Racial Disparities in Provider-Patient Communication of Incidental Medical Findings

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Abstract

Health disparities research often focuses on the social patterning of health outcomes. Increasingly, there has been an emphasis on understanding the mechanisms perpetuating disparities, even after issues of patient access to health services are addressed. The following study utilizes a novel dataset of electronic medical records (EMR), radiology records, and U.S. Census data to investigate the racial/ethnic patterning of provider-patient communication among patients diagnosed with incidental medical findings requiring follow-up. My results indicate that racial/ethnic disparities in follow-up adherence stem from initial disparities in provider-patient communication. These communication disparities persist even after accounting for multiple socioeconomic, health, and provider characteristics, indicating a bias in medicine, whereby providers are less likely to communicate information about incidental medical findings to patients of color relative to White patients. This paper has important clinical implications, as it sheds new light on why we might see low adherence to medical advice among patients of color. Findings also have social, political, and policy relevance, as they suggest an important mechanism through which health inequalities persist. To finally eliminate racial/ethnic health inequalities in the United States, racial bias and discrimination within medical and public health infrastructures must be eliminated.

Keywords

United States; racial/ethnic disparities; provider-patient communication; adherence; incidental findings; radiology; EMR

Introduction

Despite an abundance of research demonstrating the existence of health inequalities by race and ethnicity (e.g. Phelan and Link 2015; Williams and Sternthal 2010) questions remain surrounding the mechanisms generating disparities (Williams et al. 2019a). One mechanism

is via differential access to healthcare services, whereby disparities in financial and social capital prevent people of color from accessing preventative, screening, and diagnostic services, participating in clinical research trials, and receiving medical treatment (Williams and Wyatt 2015; Ford and Airhihenbuwa 2010). Yet, research shows that even when people of color access health services, their experiences within the healthcare system are marred by prejudice and discrimination, deterring many from engaging in future healthcare-seeking (Johnson et al., 2004, Williams and Wyatt, 2015). Whereas health disparities can result from access barriers, they are also the consequence of hurdles faced during the process of navigating complex health systems, insurance schema, and interactions with medical providers. As Ashton et al. (2003) describe, "…some disparities emerge after the patient gets to the doctor …some disparities are emerging from the context of the doctor-patient interaction" (146).

A wealth of literature to date has documented disparate treatment within the context of doctor-patient visits (e.g. Williams et al. 2019b) including disparate communication between providers and their patients (e.g. Hagiwara et al. 2013). These communication disparities may result from provider bias, and can lead to decreased patient adherence, delays in healthcare-seeking, and increased mistrust of healthcare providers (Beyer et al., 2019; Blair et al., 2013; Feagin and Bennefield, 2014; Mayberry et al., 2000; Sewell, 2015). Still, more research is needed to understand how such disparities in patient interactions with providers and health systems affect patient outcomes, including follow-up adherence to healthcare recommendations.

This study utilizes a unique dataset of electronic medical records (EMR), radiology records, and U.S. Census data to examine provider-patient interactions among a cohort of patients diagnosed with incidental medical findings. The incidental findings examined here are small pulmonary nodules, "spots" on the lung that represent a potential medical condition requiring follow-up. Still, follow-up adherence for these nodules has been shown to be low, with studies suggesting less than 40% of patients receive timely follow-up (McDonald et al., 2017). Recent research finds follow-up adherence for these nodules is lowest among Black and Hispanic patients (Schut and Barbosa, 2020).

As I argue the process of adherence is contingent upon communication between providers and patients regarding how a patient ought to adhere, the goal of this study is to argue that focusing on adherence disparities alone fails to recognize that communication disparities may importantly impact adherence, as individuals can only follow medical directives they are aware of in the first place. Critically, my findings show that adherence disparities appear to be linked to provider-patient communication disparities. I find striking evidence that wide gaps in provider-patient communication of incidental findings persist across racial groups even after adjusting for socioeconomic, health, and provider characteristics. These disparities may indicate discriminatory communication patterns, which can have a "domino effect" on the health of patients of color via negatively impacting adherence. Such disparities may undermine healthcare-seeking and utilization, leading to the potential magnification of health inequalities between racial/ethnic groups in the United States.

Background

Racial/Ethnic Healthcare Inequalities

Although advancements in public health and medical technology during the 20th century significantly reduced morbidity and mortality in the United States, vast health disparities across racial groups persist (Ashton et al., 2013; Feagin and Bennefield, 2014). Racism present in US health care is one factor responsible for generating and maintaining these health disparities via discriminatory treatment of people of color (Hoberman 2007; Feagin and Bennefield 2014; Sewell 2015; Roberts 2011). For example, evidence indicating "differential diagnosis and treatment for a wide range of diseases and disorders" across racial groups serves as striking evidence that healthcare providers routinely, "…employ racially-motivated thinking" when treating patients of color (Hoberman, 2007, 507).

