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Racial and Ethnic Differences in Cardiovascular Disease Medication Management for
Patients with Diabetes

By

Ana Helena Traylor

A dissertation submitted in partial satisfaction of the
requirements for the degree of

Doctor of Philosophy

in

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in the

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of the

University of California, Berkeley

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Professor Stephen Raphael, Chair
Rucker Johnson
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Abstract

Racial and Ethnic Differences in Cardiovascular Disease Medication Management for Patients with Diabetes

by

Ana Helena Traylor

Doctor of Philosophy in Public Policy

University of California, Berkeley

Professor Stephen Raphael, Chair

Extensive research documents inequities in the quality of health care provided to members of racial and ethnic minority groups in the United States. Cultural differences between patients and health care providers may contribute to health disparities by increasing the likelihood of physician bias, patient distrust and patient-provider miscommunication.

This dissertation uses data from Kaiser Permanente's Northern California Diabetes Registry of 2005 to 1) examine racial and ethnic disparities in cardiovascular disease (CVD) risk factor management for patients with diabetes, 2) explore the prevalence and predictors of patient-physician racial/ethnic match and 3) examine the association between racial and ethnic match and CVD risk factor management for patients with diabetes. I use a cross-sectional observational design and conduct a series of logistic regression models that adjust for patient, physician and medical facility characteristics.

I found significant differences in CVD risk factor control, treatment intensification for patients in poor control and CVD risk factor medication adherence. Compared to white patients, African American patients were less likely to be at target for diabetes (Hemoglobin A1c), hyperlipidemia (LDL-c) and Hypertension (SBP). Latino and Asian patients were less likely to be at target A1c levels, but more likely to be at target LDL levels. Spanish speaking patients were also less likely to be at target A1c levels.

Racial differences in treatment intensification were complex. When not at target levels, African American and Asian patients were less likely than white patients to have treatment intensified for A1c medications. However, African American patients were more likely to have treatment intensified for SBP and Asian patients were more likely than white patients to have treatment intensified for LDL and SBP medications. There were no disparities in intensification for Latinos patients; in fact Latino patients were more likely to have treatment for LDL intensified. Similarly, Spanish-speaking patients were more likely to have treatment intensified for LDL.

I found that African American and Latino patients were least likely to be racial matched, though Spanish speaking Latino patients were more likely than English speaking Latino patients to have a same race physician. Compared with patients who were assigned a physician by the health care organization, patients who chose their physicians were more likely to have a same race provider. While statistically significant for all racial and ethnic groups, this relationship was strongest for African American and Latino patients. Availability of a same race provider was the strongest predictor of patient-physician race concordance for African American and Latino patients.

I examined the association between race concordance and intermediate CVD risk factor outcomes for African American and Latino patients. Race and language concordance did not impact risk factor control or treatment intensification. However, race/ethnicity concordance was marginally associated with better adherence to medication for African American patients and language concordance was marginally associated with adherence for Spanish speaking Latino patients.

By allowing for more race and language concordance between patients and providers, increased minority representation in the medical professions is hypothesized to improve the cultural competence of health care delivery. Given wide and persistent disparities in health for African American and Latino patients, this dissertation examined the hypothesis that by increasing opportunities for race, ethnicity and language concordance, race-conscious medical school and workforce diversity efforts might lead to improvements in public health and a reduction in health disparities.

The results further highlight the need for continued efforts to measure, understand and address racial and ethnic disparities. The results presented here suggest that increasing the number and proportion of underrepresented minorities might lead to important improvements in patient adherence to medication. However, these efforts alone, will not eliminate gaps in CVD medication management for patients with diabetes.

In loving memory of my grandfather, Lorenzo Traylor

In honor of my parents, Howard and Barbara Traylor

Dedicated to Reginald W Jackson

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Introduction

Extensive research documents inequities in the quality of health care provided to members of racial and ethnic minority groups in the United States. Cultural differences between physicians and the patients they care for may contribute to health disparities by increasing the likelihood of physician bias, patient distrust and patient-provider miscommunication (IOM 2002).

A burgeoning literature explores the rationale and potential impact of policies aimed at increasing the capacity of the health care system to provide quality, culturally appropriate health care to all patients. Policy solutions to address barriers to the patient-provider relationship include cultural competency trainings for health care providers as well as efforts to increase the number of underrepresented minority health care providers. At the core of these efforts is the notion that physician knowledge of the cultural norms of and barriers faced by minority patients may enhance the experience of care and improve minority health outcomes.

The race concordance hypothesis suggests that minority physicians may possess culturally specific knowledge and experience (human capital) that reduce obstacles to the patient-physician relationship for minority patients. Race concordance is thought to improve the cultural competence of the health care system and foster trust, communication and better patient-provider interaction (Saha et al 2003). According to the race concordance hypothesis, more patients will have providers of the same race than would be expected if distribution mirrored population percentages and patients in concordant relationships would have, on average, better outcomes than similar patients in discordant relationships. The positive benefits would be more pronounced in outcomes that are associated with the quality of the physician-patient relationship such as patient adherence to medication, especially in the treatment of chronic diseases such as diabetes where successful disease management relies on consistent patient-provider communication and interaction.

In this dissertation, I use data from Kaiser Permanente's Northern California Diabetes Registry of 2005 to 1) Examine racial and ethnic disparities in Cardiovascular disease management for patients with diabetes, 2) Explore the prevalence and predictors of patient-physician racial/ethnic match and 3) Examine the association between racial and ethnic match and Cardiovascular Disease Management for patients with diabetes.

My key hypotheses are:

Hypothesis 1: Racial and ethnic minorities face clinical and structural barriers to care that can be reduced with a more ethnically, racially and linguistically representative health care workforce. I examine this hypothesis in detail in Chapter 1.

Hypothesis 2: The quality of the patient-physician interaction is a key factor in the successful management of Cardiovascular disease. CVD management disparities exist,

as a result of many factors, including disparities in intermediate processes of CVD care. I examine this hypothesis in Chapter 2.

Hypothesis 3: Due to culturally specific human capital, minority providers are more likely to treat same race patients. If given a choice, patients with a preference are more likely to choose a same race physician. Geographic availability will explain some, but not all disproportionate racial match. I examine this hypothesis in Chapter 3.

Hypothesis 4: Race and ethnic concordance fosters trust, improves satisfaction, utilization and quality of care. Racially matched patients should have better outcomes than similar patients in discordant relationships. I examine this hypothesis in Chapter 4.

Overview of Dissertation Chapters:

In chapter one, I examine the literature at the intersection of research on cultural competency, race/ethnicity concordance and race conscious medical workforce policy. Specifically, I examine the unique barriers to quality health care patients face as a result of physician bias, uncertainty and poor patient-physician communication. I also examine the barriers to trust facing minority patients. Finally, I examine the argument that increased representation of racial and ethnic minority providers may improve the cultural competence of the health care system, with a primary focus on increased representation as a mechanism to achieve greater patient-physician concordance.

In chapter two, I examine racial and ethnic disparities in Cardiovascular disease (CVD) for patients with diabetes. CVD is the leading cause of death in the United States and reducing disparities in CVD could significantly reduce morbidity and mortality gaps between patients of color and their white counterparts. I use a cross-sectional observational design to study a large cohort of patients with diabetes in an integrated delivery system. The outcomes of interest in this chapter are: risk factor control for diabetes, hyperlipidemia and hypertension, adherence to risk factor controlling medications and modification or intensification of medication treatment for patients in poor risk factor control. Using a series of logistic regression models that adjust for physician as a random effect, this chapter examines how patient race, ethnicity and language background influences the medication management of CVD for patients with diabetes and analyzes how the predictors of risk factor control, medication adherence and intensification differ by patient race, ethnicity and language.

In chapter three, I explore the prevalence and predictors of racial and ethnic match, again using data from the Northern California Diabetes Registry of 2005. I conduct race/ethnicity stratified analyses of the predictors of racial and ethnic match and compare logistic regression models that control for medical facility fixed effects, versus those that control for minority physician representation. This chapter adds to the literature on whether patient racial and ethnic match is primarily driven by patient and provider characteristics such as patient preference and socioeconomic status or driven

by geographic or medical facility availability of same race providers. The results of this study also inform efforts to understand how selection bias influences studies on race concordance.

In the fourth chapter, I examine the association of patient-physician race/ethnicity concordance on CVD risk factor levels, medication adherence and treatment intensification for African American and Latino patients in the Northern California Diabetes Registry of 2005. In addition, I examine whether language concordance for Spanish speaking Latino patients is associated with improved cardiovascular processes of care and level of intermediate outcomes. This study builds on previous research using a large sample size, among patients with a chronic illness and in an integrated delivery system where almost all patients have medication drug benefits.

In the fifth and final chapter, I summarize key findings, discuss the limitations of the current research, suggest future areas of research and discuss the policy implications of this study's findings.

Chapter 1:

**Medical Workforce Diversity, Patient-Physician Racial Match and
Cultural Competency:**

An Examination of the Rationale for Race Conscious Healthcare Workforce Policy

Introduction

Persistent gaps in health are a serious problem facing healthcare systems in the United States. Patients of color experience worse health outcomes across a wide spectrum of diseases and die earlier than their white counterparts (AHRQ 2010). While individual behaviors and genetic predisposition contribute to an individual's health, much of the current research on the sources of health disparities focuses on differences in the social determinants of health such as individual and neighborhood resources and exposure to hazards (Marmot, Kogevinas & Elston 1987; Williams & Collins 1995; Adler & Logan 1999; Lillie-Blanton & LaViest 1999). The social context influences individual patient behaviors and whether patients have access to care. However, studies have found that even after controlling for socioeconomic status, access to care and other social determinants, racial and ethnic health disparities persist (IOM 2002).

