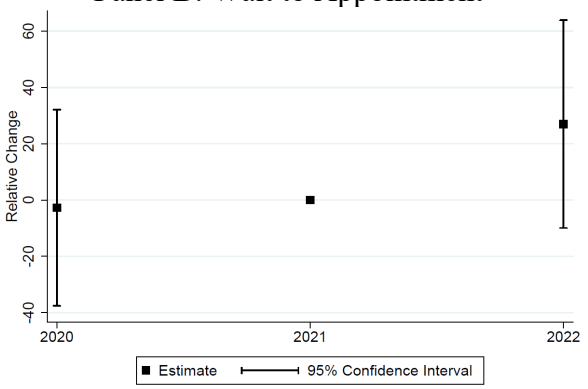
Notes: Estimates were generated using equation [F].

Figure 6: Event Studies Evaluation (Black)

Panel A: Any Appt Offered[d]



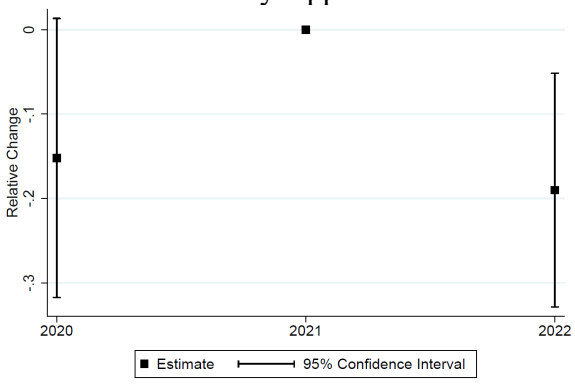
Panel B: Wait to Appointment



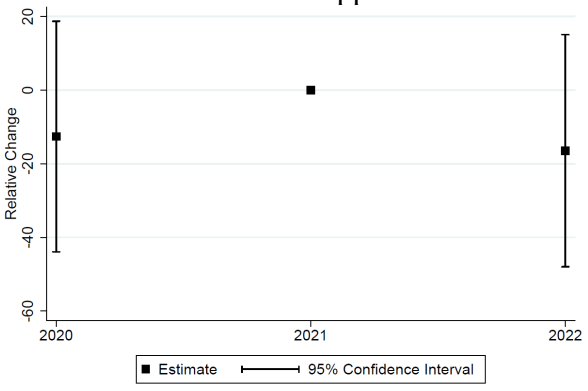
Notes: Estimates were generated using equation [F].

Figure 7: Event Studies Evaluation (Hispanic)

Panel A: Any Appt Offered[d]



Panel B: Wait to Appointment



Notes: Estimates were generated using equation [F].

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Appendix A

Figure A1: Cross-Sectional Nudge Mailer

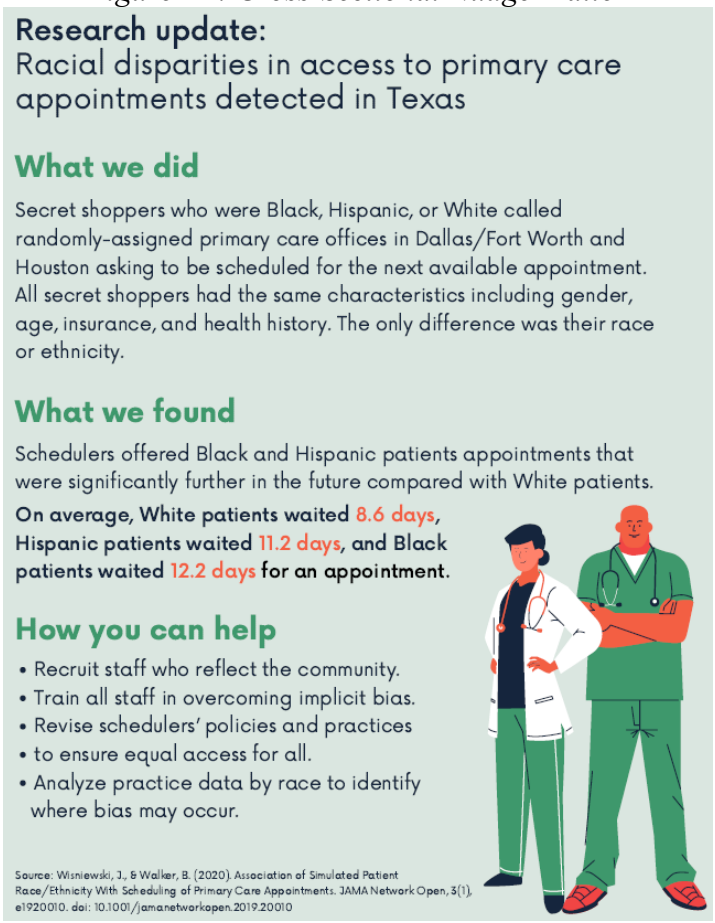


Figure A2: Longitudinal Nudge Mailer

Dear Provider,

Ongoing studies have found racial, ethnic, payer, and gender discrimination when patients attempt to make primary care appointments in your market. Patients may be less likely to be offered an appointment, or may wait longer for an appointment, depending on their demographic characteristics.

Delays in access to health care can lead to serious and avoidable health issues. Further, Title VI of the Civil Rights Act requires enforcement and provides a private right of action in federal court against centers that engage in intentional discrimination that prevents access.

This message is simply a reminder to please be mindful of the importance of equitable access.

Here are some suggestions for addressing implicit bias in medical practices:

- Recruit staff who reflect the community.
- Train all staff in overcoming implicit bias. Revise schedulers' policies and practices to ensure equal access for all.
- Analyze practice data by race to identify where bias may occur.