Discriminatory treatment of patients of color within healthcare contexts has been documented in multiple studies, demonstrating that patients of color receive lower-quality and less rigorous care across a variety of conditions (King and Redwood, 2016; Laditka et al., 2003; Phelan and Link, 2015; Schpero et al., 2017; Van Ryn and Burke, 2000). Patients of color are more likely to receive inadequate treatment recommendations for breast cancer and cardiovascular diseases (Beyer et al., 2019; Williams and Wyatt, 2015), and Ashton et al. (2003) and Mayberry et al. (2000) have shown that Black patients often receive less clinical attention and fewer diagnostic tests than White patients, net of other health factors. Black women are also less likely than White women to be given innovative treatments or combination therapies as part of their cancer care (Beyer et al., 2019), even though they experience higher rates of certain cancers compared with White women (Feagin and Bennefield, 2014).

Racial/ethnic disparities have also been observed in medical adherence, the degree to which a patient follows the recommendations of healthcare providers. Non-adherence is an important healthcare issue as it may be a key driver of negative health outcomes (Zolnierek and DiMatteo, 2010), and research on medical adherence increasingly finds that structural barriers prevent patients of color from adhering to medical directives (Braveman et al., 2010; Dominick et al., 2005; Jin et al., 2008; Kaplan et al., 2004; Wheeler et al., 2017). Notably, structural racism results in differential access to jobs that provide flexibility, sick-leave, and high-quality health insurance, hindering adherence among patients of color by preventing them from accessing necessary healthcare (Davis et al., 2017; Jin et al., 2008). Empirical work shows that neighborhood context and socioeconomic status negatively impact adherence among Black and Hispanic patients to statin medications (Davis et al., 2017). Furthermore, inability to afford healthy food, difficult work schedules, and inadequate housing have been shown to limit patient adherence to provider-recommended diabetes food regimens (Bissel et al., 2004).

Yet, although structural factors operating outside of the healthcare system limit patient adherence, hurdles experienced within the healthcare system also impact adherence. Jin et al. (2008) find that barriers including long wait-times, difficulty in filling prescriptions, and provider interactions importantly shape adherence. In particular, low-quality provider-patient communication has been associated with increased patient non-adherence. For example, one

study demonstrated that patients with whom physicians communicated poorly exhibited a 19% higher risk of nonadherence, and when physicians were trained to communicate better, adherence improved (Zolnierek and DiMatteo, 2010).

Low-quality communication between providers and patients of color is often attributed to provider bias. Biased communication is associated with lowered patient adherence, delays in healthcare-seeking, and increased mistrust of healthcare providers (Beyer et al., 2019; Blair et al., 2013; Feagin and Bennefield, 2014; Mayberry et al., 2000; Sewell, 2015). Williams et al. (2019) show patients of color who perceived biased treatment from their physicians limited their desire to communicate with, ask questions of, and trust their providers. Indeed, providers are affected by the "racial fantasies that still suffuse modern societies," and providers themselves recognize bias is common in medical teaching, rounds, conferences, and patient decision-making (Hoberman, 2007, 507). Studies find providers make a priori judgements regarding which patients are more likely to "comply" with medical advice, and use these judgements to determine whether patients are deserving of communication. Patients of color are judged for being "too passive" compared to White patients, who are believed to more actively pursue care (Feagin and Bennefield, 2014). These discriminatory judgements impact communication, and providers often engage in lower quality communication with patients of color, increasing their verbal dominance, exhibiting slower speech, and expressing less patient-centeredness in their interactions (Cooper et al., 2013; Sewell, 2015).

Taken together, this evidence highlights how discrimination is a systemic problem characterizing the everyday experiences of people of color (Ford and Airhihenbuwa, 2010). Structural racism impacts the neighborhoods, socioeconomic status, and resources available to people of color, which negatively affects their healthcare-seeking and adherence to medical directives. Furthermore, interpersonal racism perpetrated by healthcare providers against patients of color can impact communication and trust, both of which can affect healthcare-seeking, utilization, and health outcomes "downstream."

Still, unanswered questions remain regarding how exactly biased provider-patient interactions unfold, including how complex pathways of healthcare utilization and adherence are interrupted by breaks in the communication chain. Previous work focuses largely on in-office visits and rarely on adherence to medical recommendations, and most studies on bias in provider-patient encounters use hypothetical vignettes to examine the issue (e.g. FitzGerald and Hurst, 2017). Few studies to date have examined the real impact of provider bias for healthcare outcomes and disparities (Hall et al., 2015). Thus, the present study assesses whether communication failures, specifically related to incidental medical findings, disproportionately affect people of color, serving as a barrier to receiving medical care through impacting adherence (Schut and Barbosa, 2020; Williams and Sternthal, 2010). I aim to provide insight into provider-patient communication through empirical analysis of a unique dataset that allows for a "bird's-eye" perspective of patient contacts with the health system, analyzing whether instances of communication between patients and their providers occur.

Significance of Incidental Medical Findings

Incidental medical findings are undiagnosed health conditions discovered unintentionally during evaluation for another medical condition (Berland et al. 2010). One common type of incidental finding is the small pulmonary nodule. This "spot" on the lung is discovered on imaging exams such as computed tomography (CT) or magnetic resonance imaging (MRI) undergone by patients for an unrelated indication, such as trauma or cancer screening/ staging. After a patient receives an imaging exam, the images are routed to a radiologist to be "read." The radiologist summarizes findings from the exam into a report, noting all clinically-significant, including incidental, findings, and their established follow-up guidelines. This report is then sent to the provider who ordered the exam who is responsible for discussing the report with the patient, notifying the patient of any incidental findings discovered during the exam. Furthermore, follow-up recommendations for incidental findings should be explicitly discussed with the patient in order to ensure the patient not only receives information about his/her diagnosis, but is also able to understand if and how follow-up surveillance should occur (Schut and Barbosa, 2020).