A large body of evidence has examined racial and ethnic disparities in the quality of the clinical experience and patient-physician interaction (IOM 2002; van Ryn & Burke 2000; AHRQ 2010; Johnson et al 2004; Cooper et al 2003). Organizational, structural and clinical barriers to care may contribute to disparities in the experience of care for minority patients. A growing body of research explores how a diverse, culturally competent healthcare workforce might reduce these barriers to care and thus improve health outcomes for minority patients (Betancourt et al 2002; Goode, Dunne & Bronheim 2006; Brach & Frasier 2002). However, empirical evidence supporting the health benefits of a diverse and culturally competent workforce is in the early stages of development. In the absence of direct evidence, researchers have examined the association between health professions diversity, cultural competency and health outcomes across the hypothesized pathways through which a diverse, culturally competent workforce might influence outcomes, such as physician service patterns and through increased race/ethnicity and language concordance.

Cultural competency has been defined as a “set of congruent behaviors, attitudes, and policies that come together in a system, agency or amongst professionals and enables that system, agency or those professionals to work effectively in cross-cultural situations” (Cross et al 1989). A culturally competent health care system is “one that acknowledges and incorporates- at all levels- the importance of culture, assessment of cross-cultural relations, vigilance toward the dynamics that result from cultural differences, expansion of cultural knowledge, and adaptation of services to meet culturally unique needs” (Betancourt, Green and Ananeh-Firempong 2002).

The *Concordance Hypothesis* posits that racial and language dissimilarity can create barriers to the patient-physician relationship. According to the hypothesis, race and language concordance improves the cultural competence of the health care system and fosters trust, communication and better patient-provider interaction (Saha, Arbelaez & Cooper 2003). Given wide and persistent disparities in health for African American and Latino patients, this chapter examines the claim that increasing the racial and ethnic diversity of the medical workforce might improve the cultural competency of the delivery

of health care, potentially leading to improvements in public health and a reduction in health disparities.

Specifically, I examine the following propositions supporting the hypothesis that increasing the diversity of the medical workforce will lead to improvements in public health and a reduction in health disparities:

1. Even after controlling for access to care, patients from minority backgrounds may have unique barriers to receiving high quality interpersonal and technical quality of care resulting from physician bias, uncertainty or patient-physician miscommunication.
2. Due to a historical legacy of discrimination, actual or perceived current discrimination and bias and underrepresentation of medical providers from minority backgrounds, patients from underrepresented minority groups may face systematic barriers care that impact trust in the health care system and in health care providers.
3. Increasing the representation of minority providers may improve the cultural competence of the healthcare system by reducing the clinical, organizational and structural barriers to care for minority patients.

First I briefly summarize the policy context surrounding racial and ethnic disparities in health. Second, I outline barriers to care for minority patients, with a primary focus on the clinical encounter. I review the empirical evidence on the relationship between medical workforce diversity, cultural competency and health outcomes. Finally, I examine proposed policy options to increase medical workforce parity for underrepresented minority groups.

Background

Racial disparities in health outcomes

There are widely recognized disparities in cardiovascular disease, cancer, diabetes and premature death and these disparities have persisted overtime, and in many cases, have increased in recent years (IOM 2002; AHRQ 2010). For example, African-American infants are two times as likely to die in their first year of life as white infants, even when controlling for socioeconomic factors. African-American men are twice as likely as white men to die from prostate and colorectal cancers. While cancer survival rates for whites improved over the past decade, survival rates for African-Americans declined (AHRQ 2010).

Minorities bear a greater disease burden associated with mental health disorders, due in part to a lack of access to quality mental health services. American Indians and Alaskan Natives suffer from an unusually high rate of suicide. African-Americans are twice as likely as whites to be diagnosed with diabetes. Latinos, American Indians, and

certain Asian-Pacific Islander groups all have rates that far exceed that of whites. HIV prevalence in African-American women is 24 times that of white women. African-American men are 8 times as likely as their white counterparts to be diagnosed with HIV (AHRQ 2010). Almost 100,000 African Americans die each year who would not die if African American death rates were equivalent to whites (Satcher et al 2005).

Racial and Ethnic Disparities in the Social Determinants of Health

A growing body of research examines how the social context may contribute to disparities in health. Underlying disparities in health outcomes are inequities in the social determinants of health such as differences in social and economic class (Boardman 2001, Williams & Collins 1995). Indeed, African-Americans, Native Americans and Latino Americans are concentrated in neighborhoods with worse schools, lower rates of home ownership, higher rates of poverty and lower levels of educational attainment and these social factors have been associated with differences in the quality and length of life (Acevedo-Garcia 2000; Massey & Denton 2001; Boardman 2001). Economic and social inequalities can contribute to (and are reflected in) differences in rates of health insurance across groups (Piette et al 2004), differences in access to quality medical facilities (Chandra & Skinner 2003), and differences in access to providers who can communicate with and understand the social context in which patients seek treatment (Cooper et al 2006).

Even individual-level sources of health disparities such as differences in health behaviors and individual risk factors may be influenced by the above social determinants. For example, differences in behaviors such as smoking, alcohol consumption, diet and exercise can contribute to disparities in health (Emmons 2000) and these factors are influenced by patient educational attainment and socioeconomic status. Differences in health literacy also likely contribute to disparities in health and are influenced by socioeconomic status influences such as educational status (Bennett et al 2009). Occupational status and experience of racial discrimination impacts our levels of stress and the amount of control we perceive to have in our lives (Adler & Logan 1994; Marmot et al 1991; Cohen & Syme 1985). Levels of stress and self-efficacy have been tied to a host of health outcomes and racial/ethnic and socioeconomic differences in stress levels and feeling of self-efficacy have been well established (Turner et al 1995).

However, even after taking patient socioeconomic status and access to care into account, racial and ethnic disparities in healthcare persist. A growing body of evidence, stemming from the the seminal IOM report on disparities in care, examines the system and clinical level barriers to care for minority patients that contribute to racial and ethnic disparities in health outcomes.

Racial and Ethnic Disparities in Healthcare

The Bias Hypothesis

Several studies have explored how physicians contribute to racial and ethnic health disparities (IOM Report 2002; Chen et al 2002; Schulman 1999; vanRyn 2000, 2003). Physicians may exhibit conscious or unconscious biased attitudes about patients of color that impact the quality of the patient-provider interaction. For example, in a 1999 experiment by Abreu, psychotherapists primed with stereotype words rated patients significantly less favorably on hostility-related attributes and more favorably on hostility-unrelated attributes than did participants primed with neutral words. The findings suggest that therapists can be affected by African-American stereotypes in ways that produce negative or positive first impressions depending on the nature of the attribute that is rated (Abreu 1999).

A study by van Ryn in 2000 found that physicians tend to perceive African American patients and members of low socioeconomic groups more negatively on a number of dimensions than they did whites and members of high socioeconomic groups. van Ryn used survey data from 193 physicians and 618 patient encounters to examine the degree to which patient race and socio-economic status affected physicians' perceptions of patients during a post-angiogram encounter. Controlling for patient age, sex, race, frailty/sickness, depression, mastery, social assertiveness and physician characteristics, patient race was associated with physicians' assessment of intelligence, feelings of affiliation toward the patient, and beliefs about the patients' likelihood of risky behavior and adherence with medical advice (van Ryn & Burke 2000). Using the same data set, another study found that these perceptions influence rates of recommendations for coronary artery bypass graft surgery (vanRyn 2006).

Individual physicians may be unaware of, or underestimate any bias they hold against patients of color. For example, in one study, 287 internal medicine and emergency medicine residents at four medical centers in Atlanta, GA completed internet-based clinical vignettes of white and African American patients seeking care, followed by a questionnaire and three implicit association tests. The implicit association tests measured implicit race preference and perceived cooperativeness. In questionnaires, physicians reported that they had no preference for white versus African American patients and there were no differences in perceived cooperativeness. However, the implicit Association Tests showed that physicians favored white patients and perceived African American patients to be less cooperative. Sadly, as implicit bias increased, physicians in the study were less likely to use medical procedures on African American patients (Green et al 2007).

Differences in treatment are not always the result of physician bias, however. In the next sections, I describe how miscommunication and uncertainty can contribute to differences in treatment.

The miscommunication hypothesis

Miscommunication is another potential barrier to care for patients of color. Miscommunication can occur as a result of differences in communication styles between patients and physicians, differences in the quality of physician communication with patients of color and language discordance between patients and providers. Studies have found that physicians engage in less patient-centered communication with African American patients than white patients (Cooper et al 2003, Johnson et al 2004). For example, in a study that used audiotape of clinical visits and questionnaires from 458 African American and white patients who visited 61 physicians in the greater Washington DC area, patient race was associated with the quality of communication and patient centeredness. Independent raters found that physicians were more verbally dominant and less patient-centered with African American patients compared with white patients (Johnson et al 2004). In their interactions with African American patients, physicians exhibited less nonverbal attention, empathy, courtesy, and information giving, adopted a more narrow biomedical style, spent a lower proportion of time providing health education, chatting and answering questions, and were more verbally dominant and exhibited more negative emotional tone than with white patients (Johnson et al 2004, Beach et al 2006).

Miscommunication is even more pronounced for patients of color with language barriers. Many English language learners are served by providers from different language backgrounds and interpreters are used only a small proportion of the time that they are needed. A study by Baker and colleagues (1996) found that for Spanish speaking Latino patients, language concordance and interpreter use greatly affected patients' perceived understanding of their disease (Baker et al 1996).

Uncertainty

Physicians are often making quick decisions, with little time and limited information. Diagnoses and treatment plans are subject to provider discretion, which may open the door for racial bias in health care service delivery and in the design of health plans (Bloche 2001). Situations where physicians are faced with uncertainty are especially ripe for differential treatment, whether the differential treatment is mal-intentioned or not. For example, in treating patients for different cultural backgrounds than their own, physicians may face greater clinical uncertainty and may be more likely to rely on stereotypes and what they know about the prevalence and consequences of diseases for different racial groups. Even physicians with no racial prejudice may make inaccurate inferences about patients when they use observable signals such as patient age, gender and race to make clinical decisions (Balsa, McGuire & Meredith 2005.)

Other barriers to the clinical relationship for minority patients

In addition to the above possible sources of disparities, patients of color face actual and perceived historical and current discrimination. A long history of discrimination and segregation in the United States health care system and blatant examples of disregard for the health of minority patients such as the infamous Tuskegee syphilis trials, are lingering memories in the minds of many members of racial and ethnic minority groups (Gamble 1993). This history, coupled with the current under-representation of minority groups in health care professions, may lead some minority patients to distrust the healthcare system and their primary care physician at higher rates than their white counterparts.

In a 2003 study, Boulware and colleagues surveyed 118 African American and white respondents between the ages of 18-75 and found that after adjusting for education, income, employment status, age, gender, insurance status and exposure to the medical system, African American respondents were less likely to trust their physicians and more likely to be concerned about personal privacy and the potential for harmful experimentation in hospitals (Boulware et al 2003).

Another study, using data from 6299 telephone interviews with white, African American, Latino and Asian patients examined racial differences in the perception of medical care. After adjusting for patient demographics, source of care and patient-provider communication variables, members of racial and ethnic minorities were more likely than whites to perceive they would have received better medical care if they belonged to a different racial and ethnic group and that medical staff judged them unfairly or treated them with disrespect based on race and ethnicity (Johnson et al 2004).

Another study examined racial and ethnic differences in the perceptions of trust in physicians and concerns with unfair treatment in the future. Using a random sample of 3884 persons over 18 in 1999, this study examined trust in physicians, concerns with unfair treatment and preferences for race concordance with providers. In this study, African American and Latino respondents were more likely to report unfair treatment because of race or language and less likely to report that their physician explained things, provided needed tests or paid attention to their concerns (Schnittker & Liang 2008).

Several interventions have been proposed to reduce the barriers described above. Briefly, these include use of interpreters, community health workers, diversity and cultural competency training and efforts to increase the number of underrepresented minorities in the medical workforce. For a comprehensive examination of interventions thought to reduce disparities and barriers to care, see Brach & Frasierirector 2000. The current study, however will focus on one potential intervention, increasing the minority representation in the medical workforce.

Underrepresentation of African-American, Latino and Native American Physicians

Perhaps the most compelling argument behind efforts to increase the diversity of the medical workforce is that increased minority representation will improve health outcomes and reduce health disparities by reducing the barriers to care described above. Most major medical associations support efforts to increase the racial, ethnic and linguistic diversity of the US health care workforce including the American Association of Medical Colleges, the American Medical Association and the Institute of Medicine.

The American Association of Medical Colleges defines “underrepresented minority” as those racial and ethnic populations that are underrepresented in the medical profession relative to their numbers in the general population. Table 1 outlines the percentage of each major racial and ethnic category in the US population and the percentage of physicians, registered nurses and dentists from each background. According to the Bureau of Health Professions (2006) African-Americans currently make up 12.3% of the US population, but only 4.5% of physicians and 9% of Registered Nurses. The percentage of Latinos in the population is 12.5% while only 5.1% of the physician workforce and 3.3% of the Registered Nurse workforce is Latino. On the other hand, Asian and Pacific Islanders make up 3.7% of the United States workforce but over 15% of the physician workforce and 6% of the RN workforce (Bureau of Health Professions 2006). Parity among the Asian population has not been reached for all subgroups however. For example, people from Filipino and Cambodian backgrounds are also underrepresented in the physician and nurse workforce (Cooper et al 2006).

TABLE 1: MINORITY REPRESENTATION IN THE MEDICAL WORKFORCE					
	White	African American	Latino	Asian/Pacific Islander	Native American
US Population	75.1%	12.3%	12.5%	3.7%	0.9%
Physicians	73.6	4.5	5.1	15.3	.3
RNs	80.4	9.0	3.3	6	.8
Medical/Health Services Managers	78.5	10.8	5.9	3.1	1
* From Saha 2006					

Due to the low proportion of underrepresented racial/ethnic minority physicians, African-American, Latino and Native American patients are more likely than white patients to be treated by a physician from a dissimilar racial, ethnic or linguistic background. This trend is likely to persist- by 2050, people of color will make up over 50% of the United States population while the percentage of African-American and Latino physicians is expected to remain constant (Cooper et al 2006).

Evidence that increased representation of minorities can improve outcomes

Conceptual framework

In a literature review on the rationale for a diverse workforce, the Bureau of Health Professions (2006) found no studies that directly examine the association between health professions diversity and health outcomes (Bureau of Health Professions 2006). At this point it is worthwhile to note the considerable challenges associated with the empirical analysis of workforce diversity policies and cultural competence efforts. No randomized trial, for example, has been able to assign patients to providers or health systems that are more or less culturally competent and no study has randomly assigned patients to physicians from concordant or discordant backgrounds.

In the absence of direct evidence, "examining the association between health professions diversity and health outcomes requires analyzing the links in a chain of logic connecting workforce diversity to improved outcomes" (Bureau of Health Professions, page 6). In the Bureau of Health Profession's framework, four separate pathways through which diversity in the health care workforce might influence health outcomes were proposed:

1) *Service Patterns*: First, an increase in underrepresented minorities is thought to shift service patterns. If African American, Latino and Native American providers are more likely to locate their practices in underserved areas, this may lead to improved access to care for underserved populations.

2) *Race and Language Concordance*: Second, more diverse workforce will lead to increased opportunities for racial/ethnic and linguistic match between patients and physicians. This is thought to improve communication, trust and the patient-provider interaction.

3) *Trust in the health system*: Third, they propose that an increase in minority providers may lead to greater trust in the health care system. While the concordance hypothesis operates on an interpersonal level, this hypothesis works at an institutional level.

4) *Research and Advocacy*: Finally, a more diverse health workforce is thought to increase professional advocacy and greater emphasis on the needs of minority populations.

In these four streams of research, there is strong evidence that increasing underrepresented minorities could alter service patterns and increase the access to care for disadvantaged communities (Bach et al 2004, Moy & Bartman 1997, Xu et al 1997). There is also considerable evidence to support the notion that the clinical encounter for minority patients could be improved through greater opportunity for patient-physician racial, ethnic and linguistic concordance (Cooper et al 2003, LaVeist, Nuru-Jeter & Jones 2003, LaVeist & Nuru-Jeter 2002, Saha et al 1991, Saha 2000 et al). However, few studies have examined how increasing the diversity of the medical workforce could improve trust in the healthcare system for minority patients or lead to increased institutional leadership, research or advocacy to address health disparities (Bureau of Health Professions 2006).

Like diversity initiatives, research on the evidence base for cultural competency initiatives is in the early stages of development. In a comprehensive literature review, Goode and colleagues (2006) found little empirical evidence directly measuring the influence of cultural competency initiatives on outcomes (Goode et al 2006). They found that most of the literature on cultural competence focuses on defining concepts and identifying research questions. Absent strong evidence directly supporting Cultural Competence initiatives, Betancourt and colleagues similarly present a conceptual framework for understanding the influence of cultural competency initiatives (Betancourt et al 2002). Not surprisingly, Betancourt and the Bureau of Health Profession's frameworks contain overlapping concepts. Betancourt et al describe how sociocultural barriers to health care may contribute to racial and ethnic disparities in health and can be reduced with a more culturally diverse and culturally competent workforce. The barriers discussed in Betancourt's analysis include clinical barriers, structural and organizational barriers to care for minority patients.

Using a hybrid of frameworks laid out by the Bureau of Health Profession's and Betancourt, I review the empirical evidence informing the public health impact of a diverse medical workforce by examining the empirical evidence on the impact of medical workforce diversity on the structural, clinical and organizational barriers to health for minority patients.

Clinical barriers

As discussed previously, minority patients are more likely to face cultural and linguistic barriers in the clinical encounter that reduce trust and the quality of the patient-physician interaction. Bias or uncertainty on the part of providers and language or cultural barriers resulting from the higher likelihood of minority patients to be treated by culturally or linguistically dissimilar providers may all contribute to disparities in care (IOM 2002; Chen et al 2005; Schulman et al 1999; VanRyn & Burke 2000). Many hypothesize that these can be reduced through increased minority representation which increases the likelihood that patients from underrepresented backgrounds can receive care from

culturally and linguistically similar providers. Increasing minority representation at medical schools and in the medical workplace is also thought to improve cultural competency by improving the cultural sensitivity of white providers.