Pulmonary nodules are of unclear etiology and undetermined significance at their diagnosis and often require follow-up (in the form of imaging or invasive procedure) to ensure they do not further develop into a primary lung cancer, metastasis, or other clinically-relevant condition. Thus, after disclosing an incidental pulmonary nodule diagnosis to a patient, the patient's provider arranges, orders, and schedules any recommended follow-up (Schut and Barbosa, 2020; Barbosa and Osuntokun, 2019).

Incidental pulmonary nodules are therefore useful for examining provider-patient communication and its link to adherence for two reasons. First, the annual frequency of chest CT imaging increased during 2006-2012 from 1.3 to 1.9%, as did the identification of pulmonary nodules (24 to 31%). As advanced imaging techniques such as CT and MRI increase in use for many indications, so will the identification of incidental nodules (Gould et al., 2015). As small pulmonary nodules can be clinically-relevant, potentially indicative of early lung cancer and other medical conditions, their surveillance is an important way by which morbidity and mortality can be reduced or prevented (Gould et al., 2015). Still, research has shown that the management of incidental findings is a grey area in medicine, with the decision to communicate their presence to patients remaining largely dependent on the judgement of the patient's provider. For example, although many radiologists and healthcare providers believe all patients diagnosed with incidental findings should be notified of their diagnosis, other providers argue against communicating incidental findings to patients, as providers may be unsure of how to manage them clinically or because they believe such findings are of little clinical relevance (Zafar et al., 2016). Nevertheless, studies indicate that being diagnosed with an incidental pulmonary nodule may have implications for inciting behavioral change, such as smoking cessation, and suggest it is important for providers to discuss even low-risk findings with their patients (Brian et al., 2017; Tammemagi et al., 2014).

Second, pulmonary nodules are ideal for examining provider-patient communication and follow-up adherence because radiologists include explicit, standardized follow-up guidelines in their reports, such that there is little ambiguity for ordering providers regarding how a

pulmonary nodule should be surveilled. Because the ordering provider serves as an intermediary between the radiologist's recommendations and the patient, it is straightforward to determine if a provider succeeded in communicating follow-up recommendations to the patient, as providers must report they communicated with a patient in the EMR in order for the radiology report to be released to patients. From the researcher's perspective, it is simple to follow this "paper trail" of communication and interactions. If there is no evidence in the EMR that communication of findings to patients occurred, then it is unlikely the communication occurred.

Data and Methods

Data are drawn from the electronic medical record (EMR) database and radiology records of a major tertiary healthcare system located in the northeastern United States. This health system is representative of other major health centers in the United States, with a central urban hospital and multiple satellites.

This study received local Institutional Review Board approval with HIPAA (Health Information Portability and Privacy Act) waiver of informed consent prior to its commencement. A radiology-centric search engine was utilized to retrospectively identify all patients who received a chest CT for any medical indication in 2016, in which a previously undiagnosed incidental pulmonary nodule was also detected. This was done using a unique search to identify all pulmonary nodule codes included in CT chest reports that categorize the nodule by size, composition, and risk-level (Barbosa and Osuntokun, 2019; Schut and Barbosa, 2020). The search resulted in 1,846 unique patient records. I excluded 3 patients under the age of 18 at the time of their initial CT scans, resulting in a final analytic sample of 1,843 patients.

After identifying the study cohort, a digital REDCap (Research Electronic Data Capture, a web-based, open access, HIPAA-compliant secure database) form was created to collect patient data (Harris et al., 2009). I manually searched for each patient in the EMR and collected sociodemographic and clinical information at baseline (defined as the date of the initial chest CT in 2016). Information regarding provider communication and patient adherence to recommended follow-up was retrospectively collected from the time of the initial CT until 3 years after the date of the initial CT.

I geocoded cross-streets of patient addresses and matched them to their census block groups. Then, I collected block group-level SES data (median household income and educational attainment) from the 2016 American Community Survey (ACS) 5-year estimates in order to proxy patient socioeconomic status (SES) via neighborhood SES (Ruggles et al., 2019). This was done following an approach similar to that described by Krieger (1992) to overcome inconsistently-collected individual SES information recorded in the EMR. Block group-level data was obtained because the block group is the smallest geographical unit for which the U.S. Census Bureau publishes sample data, such as median household income and education.

Outcome Measure

To examine whether disparate provider-patient communication occurs across patient race/ethnic groups, and to examine if communication and adherence are linked, I present descriptive statistics showing the percentage of all patients (and by racial/ethnic group), who 1) were notified of their incidental pulmonary nodules, 2) adhered to radiologist-recommended follow-up imaging/procedures for their incidental pulmonary nodules, and 3) among those notified, adhered to the recommended follow-up. I determined if follow-up was obtained within the studied healthcare system through extensive review of the EMR. A patient was considered adherent to follow-up if documentation was present in the EMR of either noninvasive (follow-up CT scan) or invasive (surgical procedure or biopsy) follow-up having occurred, in accordance with the recommendations in the radiology report. Follow-up type and interval were determined by the radiologist according to the frequency, size, and composition of incidental pulmonary nodules, following Fleischner Society guidelines (Naidich et al., 2013). Some nodules, depending on their size and risk level, did not require follow-up. Others required immediate invasive follow-up or a second CT scan at 3, 6, or 12 months. Nodules were categorized by radiologists into 9 groups, which are condensed into low, mid, and high risk for malignancy in this analysis. I was able to determine if follow-up was obtained outside of the studied healthcare system, (i.e. in another hospital), through a feature of the EMR that allows for record sharing across 1,700 institutions in the United States (Healthcare Information and Management Systems Society, 2016).