Medical Workforce Diversity, Race concordance and improved clinical encounters

Some evidence suggests that race concordance fosters trust, communication and better patient-provider interaction (Saha et al 2003). For example, using cross-sectional written surveys and audiotape analysis of 142 African American and 110 white patients in 16 primary care practices in the Washington DC areas from 1998 to 1999, Cooper et al, found that race-concordant visits were longer and characterized by more patient positive affect. Patients in concordant relationships also rated physicians participatory decision making higher (Cooper et al 2003).

Researchers have also found that concordance increases appropriate utilization. Saha et al found that African American patients in concordant relationships were more likely than those in discordant relationships to report having received preventative care and all the care they needed (Saha et al 1991). Compared to patients whose regular doctors are of a different race, patients who are of the same racial or ethnic group as their physicians were more likely to use needed health services, were less likely to postpone or delay seeking care and reported a higher volume of use of health services (LaVeist et al 2003). Some evidence suggests that patients in race concordant patient-provider relationships also reported greater satisfaction (LaVeist & Nuru-Jeter 2002).

While strong evidence exists to suggest that concordance can improve satisfaction, access, utilization and quality, less evidence exists to support the claim that concordance improves health outcomes. In fact, in the Bureau of Health Professions' literature review on the subject, the influence of concordance on health outcomes was mixed, with many studies finding no effect of concordance on health outcomes.

Improved cultural sensitivity of white providers:

Increased representation of minority medical students and physicians is thought to improve white providers cultural competence by exposing white physicians to more non-white colleagues, thus improving cultural sensitivity. The Association of American Universities (AAU) believes that students benefit significantly from the education that takes place in a diverse setting. A heterogeneous student body at medical schools and a diverse medical workforce enhances discourse and learning and may provide white providers with more opportunities to learn about cultures different from their own. However, I was unable to find any empirical evidence to support this claim.

Structural barriers

Both the Bureau of Health Professions and Betancourt discuss structural barriers to care for minority patients including a lack of interpreter services or appropriate health education materials and access to care for underserved populations. Increased

representation of minority healthcare providers is thought to reduce structural barriers to care such as shortages of physicians in low income, disadvantaged communities which are disproportionately African American, Latino and Native American. Minority physicians are hypothesized to more likely to care for traditionally underserved populations; racial and ethnic minorities, patients from low socioeconomic status, the uninsured, and patients with language barriers. In addition, increasing the proportion of Spanish speaking Latino physicians is thought to reduce structural barriers such as a lack of interpreter services for Spanish speaking patients.

Medical Workforce Diversity, Service patterns and access to care for minority patients

The vast majority of studies on health professional service patterns have found that African-American, Latino, and other underrepresented minorities were more likely to serve minority/same race populations and underserved or poor populations. The preponderance of studies have also found that Asian physicians were also more likely to serve minority/same race physicians.

Even after controlling for other physician factors such as gender, geographical background, childhood socioeconomic background and outstanding financial obligations, physician race is a strong predictor of the likelihood of serving disadvantaged and underserved populations (Moy & Bartman 1995, Rabinowitz et al 2000). Underrepresented minority physicians are more likely to serve Medicaid patients, and other underserved populations (Xu et al 1997). Nationwide, minority patients are disproportionately seen by same race, minority physicians (Murray-Garcia 2001). For example, one study found that 22% of African-American visits were to African-American physicians, which was substantially greater than the proportion of physicians nationally (5%) (Bach et al 2004). A study by Cantor and colleagues found that African American and Latino physicians were more likely to report they cared for African American and Latino patients respectively and also more likely to treat patients from economically disadvantaged backgrounds. In this study, while Physician race was a strong predictor, socioeconomic background was only weakly associated with increased care of underserved patient groups (Cantor et al 1996). At least one study suggests that much of the difference in likelihood to serve minority patients can be explained by physician specialty, practice setting and location (Stinson & Thurston 2002).

To the extent that the service patterns documented in the studies reviewed above improve access to care for underserved populations, increasing medical workforce diversity can influence public health by improving and ensuring access to care for disadvantaged, underserved communities.

Organizational barriers

Increased diversity of the medical workforce can also reduce organizational barriers to care such as a lack of institutional leadership and a health care workforce that doesn't adequately reflect the cultural and linguistic diversity of the general population. Diversity in healthcare leadership is thought to provide more impetus for organizational changes to address health disparities and improve minority health such as funding for healthcare disparities research and studies on minority health. However, no studies have directly tied increases in the diversity of health leadership to improved health outcomes for minority patients.

No studies have empirically examined whether health professionals from underrepresented backgrounds would be more likely than others to advocate for or implement programs to address health disparities. Nor have studies examined whether a diverse workforce would lead to more research on health disparities or minority health issues. However, studies have found that minority patients are more likely to participate in clinical trials run by minority scientists (Mouton 1997).

Medical Workforce Diversity and Public Policy

In order to understand what policy levers might increase the racial, ethnic and linguistic diversity of the medical workforce, it is important to understand the historical and current context for why Latino and African American patients are underrepresented.

First, several barriers to enrollment in medical school for minority populations exist. These include a legacy of discrimination and segregation that barred many people of color from admission to medical school, the economic costs associated with obtaining health professions training, including the high cost to attend medical school and barriers to competing on a level playing field for admission such as educational inequities and heavy reliance on standardized test scores in admission decisions.

In 1895, of the 395 African American medical doctors, 93% had been trained in one of eight African American institutions. These institutions were founded in response to the historical legacy of African-American exclusion from white medical schools. However, by 1910, the American Medical Association was pushing for more stringent eligibility requirements, more competitive admissions and more scientific rigor in medical schools. By 1920, only two of the eight established African American medical schools remained open while over 30% of all medical schools continued to have policies prohibiting African American student enrollment (IOM 2002).

In the mid 1950's, the African American population made up about 10% of the total population but only about 2% of all physicians. Efforts to expand opportunities for careers in the health professions were intensified in the 1960s and 70s. For example, the Association of American Medical Colleges and other groups actively encouraged

member institutions to improve outreach, recruitment and retention of minority students (AAMC 2000; Nickens & Cohen 1999; Nickens & Ready 1999). By 1974, largely due to affirmative action efforts, 10% of all medical school graduates were underrepresented minorities and by 1994, the percentage of medical school graduates that were underrepresented was 12.4%. However, legal challenges to Affirmative Action programs in Texas, California, and Washington have led to declines in underrepresented minority graduates. Today, only 9% of medical school graduates are from underrepresented backgrounds (AAMC 2000).

Race Conscious medical school and workforce policies to increase physician diversity

Most major medical associations have stated their support of efforts to increase the diversity of the medical workforce. These efforts have included targeted recruitment efforts, enrichment and outreach programs for young scholars from racial and ethnic minority backgrounds and affirmative action programs in medical schools and health care organizations (Saha 2008, Cohen 2003, Lakhan 2003). For example, the federal government's Minority Faculty Fellowship Programs aims at increasing the pool of minority faculty at medical schools and many universities use applicant racial and ethnic background as one component of admissions decisions.

Race conscious public policies such as affirmative action in medical school enrollment, are thought to address the considerable financial and academic barriers to medical school enrollment for African American and Latino students. Many argue that basing admissions decisions on standardized test scores and grades alone ignores the considerable educational and economic hurdles faced by many students of color. Researchers have found that grades and test scores are poor predictors of achievement and performance in the training and practice of medicine, especially for minority students (Lakhan 2003).

Some opponents of race based policies have advocated for policies that take socioeconomic status (and not race) into account. While more politically salient/popular, race-neutral efforts to increase the number of professionals from socio-economically disadvantaged backgrounds are "not adequate substitutes for racial diversity programs in addressing access to care for the underserved." (Saha & Shipman 2008).

Class considerations in medical school admissions are often seen as a way of ensuring that universities seek and enroll as broad a range of intellectual interests and talents as possible. But class issues are not synonymous or interchangeable with racial issues. Takagi (1993) explains that a major myth about class-based affirmative action is that such preferences increase minority enrollment and are better for minority students' self esteem because they lack the stigma associated with racial preferences. However, white students are more likely to benefit from class-based preferences because while a greater proportion of African American and Latino's are poor, there are still more poor whites than poor African American's or Latinos.

Further, in some cases, economically disadvantaged whites may be more academically advantaged than middle and upper class African Americans. For example, for various reasons, there are enormous differences in the mean standardized test scores used heavily in admissions decisions, of African Americans and whites even after accounting for socioeconomic status. For example, African Americans who come from families with incomes over \$70,000 score lower on the SAT than whites with incomes between \$10,000 and \$20,000 (Jencks & Phillips 1998). These differences are not due to genetic factors, but consistent inequalities encountered in access to quality schools for African American and white children (Jencks & Phillips 1998).

Race Conscious Outreach programs

Outreach programs for minority undergraduate students aimed at increasing prospective students awareness of and preparedness for university admissions is an alternative to race-based preferences in admissions decisions. Outreach strategies include building partnerships with k-12 schools and undergraduate institutions, strengthening academic development programs and increasing informational outreach and university research and evaluation.

For example, several private initiatives have aimed to increase the pool of minority students interested in and competitive for entrance into the Health professions. The Robert Wood Johnson foundation funds the Health Professions Partnership Initiative which targets schools with large minority populations from kindergarten through college, and the Minority Medical Education Program provides six weeks of training for minority students interested in medical school. Federal government programs such as the Health Careers Opportunity Program provide grants to support programs that target and prepare disadvantaged students to enter the health professions and the National Institute of Health has a competitive loan forgiveness program for graduate students who commit to conducting health disparities research upon graduation.