In order to determine if provider-patient communication occurred, I conducted an extensive EMR review, including provider notes, visit summaries, phone calls/messages between provider and patients, and discharge notes. For communication to have been considered "occurred" in this analysis, EMR documentation had to show a provider contacted and discussed the incidental finding with the patient, either during an in-person visit, through electronic message, or via phone conversation. For example, communication was considered "occurred" if EMR documentation showed a provider made an electronic addendum to a patient's CT scan report stating, "Called patient to discuss CT scan, which identified 4 mm pulmonary nodule. Patient will schedule follow-up CT in 12 months." If the ordering provider saw a patient in their office post-CT, EMR documentation of communication could, for example, read, "Discussed recent CT including incidental nodule finding. Recommend follow-up CT in 6 months." For the purpose of this analysis, it was sufficient for any provider to communicate the incidental pulmonary nodule diagnosis to a patient, regardless of whether that provider ordered the initial CT. For example, if a physician ordered a patient's CT and then delegated the responsibility of discussing the CT results with the patient to a nurse practitioner, communication was counted as having occurred. In analysis, the communication variable was constructed as binary, with 0 indicating "no communication occurred" and 1 indicating "communication occurred."

Key Explanatory Measures

Explanatory variables are grouped into three categories: patient social, economic, and demographic characteristics; patient health characteristics; and healthcare provider characteristics. As I will describe in more detail, I include these categories of explanatory measures to test various hypotheses regarding why we might observe racial/ethnic disparities

in provider-patient communication. For example, SES, health status, and provider differences might contribute to racial-ethnic disparities in patient-provider communication.

Race/ethnicity (Black, White, Asian, and Hispanic) is the main predictor variable in this analysis. Sociodemographic controls include nativity (foreign-born/native-born), age, sex, and marital status (single, married, widowed, divorced, and separated). Nativity status was included because immigrant patients may face barriers, such as language differences, in their encounters with the US healthcare system, making it more difficult for communication to occur (Sewell, 2015). Marital status was included as it may indicate some level of social support encouraging provider-patient communication. Race/ethnicity, nativity, age, sex, and marital status were self-reported by patients and captured in the "Demographics" section of the EMR.

A neighborhood SES index is included as a binary variable coded as 0 for low-SES block groups (where the median household income was under $60,855 and >50% of the population in that block group had not attended college) and 1 for mid/high-SES block groups (where the median annual income was greater than $60,855 and >50% of the population had a college degree). The income cutoff of $60,855 was chosen because it was found to be the median of the median household income for respondents' census block groups. Additionally, it corresponded to the median household income for a family of four in the United States in 2016 (Fontenot et al., 2018). The neighborhood SES control was included because patients from low SES contexts may receive less or lower-quality information from providers compared to patients from mid/high SES contexts (Verlinde et al., 2012).

Block group SES was coded as "missing" for 27 patients who had a P.O. Box as opposed to a residential address in their EMR. Sensitivity analyses showed the results of bivariate models remained similar with and without "missing" cases. Furthermore, for 92 patients, median income was not able to be obtained due to missing data in the ACS file for their census block groups. I imputed median household income for these block groups as an average of the three surrounding block groups.

The second group of patient characteristics control for health and clinical experiences that may impact a provider's likelihood of communicating the presence of incidental findings to patients. I include smoking history (current, past, never), context of visit in which the patient obtained his/her first CT (outpatient, inpatient, ER), and relevant comorbidities reported in the EMR. Comorbidities reflect ICD-10 diagnoses pertaining to chronic diseases, grouped by etiologic groups, including cardiovascular, immunologic, oncologic, respiratory, environmental, musculoskeletal, gastrointestinal, and genitourinary conditions. In the descriptive statistics and regression models, patients are categorized as either having "any comorbidity" or "no comorbidities." Comorbidities may either encourage or discourage incidental pulmonary nodule communication. For example, patients with no comorbidities may be more likely to receive communication about incidental findings, which could present a new health concern. Alternatively, patients with serious, life-threatening comorbidities may not receive communication if their provider believes there is little to be gained from surveilling incidental findings in the context of greater health concerns. Similarly, smoking

status may encourage provider communication of incidental pulmonary nodules, as former and current smokers are more at risk of developing lung cancer than non-smokers. Finally, the context of CT reception is important as patients diagnosed with incidental findings in the ER have been shown to rarely adhere to follow-up recommendations. This indicates ER provider-patient communication of incidental findings seldom occurs (Barbosa and Osuntokun, 2019). I also control for the malignancy risk-level of the pulmonary nodule, as determined in the radiology report. Low risk nodules are solid or "ground-glass" in composition, under 6 millimeters in diameter, and have the longest recommended interval from initial diagnosis to follow-up. Nodules posing intermediate risk for malignancy are solid or ground-glass and 6-10 millimeters in diameter. High risk nodules are solid or part-solid and 10 millimeters or larger, and require follow-up within the shortest time interval from initial diagnosis (Naidich et al., 2013). Nodule risk-level is an important control because providers may be more likely to communicate incidental findings with patients if the findings are considered high-risk for malignancy.

Last, I include controls related to patients' healthcare providers, collected from the EMR. Two provider-types were examined in this study: primary care providers (PCP) and "ordering" providers (providers who ordered the patients' initial CT). I documented if a patient had a PCP listed in their EMR and if the patient had visited that PCP in 2016, as these factors indicate a patient's healthcare utilization, and because a PCP can create a communication channel for diagnoses such as incidental findings. Thus, patients with PCPs, and those who have seen that PCP in the past year, may be more likely to receive communication of incidental findings and ultimately adhere to follow-up recommendations. For a patient's ordering provider, I collected information on degree/training and medical specialty, as some providers (e.g. pulmonologists) may be more familiar or comfortable with managing incidental pulmonary nodules than others, increasing the likelihood of provider-patient communication of findings.

Analytic Strategy

My analysis presents descriptive statistics and binomial logistic regression models. I first present descriptive statistics pertaining to patient and provider characteristics. I then include the percent of patients who received provider-patient communication regarding an incidental finding diagnosis as well as the percentage of patients who adhered to follow-up recommendations. I also present the percent of patients who adhered to follow-up recommendations, conditional on having received provider-patient communication of their incidental finding. All descriptive statistics are presented for the full sample (all racial/ethnic groups combined), and by racial/ethnic group separately.

Next, I show a series of stepwise binomial logistic models predicting provider-patient communication. The equation for these models is presented below, where p indicates the probability a provider will disclose the incidental finding to a patient ($y_i = 1$). Racial/ethnic disparities are indicated by the race/ethnicity variable, where White is the reference category. X_{ik} indicates all control variables, including other patient demographic, SES, and health characteristics, as well as provider characteristics:

Most patients received their initial CT exam in an outpatient context (61%), but a significant minority (22%) received their initial CT exam in the ER. Black and Hispanic patients were most likely to receive their initial CT in the ER (38 and 30%, respectively). Nodules varied similarly in risk-level across racial/ethnic groups, and most nodules were deemed to be low-risk for cancer (63-71%). Notably, however, Black patients were most likely to be diagnosed with high-risk nodules (14%), and Asian patients were least likely to be diagnosed with such nodules (7%).

Results indicate that provider-patient communication and adherence are linked. Among patients who received provider communication of their incidental nodule diagnosis, 63% obtained follow-up, 24% did not obtain follow-up, and 14% did not require follow-up, per radiology recommendations. Hispanic patients notified of their incidental finding were most likely to adhere to follow-up recommendations (71%) and Asian patients were least likely (56%). Black patients who received their diagnosis were most likely to not obtain follow-up (31%).

Logistic Regression Analysis

White patient, adjusting for other demographic characteristics. Foreign-born patients were also less likely than native-born patients to receive provider-patient communication by an odds-percent of 30%, holding all other demographic characteristics constant. Models 2-4 show Black-White and Hispanic-White gaps persist across models; if racial/ethnic differences in provider-patient communication were due to differences in socioeconomic characteristics, we would expect to see the effects of race/ethnicity disappear in Model 2; yet, the effects diminished only slightly for Black patients and for Hispanic patients. Notably, however, point estimates in Model 4 demonstrate that the odds of patients with PCPs receiving communication were two times those of patients who did not have a PCP, and the odds of those patients who saw their PCP in 2016 receiving communication were nearly three times those of patients who did not see their PCP in 2016. In the fully-adjusted model, it is striking to note that even when demographic, socioeconomic, health, and provider characteristics are controlled for, the odds-percent that Black and Hispanic patients received provider-patient communication was lower than that of White patients by an odds-percent of 40% and 70%, respectively.

Discussion and Conclusion

This study provides evidence of striking racial/ethnic disparities in provider-patient communication of incidental findings. The disparities investigated in this study are not explained by differentials in patient socioeconomic status, health status, or provider characteristics, and thus, neither structural nor interpersonal factors fully explain communication disparities. Unexplained disparities in provider-patient communication with Black and Hispanic patients may indicate the "discomfiting explanation" that racially-discriminatory communication by healthcare providers is responsible for the observed communication gaps (Hoberman 2007, 505). This finding, in turn, has implications for the persistence of health disparities in the United States.

This study makes several key contributions to our understanding of racial/ethnic disparities in adherence by examining this issue as a consequence of biased provider communication. As shown in Table 3, wide disparities in adherence to follow-up recommendations exist, with gaps particularly apparent between Black and Hispanic patients compared to White patients. These disparities in follow-up adherence are likely magnified by initial racial/ethnic disparities in provider-patient communication of an incidental nodule diagnosis, and I suggest in order to fully understand issues of low adherence, we must first examine how communication failures are contributory to the issue. Patients must first possess knowledge about a given diagnosis and its follow-up recommendations in order to then adhere to medical advice regarding that diagnosis.