Percentage plans

Percentage plans have been proposed in states with challenges or bans to affirmative action. They have mostly been used in the undergraduate admissions context, where a fixed percentage of spots at an institution are set aside for the top students from each school. Because high schools are highly segregated, admitting the top students from each school is thought to improve the opportunity of students from schools with a higher proportion of minority students. This policy has not had its intended consequences in the states that have tried it and is unlikely to be successful for medical admissions. In fact, undergraduate institutions are not sufficiently diverse for percentage plans to work in the context of medical school.

The evidence appears to indicate that either affirmative action or some functional and effective alternative is still needed to counter the legacy of minority shortages of physicians due to the impact of past and present discrimination and inequities.

Affirmative action has allowed for a diverse student body at selective colleges and one that is more demographically representative of the growing minority population in the United States.

Conclusion

The increasing challenges to race based workforce policies has put greater pressure on affirmative action proponents to “prove” that the social benefits of these programs outweigh the potential costs. While certainly a case can be made for race conscious workforce policy as a matter of fairness and justice, the most compelling argument for race conscious workforce policy is that increasing the diversity of the medical workforce can improve public health and reduce disparities.

There is general consensus that increasing the diversity of the medical workforce is a worthy goal for medical schools and health care organizations to pursue. A diverse workforce is thought to increase access to health care for underserved populations and increase the linguistic and cultural capacity of the health care workforce to provide quality care to all patients. However, while some evidence supports these claims, more research on the impact of culturally competent health care and the other benefits of a more diverse workforce is needed.

In the following chapters, I examine racial and ethnic differences in Cardiovascular Disease (CVD) risk factor management for patients with diabetes as well as present the results of two empirical analyses that add to the literature on how increasing the number of and proportion of racial and ethnic minority providers can influence barriers to health care and health outcomes.

Chapter 2:

An Examination of Racial/Ethnic Disparities in Cardiovascular Risk Factor Control, Medication Adherence and Treatment Intensification Among Patients with Diabetes.

Introduction

As the sixth leading cause of death in the United States, diabetes is a chronic disease with tremendous social and economic costs to society. The burden to society is not distributed evenly. For example, African Americans and Latinos are 1.4 to 2.2 times more likely to have diabetes than white persons (AHRQ 2010). African Americans and Latinos are also more likely to suffer from diabetes related complications, including end stage renal disease, amputation and blindness (AHRQ 2010). There are also widely recognized disparities in cardiovascular risk factors associated with diabetes. African American and Latino patients with diabetes are less likely to meet glucose, cholesterol or blood pressure targets (Saddine et al 2002). Sadly, African Americans and Latinos are also more likely to die from diabetes (AHRQ 2010).

Differences in access to and the quality of care provided to racial and ethnic groups have been documented and likely contribute to disparities in diabetes and CVD outcomes. Studies have found significant disparities in the likelihood of receipt of cardiac procedures (Sedlis et al 1998), in receipt of medications (Herholz et al 1996) and medication intensification (Dressler & Jacobson 2004). Indeed, while improving access to care and improving social conditions that underlie health disparities is crucial, health care systems can directly reduce disparities in health across the patients they serve by measuring and addressing disparities in the quality of care provided to patients from different racial ethnic and socioeconomic backgrounds.

The purpose of this chapter is to examine how patient race, ethnicity and language background influences the medication management for cardiovascular disease risk factors for a large cohort of patients with diabetes in an integrated delivery system. The study analyzes the predictors of risk factor control, medication intensification and medication adherence for diabetes (A1c), hyperlipidemia (LDL) and hypertension (SBP) followed by analyses of how these predictors differ by patient race, ethnicity and language. I hypothesize that patients from disadvantaged racial, ethnic and linguistic groups will be less likely to reach target risk factor control levels for diabetes, cholesterol or hypertension. I predict lower adherence rates and less frequent medication intensification for minority patients. I also hypothesize that the predictors of risk factor control, medication adherence and medication intensification may differ by patient race and ethnicity.

Literature Review

There are well-documented racial disparities in diabetes prevalence and mortality. African Americans, American Indians and Latinos have higher diabetes prevalence, death rates and higher rates of serious complications (Mokdad et al 2000, Saadine et al 2002). Even after controlling for access to care and socioeconomic status, diabetes disparities in the US persist (Mokdad et al 2000). There are also widely recognized disparities in cardiovascular risk factors associated with diabetes. African American and Latino patients with diabetes are less likely to meet glucose, cholesterol or blood

pressure targets (Kirk et al 2006, Rodondi et al 2006) leading to a disproportionate number of diabetes and CVD poor outcomes such as stroke, heart attack and death.

The evidence surrounding whether insured patients of color receive worse care for diabetes and CVD risk factor control is mixed (Brown et al 2005, Duru et al 2006, Kirk et al 2006). For example, studies have found significant disparities in the likelihood of receipt of revascularization procedures (Blustein, Arons & Shea 1995), in receipt of medications (Herholz et al 1996) and medication intensification (Bolen et al 2008). However, several studies have shown that minority patients received equal or better quality processes of care such as screening and medication intensification (Duru et al 2006, McEwen et al 2009, IOM 2002). In the following sections, I review the literature on disparities in medication management for patients with diabetes with a primary focus on disparities in therapy modification/ treatment intensification and medication adherence.

Treatment Modification/Intensification

The quality and appropriateness of care provided by physicians is instrumental in the management and control of CVD risk factors. Successful control of the cardiovascular risk factors associated with diabetes requires a combination of physician behaviors, including properly diagnosing, screening for risk factors, prescribing the appropriate medication and consultation on lifestyle changes such as nutrition and exercise regimens. Successful management also requires ongoing follow up with patients including adjusting treatment for patients in poor risk factor control. Although clinical research has identified successful strategies for reducing the risk factors associated with diabetes and evidenced-based guidelines are widespread, many clinicians do not follow these guidelines consistently (Ziemer et al 2005).

For example, even though studies have found that patients receiving more intensive medication therapy for cardiovascular disease had greater improvements in outcomes (Berlowitz et al 2005) both national and international studies have found that physicians are not increasing medications adequately for patients with uncontrolled hypertension, hyperlipidemia or diabetes (Asai 2002). Oliveria and colleagues (2002) found that pharmacological therapy was initiated or changed at only 38% of visits, despite documented hypertension for at least 6 months before the patient's most recent visit (Oliveria 2002).

Studies have found that several patient level factors are associated with intensification of therapy. Rondoni et al (2005) found that patients with more than one risk factor condition, higher baseline values and target organ damage were more likely to receive appropriate care. Few studies examine how patient race influences treatment intensification and the few studies that examine the influence of race/ethnicity have had contrasting results (Rondoni et al 2005).

A study looking at 1376 African American and white Medicare beneficiaries used linear and logistic regression to examine whether African American patients experienced differences in care compared to white patients. African Americans were less likely to have measurement for diabetes risk factors, had less ophthalmologic visits, fewer influenza vaccinations, greater emergency department utilization and fewer primary care visits. However, this study was conducted in 1998, it is possible that these disparities could have converged over time (Chin, Zhang & Merrell 1998).

A more recent study examining many of the same processes of care found that few processes of care differences remain after adjusting for potential confounders. Brown et al (2005) conducted a study of 7456 African American and white patients in a managed care setting (using hierarchical linear models to adjust for differences across health plans) to examine the association between race and socioeconomic status and diabetes processes of care. Adjusting for patient age, gender, duration of diabetes, physical and mental health measures (components of the SF-12) and comorbidities, Brown et al, examined rates of diabetes and CVD assessment and measurement, foot and eye examinations, use or advice to use aspirin and vaccination for influenza. In this study, most processes of care were comparable across groups, but African Americans had lower rates of measurement and vaccination and higher rates of foot and eye examinations. Across racial and ethnic groups, minority patients had similar or more appropriate intensification of therapy relative to whites. The authors conclude that managed care settings may help to reduce disparities in processes of care. (Brown et al 2005)

A study by Dressler and Jacobson (2004) found significant disparities in lipid medication management (lipid control and appropriate titration of lipid-reducing therapy) between African American and white patients hospitalized with coronary heart disease. Using the records of 98 patients with documented CHD who were admitted to a teaching hospital, Dressler and Jacobson used multivariate logistic regression models to examine racial differences in treatment and found that 52% of African American patients compared with 17% of white patients received suboptimal lipid management (Dressler and Jacobson 2004).

Another study on intensification of antihypertensive medications during doctors office visits (Bolen et al 2008) examined a total of 1374 visits by 245 patients with diabetes and hypertension enrolled in a managed care program. In logistic regression models controlling for patient-related factors such as age, gender, comorbid conditions, and provider related factors such as provider specialty, gender and year of graduation, patient race (white versus non-white) was not associated with treatment intensification rates. However, grouping all non-white patients together does not give much information on the rates of intensification across nonwhite groups (Bolen et al 2008).

A study by Grant et al (2005) studied 1765 patients from 44 clinics in US academic medical centers and found that patient demographic factors (including race) were not associated with changes in therapy during a visit to the doctor. The authors do not

report how they defined race, or provide any coefficient/standard error or p-value information for patient race. Because it is unclear how patient race was included in the regression models, it is difficult to assess racial subgroup differences (Grant, Buse & Meigs 2005).