Logistic regression models show that differences in socioeconomic, health, and provider characteristics may shape communication disparities between Black-White patients, though these compositional demographic differences do not appear substantial. Between Hispanic-White patients, few covariates are able to explain communication disparities. Hispanic patients are less likely than Whites to be notified of their incidental nodule by the most significant margin.

Finally, although adding provider characteristics into Model 4 did not eliminate gaps in provider-patient communication completely, estimates of PCP-related controls in Models 4 and 5 show that patients who had a PCP and who further visited that PCP in 2016 were more likely to receive provider-patient communication of their incidental nodules than those who did not. This finding highlights the importance of PCPs in the US healthcare system. As PCPs often coordinate specialty care for their patients and are available to explain complex medical directives and answer questions from patients, a patient lacking a PCP may be particularly at risk of "falling through the cracks" and off the path towards adherence.

Ultimately, communication disparities discovered in this study may reflect that providers employ racially-motivated thinking in their clinical judgements. For example, if providers hold stereotypes that Black patients are less likely than White patients to proactively pursue healthcare and adhere to medical directives relative to White patients (Feagin and Bennefield, 2014; Cooper et al. 2013), they may in turn be less likely to communicate certain medical information, such as incidental findings, to Black compared to White patients. Disparities observed in provider-patient communication with Hispanic patients may reflect combined structural disadvantages (such as low SES) and "cultural" factors such as language ability (or, provider-perceived language ability) which doubly-disadvantage Hispanic patients navigating the US healthcare system (Sewell, 2015). For example, if providers perceive that Hispanic patients exhibit limited English ability and have lower levels of education, they may ultimately communicate less information with them compared to with their White patients.

This study had several limitations. First, utilizing a single health system's EMR data presents unique challenges, and patients in this analysis may not be generalizable to those receiving care in small community or rural hospitals in other states. However, there are many strengths of this dataset, and whereas it only examines one health system, the number of patients examined is substantial and representative of all patients who received chest CTs

with an incidental nodule during the study period. As hospital consolidation and mergers become increasingly common, we can expect such systems to become dominant providers of healthcare services in the future.

Additionally, the EMR is stable and standardized across this institution, as are radiology recommendations for incidental pulmonary nodule follow-up. Finally, EMR data allow for detailed examination of provider-patient interactions and patient contact with the healthcare system, and do not require reliance on patient self-report of health and diagnoses or patient recall.

Second, as only one year's worth of patients were analyzed, the sub-sample of Asian, Hispanic, and foreign-born groups was small, limiting statistical power and likely affecting the statistical significance of results pertaining to Asian and foreign-born groups in logistic models. Alternatively, it may also be that Asian and foreign-born patients specifically were too similar to White patients, such that no difference between those groups could be observed, or, alternatively, that Asian and foreign-born individuals were too diverse to be analyzed together.

Finally, this study assumes that what providers recorded (or did not record) in the EMR is the same as what actually happened. Whereas one might question this assumption, I am inclined to believe that providers are more likely to over-report communication with patients than underreport in order to ensure care is well-documented. Under this assumption, the findings of this study are conservative, and racial/ethnic disparities highlighted here may actually be more striking in reality than is estimated in this research.

Martin Luther King Jr. once stated, "Of all the forms of inequality, injustice in health is the most shocking and inhumane." Despite its limitations, this study provides a unique picture of how bias may influence provider-patient communication, through demonstrating that even when all other characteristics are equal, provider-patient interactions are indeed patterned by patient race/ethnicity, to the detriment of patients of color. This finding exemplifies how the practice of medicine is not immune to the intense system of racial stratification present in the United States, with the most at-risk populations still at a disadvantage even after they gain access to health services.

Further understanding of and attempts to remedy bias in medicine are meaningful areas of research meriting further examination. Hoberman (2007) argues research must investigate how racially-motivated diagnostic errors occur and how racial mythologies are passed from one generation of providers to the next. Although this study and others have added to this gap in the literature, still, more work must be done to investigate the ways institutional and provider-level discrimination impacts healthcare utilization and adherence, and furthermore, must link the racial-patterning of provider/patient interactions to health outcomes.

Furthermore, ensuring equal access to primary care is key. PCPs are shown here to play a key role in managing and coordinating patient care, and in ensuring that patients receive important communications and follow through with their medical care. As accessing specialty care can be a difficult and disjointed experience for patients, PCPs play a critical role in ensuring patients are connected to specialists and the healthcare system, and that

medical diagnoses, recommendations, and communications are fully understood and managed.

Finally, communication bias has been shown here and in other studies to hinder healthcare utilization among Black and Hispanic patients, indicating that health policy and healthcare training programs must prioritize instructing providers on medical racism and interpersonal bias. Specifically, new and already-practicing providers must receive training on the role of structural racism in generating healthcare and health disparities (Sewell, 2015). More critically, it is imperative that medical institutions address structural racism embedded within health care at the organizational level (Metzl and Roberts, 2014). Only when efforts are taken to eliminate medical racism both at the institutional and interpersonal levels will the provision of care for patients of color improve, and only then will healthcare disparities finally be eliminated.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements:

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- Examines if disparate provider-patient communication of incidental medical findings occurs

- Finds provider-patient communication occurs disparately across patient racial groups

- Effects strongest for Hispanic and Black patients; disparities remain after including controls

- Access to primary care somewhat attenuates communication disparities

- Policies must address provider communication bias and ensure access to primary care

Table 1:

Patient Characteristics

Patient Demographic, SES, and Health Characteristics	Full Sample	By Patient Race/Ethnicity			
	All Races	White	Black	Asian	Hispanic
N	1843	1064	654	60	65
%	100.0	57.7	35.5	3.3	3.5
Foreign-Born (%)	8.5	28.9	18.6	36.5	16.0
Female (%)	54.8	52.3	60.7	40.0	50.8
Age (%)					
18-28	2.8	2.0	4.1	0.0	6.2
29-39	4.8	3.9	5.5	8.3	10.8
40-49	9.7	8.4	11.5	15.0	7.7
50-59	20.2	17.9	23.7	10.0	32.3
60+	62.5	68.0	55.2	66.7	43.1
Employment Status (%)					
Employed	30.6	34.7	22.9	35.0	36.9
Unemployed	4.3	1.9	8.1	5.0	4.6
Retired	41.7	45.5	37.0	41.7	27.7
Out of labor force	16.1	10.4	25.1	10.0	23.1
Unknown	7.3	7.5	6.9	8.3	7.7
Neighborhood SES (%)					
Low	41.4	42.1	83.3	28.3	66.2
Mid/High	57.1	56.2	15.3	71.7	33.9
Missing	1.5	1.7	1.4	0.0	0.0
Health Insurance Type (%)					
Private	28.6	34.9	17.6	38.3	27.7
Medicaid	14.1	4.5	29.1	10.0	23.1
Medicare	55.9	59.9	51.1	48.3	46.2
None	1.5	0.8	2.3	3.3	3.1
Marital Status (%)					
Single	29.8	19.2	50.8	16.7	29.3
Married	51.0	63.2	29.4	71.7	49.2
Widowed	9.4	8.4	11.3	6.7	9.2
Divorced	8.0	8.3	8.1	0.0	10.8
Separated	1.8	1.0	0.5	5.0	1.5
Smoking status (%)					
Never smoker	46.1	47.2	40.4	71.7	60.0
Former smoker	39.8	43.6	36.2	25.0	27.7

Patient Demographic, SES, and Health Characteristics	Full Sample	By Patient Race/Ethnicity			
	All Races	White	Black	Asian	Hispanic
Current smoker	14.2	9.2	23.4	3.3	12.3
Comorbidities (%)					
Any	91.3	90.8	92.8	81.7	92.3
None	8.7	9.2	7.2	18.3	7.7
Context of Initial CT (%)					
Outpatient	60.7	72.1	43.0	61.7	50.8
Inpatient	17.4	16.4	18.7	18.3	20.0
Emergency	21.9	11.6	38.4	20.0	29.2
Nodule (Risk for Malignancy) (%)					
Low	67.1	65.6	69.7	63.3	70.8
Intermediate	19.9	21.8	15.9	30.0	18.4
High	13.0	12.6	14.4	6.7	10.8

Table 2:

Provider Characteristics

Provider Characteristics	Full Sample	By Patient Race/Ethnicity			
	All Races	White	Black	Asian	Hispanic
N	1843	1064	654	60	65
PRIMARY CARE PROVIDER CHARACTERISTICS					
PCP listed in EMR (%)	86.8	89.6	82.1	80.0	81.5
PCP Visit in 2016 (%)					
Yes	36.7	34.6	41.4	26.7	32.3
No	6.1	5.5	8.0	1.7	3.1
Unknown	44.2	50.3	33.3	51.7	46.2
No provider listed (N/A)	13.0	9.7	17.3	20.0	18.5
PCP Location (%)					
Hospital system being studied	39.0	35.2	46.9	28.3	30.8
Other tertiary care center	14.3	16.9	10.2	16.7	10.8
Private practice	26.5	27.2	24.6	31.7	29.2
Hospital/practice outside of region	7.0	10.7	0.9	3.3	10.8
No provider listed (N/A)	13.2	10.0	17.3	20.0	18.5
PCP Degree/Training (%)					
Attending	79.8	86.9	69.3	76.7	72.3
Resident	3.1	0.6	7.2	3.3	3.1
Physician's assistant or CRNP	3.7	2.5	5.8	0.0	4.6
No provider listed (N/A)	13.4	10.0	17.7	20.0	20.0
ORDERING PROVIDER CHARACTERISTICS					
Area of Practice (%)					
Primary care	22.5	26.1	13.5	18.3	13.9
Emergency	26.2	21.8	23.2	25.0	23.1
Pulmonary	20.9	14.5	44.5	28.3	32.3
Other (rheumatology, oncology, etc.)	25.6	31.5	16.2	23.3	24.6
Thoracic surgery	4.8	6.1	2.6	5.0	6.2
Ordering Provider Degree/Training (%)					
Attending	81.2	83.2	78.4	80.0	78.5
Resident	9.4	5.6	14.7	11.7	16.9
Physician's assistant or CRNP	9.4	11.3	6.9	8.3	4.6
PULMONARY CARE CHARACTERISTICS					
Pulmonary Care Established before Initial CT (%)	25.1	30.4	16.7	31.7	18.5
Pulmonary Care Established after Initial CT (%)	17.0	17.7	16.9	17.1	9.4