Another study (Oliveria et al 2002), examined the predictors of therapy modification and also adjusted for patient race/ethnicity. In this study, racial comparisons were made between African American versus non-African American patients. Race/ethnicity was not associated with intensification using this definition. Again, it is possible that results would have been different had African American, Latino and Asian patients been compared against white patients separately (Oliveria 2002).

Therapy modification/treatment intensification is a relatively new way of looking at the quality of care patients receive (Grant et al 2005). As this measure gains traction and becomes more widely used as a quality indicator, it is likely that additional studies examining racial and ethnic differences in treatment intensification will be available. The current study adds to the existing literature by being the largest study to date to examine racial and ethnic differences in treatment intensification and also by being the first study to examine African American, Latino, and Asian patients separately in comparison to white patients.

Medication Adherence

In addition to appropriate medication management by physicians, patient adherence to medications is also a strong predictor of risk factor control for patients with diabetes. Because the control of diabetes CVD risk factors rests so much on patient self-management, promoting adherence to medication regimens for diabetes is of utmost importance. Understanding the predictors of adherence will therefore assist in efforts to improve overall outcomes and reduce disparities. Patients who take their medications as directed are more likely to reach diabetes, cholesterol and blood pressure targets and less likely to suffer from cardiovascular disease complications as a result (Munger, Van Tassel & LaFleur 2007). Unfortunately, medication regimens for patients with multiple risk factors are often complex and difficult to follow.

Several studies have found that both patient and provider level factors impact patient adherence to medications. Patient level factors that may contribute to poor adherence include patient forgetfulness or other priorities (Cramer 1991), the presence of psychological problems (van Servellen et al 2002), cognitive impairments (Stilley et al 2004), lack of belief in the benefit of treatment (Okuno, Yanagi & Tomura 2001), lack of information or insight into the illness (Lacro et al 2002), the cost of medication and copayment (Balkrishnan 1998) and the complexity of treatment (Ammassari et al 2002). Patients are also less likely to adhere to medications for a disease with an absence of

symptoms (Sewitch et al 2003) and adherence declines sharply following treatment initiation (Chapman et al 2005).

Provider level factors that contribute to poor adherence include physicians prescribing complex regimens, failing to explain the benefits and side effects of medication and not taking a patient's lifestyle or the cost of medications into consideration (Osteberg and Blaschke 2005). The quality of the patient-physician interaction also predicts patient adherence to medication. A poor therapeutic relationship between provider and patients can lead to suboptimal medication adherence (Okuno et al 2001, Lacro et al 2002). Patients who trust their providers are more likely to adhere to medications (Altice, Mostashari & Fredland 2001). Cultural factors such as language and communication barriers, and perceptions of stereotypes and bias may also affect the patient-physician relationship and treatment adherence (Bureau of Health Professions 2006).

The evidence suggesting disparities in medication adherence by patient race and ethnicity is more conclusive in identifying racial and ethnic differences than the treatment intensification literature. For example, in a nationally representative 2003 survey of patients with diabetes who were 55 years or older, Heisler et al (2007) found that African American survey respondents had worse medication adherence for diabetes medications than white respondents. These results were similar to a 1999 study by Sclar et al which found that white patients were 35% more likely than African American patients to have obtained at least a 6-month supply of medications to achieve glycemic control (Sclar et al 1999, Heisler et al 2007)

Oster et al (2006) surveyed 6035 African American, white and Latino diabetes patients enrolled in a managed care organization and found that African American and Latino patients had more healthcare visits compared to whites, but significantly lower utilization of preventative services. African American patients were also less likely than whites to monitor their diet, exercise and smoking (Oster et al 2006).

A retrospective cohort study of Medicaid insured patients with diabetes compared medication adherence among African American, white and other patients in North Carolina. After controlling for patient age, gender, healthcare utilization propensity score, type of therapy, number of medications and number of comorbidities, African American race was associated with worse adherence. However, the study did not include Latino or Asian patients (Shenolikar et al 2006).

In addition to being one of the largest studies to examine treatment intensification, the current study is also one of the largest to examine racial and ethnic differences in treatment adherence and is one of few studies to compare African American, Latino and Asian patients with white patients separately while adjusting for a comprehensive set of both patient and physician variables.

Data description

Study Population

Study participants were members of Kaiser Permanente Northern California's (KPNC's) Diabetes Registry of 2005. KPNC provides comprehensive medical care to approximately 3.2 million members. Patients were selected for the study if they were diagnosed with type 2 diabetes prior to January 1, 2005 and were enrolled with an active drug benefit continuously throughout 2005. Eligible patients were further assessed for the presence of hypertension and hyperlipidemia using KP automated clinical databases. Self-reported race/ethnicity data, obtained from KP member surveys, study surveys and hospitalization data, were available for 87.3% of patients. Physician data were obtained from physician demographic files maintained by The Permanente Medical Group. The final study population consisted of 131,277 African-American, Latino, Asian and white adult diabetes patient and 1750 physicians.

KP Northern California members comprise approximately 25% of the adult population between 20-79 years old in Northern California and are similar in age and gender to both the insured and uninsured non KP population. Compared to non-KP insured, KP members were less likely to be white but similar in other characteristics. Compared to non-insured Northern Californians, KP members are more likely to be white and less likely to be very low income or to have very low levels of education (Gordon 2006).

Definition of Dependent Variables

Good versus Poor Risk Factor Control: Three measures of risk factor control were used as dependent variables in this study. Good A1c risk factor control for diabetes was defined as a patient having an A1c lab value of less than 8.0% throughout 2005; this level is in accordance with quality guidelines at KPNC. Good risk factor control for patients with hypertension was defined as not having two or more consecutive SBP readings greater than 140 mm Hg at any time during the year. This blood pressure cut-off point is higher than the American Diabetes Association (ADA) guideline, but is generally agreed-upon and consistent with the Veteran's Affairs quality goal for diabetes patients and one that clearly needs therapy modification. Good risk factor control for patients with hyperlipidemia was defined as an LDL-c value less than 100 mg/dL during the year. Lab and blood pressure values for 2005 were obtained from automated KPNC databases.

Treatment Intensification: A binary variable was created to indicate whether pharmacy databases indicated an intensification of pharmacotherapy within six months following an instance of poor risk factor control during 2005. A six-month period (as used in previous studies) was chosen because the high visit rate of diabetes patients within KPNC, and the use of primary care teams who can reach out to initiate therapy modification on the physician's behalf via phone or mail, give sufficient opportunity for therapy modification in this setting. Intensification was defined as an increase in the

number of drug classes, an increase in dosage of at least one drug class or a switch to a different drug class within six months. Daily doses were categorized as low (near initial starting doses), medium (maintenance range), or high (high end or above maintenance range) based on package insert recommendations and inspection of actual dosage distributions. Patients who were already using insulin were excluded from the analysis of treatment intensification for hyperglycemia because treatment intensification for insulin cannot be measured in automated pharmacy databases.

Medication Adherence: Treatment adherence for CVD risk factor controlling medications (diabetes, cholesterol and hypertension medications) was calculated with KP prescription databases using Continuous Multiple interval measures of Gaps in therapy (CMG). CMG is the proportion of days a patient was prescribed medication and did not have the medication available (most often because the patient did not pick up their medications) (Steiner & Prochazka 1997) . For each individual condition (hyperglycemia, hypertension and hyperlipidemia), CMG was first calculated separately for each medication class filled at least twice in the 12 months prior to the last date when above target levels were observed in 2005. Individual class adherence was then combined into a single measure for all medications prescribed for a single condition, weighting the estimate for each medication class by the number of days from the first to last fill in the 12 month period. Medications filled only once were not included in the analysis because CMG can not be calculated from single fills. Because many prior studies have found significant clinical effects when cumulative days of refill gaps equal or exceed 20% (Steiner & Prochazka 1997) I defined good adherence for each condition as a non-adherence measure less than 20%. Individual condition adherence was then combined into a single measure of adherence for all medication classes a patient was prescribed for diabetes, hypertension and/or hyperlipidemia. Patients who 80% of the time had their medications available for each condition for which they were being treated were coded as 1. Patients who had medications available less than 80% of the time for any condition were coded as 0.

Main Explanatory Variables

Patient Race/ethnicity: Patient race/ethnicity was the main explanatory variable for multivariable models that assessed predictors of risk factor control, treatment intensification and medication adherence. In these models, separate dummy variables were created for African American, Latino and Asian race/ethnicity with white patients as the reference group.

Patient Language: Patient self-reported language was a main explanatory variable for multivariable models that assessed predictors of risk factor control, treatment intensification and medication adherence for Latino and Asian patients. In these models, separate dummy variables were created for the two most common patient languages, Spanish and Cantonese. Another dummy variable was created for all other patient

languages with English language as the reference group.

Multivariate Regression Models

Multivariable probit regression models assessed the marginal effect of patient race/ethnicity and language on A1c, LDL-c and SBP control, medication intensification and medication adherence. The resulting marginal effects were converted into adjusted percentages of patients in good CVD risk factor control, patients at above target CVD risk factor levels who received treatment intensification and patients in adherence to A1c, LDL-c and SBP medications. Each model controlled for patient age, gender, preferred language, number of comorbidities, risk factor values (for treatment intensification analysis and adherence), number of primary care visits in 2005, Medicare status, number of medication classes taken for each condition, overall pill burden and geocoded education and income as fixed effects. Physician age, gender, race/ethnicity, language proficiency (which is self-reported by physicians at their onset of employment with the medical group), panel size and number of diabetic patients in panel were also included as fixed effects.