Table 3:

Provider/Patient Communication of Incidental Nodule Diagnosis and Patient Adherence

Outcomes	Full Sample		Patient Race/Ethnicity		
	All Races	White	Black	Asian	Hispanic
Total N	1843	1064	654	60	65
Patients Notified of Incidental Nodule Diagnosis (%)	67.7	77.7	53.7	65.0	47.7
			(<0.001)	(<0.001)	(<0.001)
Patient Adherence (%)					
Recommended Follow-Up Obtained	44.6	51.2	35.0	36.7	38.5
			(<0.001)	(<0.001)	(<0.001)
Recommended Follow-Up Not Obtained	40.2	31.7	53.2	40.0	49.2
			(<0.001)	(<0.001)	(<0.001)
NA (Follow-Up Not Recommended, Not Obtained)	15.3	17.1	11.8	23.3	12.3
			(<0.001)	(<0.001)	(<0.001)
Among Notified Patients, Follow-Up Obtained					
N	1248	827	351	39	32
Yes	62.6	63.6	60.1	56.4	70.9
			(0.012)	(<0.001)	(<0.001)
No	23.7	21.2	30.5	20.5	19.4
			(<0.001)		
NA (Not Recommended, Not Obtained)	13.7	15.2	9.4	23.1	9.7
			(<0.001)	(<0.001)	(<0.001)

Note. P-values presented in parentheses, reflecting two-tailed t-tests between Black/Asian/Hispanic and White patients.

Table 4:

Binary Logistic Regression Models Predicting Provider-Patient Communication of Incidental Nodule Diagnosis

Characteristics	(1) Demographics	(2) M1 + SES	(3) M1 + Health	(4) M1 + Provider	(5) Full Model
Race (ref = White)					
Black	0.3 ***	0.5 ***	0.5 ***	0.6 ***	0.6 **
	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)
Asian	0.8	0.8	0.6	0.8	0.7
	(0.3)	(0.3)	(0.3)	(0.4)	(0.3)
Hispanic	0.3 ***	0.4 ***	0.3 ***	0.4 ***	0.3 ***
	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
Nativity (ref = Native-born)					
Foreign-born	0.7 *	0.6 **	1.1	1.0	1.2
	(0.1)	(0.1)	(0.3)	(0.3)	(0.4)
Age	1.0 ***	1.0 **	1.0	1.0	1.0
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Sex (ref = Female)					
Male	0.7 ***	0.7 ***	0.7 **	0.8 *	0.8 *
	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
SES (ref = Low-SES)					
Mid/High-SES		1.4 ***			1.3 *
		(0.2)			(0.2)
Missing		0.7			0.9
		(0.3)			(0.5)
Insurance Status (ref = Private)					
Medicaid		0.6 ***			0.9
		(0.1)			(0.2)
Medicare		0.7 ***			0.8
		(0.1)			(0.2)
None		0.3 **			0.9
		(0.2)			(0.5)
Marital Status (ref = Single)					
Married		1.9 ***			1.3
		(0.3)			(0.2)
Widowed		1.1			0.9
		(0.2)			(0.3)
Divorced		1.7 **			1.3
		(0.4)			(0.4)
Separated		1.7			1.0

Characteristics	(1) Demographics	(2) M1 + SES	(3) M1 + Health	(4) M1 + Provider	(5) Full Model
			(0.7)		(0.5)
Smoking Status (ref = Never Smoker)					
Former Smoker			2.0***		1.8***
			(0.3)		(0.3)
Current Smoker			1.2		1.2
			(0.2)		(0.2)
Hospital Context (ref = Outpatient)					
Emergency			0.1***		0.1***
			(0.0)		(0.0)
Inpatient			0.1***		0.1***
			(0.0)		(0.0)
Comorbidities (ref = None)					
Any			0.8		0.7
			(0.2)		(0.2)
Nodule (ref = Low Risk)					
Intermediate			1.2		1.2
			(0.2)		(0.2)
High			6.6***		7.1***
			(1.6)		(1.8)
Ordering Specialty (ref = Pulmonary)					
Internal Medicine				0.3***	0.4***
				(0.1)	(0.1)
ER				0.1***	0.2***
				(0.0)	(0.1)
Other				0.2***	0.4***
				(0.0)	(0.1)
Surgery				0.4***	0.4**
				(0.1)	(0.2)
Ordering Degree/Training (ref = Attending)					
Resident				1.3	1.5*
				(0.3)	(0.3)
CRNP, PA-C, Other				2.8***	1.6
				(0.7)	(0.4)
Has PCP (ref = No)					
Yes				2.2***	1.5**
				(0.4)	(0.3)
PCP Visit in 2016 (ref = No)					
Yes				2.6***	2.3***
				(0.4)	(0.4)

Characteristics	(1) Demographics	(2) M1 + SES	(3) M1 + Health	(4) M1 + Provider	(5) Full Model
Constant	2.0***	1.6	9.0***	4.1***	6.7***
Standard Errors	(0.5)	(0.5)	(3.2)	(1.6)	(3.4)
Observations	1,843	1,843	1,843	1,843	1,843

Note. Binomial logistic regression models presented in odds ratios. Base outcome for these models is "provider did not communicate finding to patient."

***
p<0.01,

**
p<0.05,

*
p<0.1