To account for patient clustering within physician panels, the multivariable models adjusted for physician as a random effect. Mixed models take into account the nested nature of hospital data. Outcomes for patients receiving care from the same physicians may be influenced by individual patient characteristics but also by characteristics of the physicians providing them care. For example, some physicians may provide more patient centric care and this could influence the adherence rates for all the patients in their panel. In addition to the above analyses, I conduct stratified multivariable analyses for each racial group (African American, Latino and Asian) to understand if predictors of risk factor control, medication intensification and medication adherence differ by patient race/ethnicity.

Results

Patient sample characteristics

Most patients in the sample (94%) were being treated for more than one CVD risk factor and almost three-quarters of patients (72%) were being treated for all three conditions (diabetes, high cholesterol, and hypertension). Almost half of the patients (46%) were White, 11% Latino, 16% Asian, and 10% were African-American. Most patients reported speaking at least some English (97%). Spanish was the primary language of almost a quarter (22%) of Latino patients while 10% of Asian patients reported speaking Cantonese or another Asian language. African American and Latino patients had lower geocoded household incomes than white and Asian patients and came from census tracks with fewer college graduates [Table 1].

TABLE 1: PATIENT SAMPLE CHARACTERISTICS					
	African-American n=15,905 (%)	Latino n=17,750 (%)	White n=74,900 (%)	Asian N=22,722 (%)	P-value*
Age (Mean)	60.8	60.1	63.8	60.1	(<.001)
Male	45	50	52.6	49.2	(<.001)
Female	55	50	47.4	50.8	(<.001)
English not primary language	.7	22	1.5	10.2	(<.001)
Median household Income (Geocoded)**	\$50,371	\$55,956	\$61,712	\$68,016	(<.001)
% College Degree in census block (Geocoded)**	15.3	15	19.5	21.7	(<.001)
Physician Race					
African American	9.7	3.4	3.3	2.2	(<.001)
Latino	3.7	11.2	4.4	2.5	(<.001)
White	40.4	35.6	47.4	31.5	(<.001)
Asian	44	46.3	41.7	63.2	(<.001)
Health Status Variables					
# of visits (Mean)	6.4	6.2	6.3	5.3	(<.001)
# of years with physician	6.3 years	5.6 years	6.1 years	5.9 years	(<.001)
# Comorbid conditions (Mean)	2.7	2.5	2.8	2.4	(<.001)
Pill burden (Total number of drug classes)	8.3	7.4	8.2	7.6	(<.001)
* p-values for bivariate tests of differences (ttests, anova and chi-square)					

Predictors of Risk Factor Control

Patient race

After controlling for patient and physician characteristics, patient race/ethnicity was a significant predictor of risk factor control for all three risk factors. African American patients were less likely than whites to have A1c less than 8% (64% versus 69%, $p < .001$; OR=0.8). African American patients were also less likely to be at or below target LDL-c (40% versus 47% $p < .001$; OR=0.7) and SBP (70% versus 78% $p < .001$; OR=0.6). Latino patients were less likely than whites to have A1c less than 8% (62% versus 69%, $p < .001$; OR=0.7) but more likely to be at or below target LDL-c (49% versus 47%, $p = .012$; OR=1.09). Asian patients were less likely than whites to have A1c less than 8% (65.8% versus 69%, $p < .001$; OR=.85) but more likely than whites to be at or below target LDL-c (49.4% versus 47%, $p < .01$; OR=1.1). Latino and Asian patients had similar rates of risk factor control as whites for SBP control. [Table 2]

	African American Patients		Latino Patients		White Patients		Asian Patients	
	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value
Glucose (A1c <8%)	.76 .71, .81	64 .6, <.001	.69 .71, .81	62 .7, <.001	1.0	69 (reference)	.85 .80, .91	65.8 .6, <.001
Lipids/Cholesterol LDL-c <100mg/dL	.71 .66, .76	40 .8, <.001	1.09 1.02, 1.16	49 .7, .012	1.0	47 (reference)	1.1 1.04, 1.18	49.4 .7, <.01
Systolic Blood Pressure SBP < 140 mmHg	.62 .58, .67	70 .6, <.001	.95 .87, 1.03	77 .6, .183	1.0	78 (reference)	1.01, .86, 1.02	78 .6, .962

Physician random effect probit models adjusted for patient age, gender, preferred language, number of comorbidities, # of primary care visits in 2005, Medicare status, # of medication classes taken for condition, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and # of diabetic patients in panel.

Patient language

Spanish speaking patients were less likely to be at target A1c levels (65.4% versus

69%, $p < .001$; $OR = .84$), but there was no significant difference in risk factor control for Spanish speaking versus English speaking patients for LDL-c and SBP control. There were no significant differences between Cantonese and English speakers for any risk factor. [Table 3]

	Spanish Speaking Patients		Cantonese Patients	
	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value
Glucose (A1c <8%)	.84 .79, .90	65.4 .6, <.001	1.01 .88, 1.15	68.4 1.2, .543
Lipids/Cholesterol LDL-c <100mg/dL	.95 .89, 1.02	46.1 .8, .236	.96 .84, 1.10	46.4 1.4, .649
Systolic Blood Pressure SBP < 140 mmHg	.93 .86, 1.02	77.2 .6, .163	1.04 .87, 1.24	77.3 1.3, .539

Other predictors of Risk Factor Control

Other predictors of risk factor control were complex and complicated. Patients taking a higher number of different medications were less likely to be at or below target A1c levels and SBP levels but more likely to be at or below target LDL-c levels. Patients with more primary care visits were less likely to be at or below target A1c, LDL or SBP levels. Interestingly, patients with more chronic conditions were more likely to be at or below target LDL and SBP levels. Female patients were more likely than their male counterparts to be at or below target A1c levels for A1c and SBP levels, but less likely to be at or below LDL-c levels. Older patients were more likely to be at target A1c and LDL-c levels, but less likely to be in control of hypertension levels. Patients from census blocks with a greater proportion of college graduates were more likely to be at target risk factor levels for A1c and SBP. Patients with higher geocoded household income were more likely to be at or below target ldl-c levels. These predictors were similar for all patients in race stratified models [Results not shown].

Predictors of Treatment Intensification

Race

Table 4 shows the proportion of patients at above-target risk factor levels who received treatment intensification within six months, by race/ethnicity, after adjusting for patient and physician characteristics. Patient race/ethnicity was a significant predictor of treatment intensification for all three risk factors. African American patients were less likely than white patients to have A1c intensification (73% versus 77%, $p < .001$; $OR = 0.8$)

and more likely to receive treatment intensification for SBP above target (78% versus 71% $p<.001$; $OR=1.5$). African American and white patients had no significant differences in medication intensification for LDL-c medications. No significant differences in A1c or SBP intensification were found for Latino patients, compared to white patients. However, Latino patients were more likely than white patients to have treatment intensification for LDL-c (47% versus 45%, $p<.05$; $OR=1.1$). Asian patients were less likely to have A1c intensification (72.2% versus 77%, $p<.001$; $OR=.76$) and more likely to have treatment intensification for LDL-c medications (49% versus 45%, $p<.001$; $OR=1.18$) and SBP medications (75.4% versus 71%, $p<.01$; $OR=1.24$). [Table 4]

	African American Patients		Latino Patients		White Patients		Asian Patients	
	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value
Glucose (A1c <8%)	.82 .71, .94	73 1.2, .009	.92 .80, 1.05	75 1.1, .307	1.0	77 (reference)	.76 .67, .87	72.2 1.1, $p<.001$
Lipids/Cholesterol LDL-c <100mg/dL	.96 .87, 1.04	44 1.0, .266	1.1 1.0, 1.2	47 1.1, .019	1.0	45 (reference)	1.18 1.08, 1.30	48.8 1, <.001
Systolic Blood Pressure SBP < 140 mmHg	1.47 1.28, 1.68	78 1.3, <.01	1.14 .98, 1.33	74 1.5, .067	1.0	71 (reference)	1.24 1.06, 1.46	75.4 1.5, <.01
Physician random effect probit models adjusted for patient age, gender, preferred language, number of comorbidities, number of primary care visits in 2005, medicare status, number of medication classes taken for condition, lab values, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and number of diabetic patients in panel								

Language

Cantonese language and Spanish language were not significant predictors of treatment intensification for diabetes or hypertension medications. However, Spanish speaking patients were more likely to have treatment intensification for LDL-c medications (49.4% versus 45%, $p < .001$; OR=1.18) and Cantonese patients were less likely to have LDL-c medications intensified (40.7% versus 45%, $p = .026$; OR=.87). [Table 5]

TABLE 5: ADJUSTED PERCENT OF PATIENTS IN POOR CONTROL RECEIVING TREATMENT INTENSIFICATION BY RISK FACTOR AND PATIENT LANGUAGE				
	Spanish Speaking Patients		Cantonese Patients	
	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value
Glucose (A1c <8%)	.94 .84, 1.07	76.4 1, <.568	.87 .68, 1.13	73.6 2.2, .123
Lipids/Cholesterol LDL-c <100mg/dL	1.18 1.08, 1.30	49.4 1, $p < .001$.87 .73, 1.03	40.7 1.9, .026
Systolic Blood Pressure SBP < 140 mmHg	1.11 .94, 1.31	72.9 1.6, .233	1.07 .75, 1.53	72.1 3.3, .748
Physician random effect probit models adjusted for patient age, gender, preferred language, number of comorbidities, number of primary care visits in 2005, medicare status, number of medication classes taken for condition, lab values, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and number of diabetic patients in panel				

Other predictors of Treatment Intensification

For each risk factor, treatment intensification was more likely to happen in patients who had higher lab values (i.e. the more above target levels, the more likely a patient was to receive treatment intensification). Similarly, patients with more comorbid conditions were also more likely to have appropriate treatment intensification for A1c and SBP. Patients with a higher number of medications were also more likely to have treatment intensified. Older patients, on the other hand, were less likely to have treatment intensification for A1c but more likely to have treatment intensification for SBP. Patient gender was not a significant predictor of treatment intensification for A1c and SBP, but male patients were more likely to receive LDL-c intensification. Patient socioeconomic measures (geocoded household income and education) were not significant predictors of intensification, except for LDL-c treatment intensification. Patients from census blocks with fewer college graduates were more likely to receive treatment intensification. These predictors were similar in scope and significance whether models controlled for patient adherence or not. These predictors were also similar across racial and ethnic groups in race stratified analyses [Results not shown].

Predictors of Patient Adherence to medications

Race

Table 6 shows the proportion of patients in good medication adherence for each CVD risk factor by race, after adjusting for patient and physician characteristics. African American patients were significantly less likely than white patients to be in good adherence for diabetes medications (74.4% vs. 82%, $p < .001$, OR=.62), cholesterol medications (75% vs. 81.3%, $p < .001$; OR=.65) and hypertension medications (74.4% vs. 81.7%, $p < .001$; OR=.64). Latino patients were also significantly less likely than white patients to be in good adherence for diabetes medications (75% vs. 82%, $p < .001$; OR=.64), cholesterol medications (75.2% vs. 81.3%, $p < .001$; OR=.68) or hypertension medications (77.4% vs. 81.7%, $p < .001$, OR=.76). Adherence to all CVD risk factor controlling medications for patients being treated for more than one condition was low, regardless of patient race. In adjusted analyses, only 46 percent of African American patients, 52.6 percent of Latino patients, 52.2 percent of Asian and 61.4 percent of white patients were in good medication adherence for all CVD risk factor controlling medications for which they were being treated. [Table 6]

	African American Patients		Latino Patients		White Patients		Asian Patients	
	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value
Glucose (A1c <8%)	.62 .57, .68	74.2 .6, <.001	.64 .59, .60	75 .6, <.001	1.0	82 (reference)	.73 .67, .78	77.1 .5, <.001
Lipids/Cholesterol LDL-c <100mg/dL	.65 .60, .71	75 .6, <.001	.68 .60, .71	75.2 .6, <.001	1.0	81.3 (reference)	.76 .70, .82	77 .5, <.001
Systolic Blood Pressure SBP < 140 mmHg	.64 .59, .69	74.4 .5, <.001	.76 .70, .82	77.4 .6, <.001	1.0	81.7 (reference)	.81 .74, .88	78.5 .5, <.001
All Meds	.61 .57, .65	46 .8, <.001	.71 .57, .65	49.4 .8, <.001	1.0	57.8 (reference)	.81 .74, .88	52.2 .7, <.001
Physician random effect probit models adjusted for patient age, gender, preferred language, number of comorbidities, # of primary care visits in 2005, Medicare status, # of medication classes taken for condition, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and # of diabetic patients in panel.								

Patient language

Patient language was a key predictor of adherence. Spanish speaking patients were less likely to adhere to A1c medications (76% versus 82%, $p < .002$; OR=.70), LDL-c medications (79% versus 81.3%, $p < .001$; OR=.79) and SBP medications (78.7% versus 81.7%, $p < .001$, OR=.82). Cantonese speaking patients, on the other hand, were more likely to be in good adherence to medications for A1c (84.2% versus 82%, $p < .01$, OR=1.39), LDL medications (83.7% versus 81.3%, $p = .014$, OR=1.20) and SBP medications (83.9% versus 78.7%, $p = .012$; OR=1.26). 50.7% of Spanish speaking and 63.8% of Cantonese speakers were in adherence to all of the medications for which they were prescribed medications, compared with approximately 60% of English speaking patients [Table 7]

TABLE 7: ADJUSTED PERCENT OF PATIENTS WITH GOOD ADHERENCE BY LANGUAGE				
	Spanish Speaking Patients		Cantonese Patients	
	Odds Ratio 95% CI	Adjusted % SE, p-value	Odds Ratio 95% CI	Adjusted % SE, p-value
Glucose (A1c <8%)	.70 .64, .75	76 .6, <.001	1.39 1.15, 1.67	84.2 1.1, <.01
Lipids/Cholesterol LDL-c <100mg/dL	.79 .72, .87	77.3 .6, <.001	1.20 1.01, 1.43	83.7 1.1, .014
Systolic Blood Pressure SBP < 140 mmHg	.82 .76, .90	78.7 .6, <.001	1.26 1.07, 1.48	83.9 1.1, .012
All Meds	.74 .69, .80	50.7 .8, <.001	1.32 1.16, 1.47	63.8 1, <.001
Physician random effect probit models adjusted for patient age, gender, preferred language, number of comorbidities, # of primary care visits in 2005, Medicare status, # of medication classes taken for condition, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and # of diabetic patients in panel.				

Other predictors of Medication Adherence

Patients with lower lab values were more likely to adhere to medication for all three conditions. Older patients were also more likely to adhere to their medication. Patients with fewer comorbid conditions, fewer visits to a primary doctor and lower number of medications were also more likely to adhere to medication. Patients from census blocks with a greater proportion of college graduates were more likely to adhere. Female patients were less likely than male patients to adhere to all medications. These predictors were similar across racial and ethnic groups in race stratified analyses [Results not shown].

Discussion

My findings are consistent with previous research showing racial disparities in CVD risk factor control. African American patients were in worse risk factor control for A1c, LDL-c and SBP than white patients. Latino patients were in worse control for A1c than white patients. Unlike previous research, after controlling for patient and physician characteristics, Latino patients were no more likely to be in poor risk factor control for LDL-c and SBP than white patients. Asian patients were less likely to be at or below target A1c levels but more likely than whites to be at or below target ldl-c levels. Few differences in risk factor control by patient preferred language were found. However, Spanish-speaking patients were less likely to be at or below target A1c levels.

My findings also provide evidence supporting the hypothesis that patient race/ethnicity is modestly associated with treatment intensification. I found disparities in A1c intensification in comparisons of African-American patients and Asian patients with white patients. I also found that, in some cases, minority patients were more likely than whites to receive intensification. Latino and Asian patients were more likely than white patients to receive intensification for LDL-c, (as were Spanish and Cantonese speaking patients), while African-American and Asian patients were more likely than white patients to have hypertension medication intensified. One potential explanation for the greater likelihood of treatment intensification for African American patients with elevated SBP and Latinos with elevated LDL-c is what is known as the prevalence or statistical discrimination hypothesis. According to the hypothesis, in cases of uncertainty, physicians may rely on what they know about the prevalence and consequences of the disease for the racial group in which a particular patient belongs (Balsa et al 2005). Aware of high rates of hypertension in African American patients and high cholesterol in Latino patients, physicians may be more likely to intensify treatment for patients who are members of these groups.

Patient preferences may also drive differences in treatment intensification by race/ethnicity. Studies have shown differential trust in the medical system for minority patients. Patients of color are more likely than whites to perceive they would have received better medical care if they belonged to a different racial and ethnic group and that medical staff judged them unfairly or treated them with disrespect based on race/ethnicity (Johnson et al 2004). These barriers to trust may affect patients' attitude towards medicine, and may contribute to differential reluctance to intensify therapy. On the other hand, it is also possible that African-American patients may be more anxious about elevated SBP than white patients.

Race was a significant predictor of adherence to CVD risk factor medications for patients in this study. African American, Latino and Asian patients were less likely to adhere to CVD medications than white patients. Spanish-speaking patients were less likely to adhere to CVD medications, while Cantonese speakers were more likely to

adhere. Multiple factors may explain these differences including differences in attitudes and beliefs about medication (Kressin et al 2007), differences in socioeconomic status that might influence affordability of drug regimens (Gellad, Haas & Safran 2007), differences in interpersonal care that may influence patient behavior (Cooper et al 2003, Johnson et al 2004), language and communication barriers (Perez-Stable et al 1993) and different levels of trust in physicians and/or the health care system (Boulware et al 2003).

Several limitations to this study should be noted. Patients and physicians were from a single large, integrated healthcare delivery system; it is possible that patients and physicians in this setting may be different from patients and physicians in other settings. However, the patient and physician populations studied were fairly diverse, and the delivery system population is demographically similar to the region it serves (Gordon 2006). Omitted variables, such as patient family history of stroke, evidence of end-organ damage and patient and physician attitudes and beliefs regarding medication were not captured in these analyses and may influence differential intensification rates. My variables were also limited by the fact that I only had access to socio-economic status indicators from geocoding; individual-level data on education and income were not available in this study. Another limitation is that I was unable to assess treatment intensification for A1c control in patients that were already on insulin at the start of the study; it is possible that this underestimates the level of intensification in this population and potentially biases differences in intensification rates for hyperglycemia by race/ethnicity. I was also unable to measure non-medication treatment decisions physicians make; in response to poor control, physicians may provide diet, exercise and other lifestyle recommendations that I was unable to include in my analysis. Nor was I able to measure patient adherence to non-medicine treatment recommendations, such as diet, exercise and other lifestyle changes.

Conclusion

This study is the first to examine racial and ethnic disparities in risk factor control, treatment intensification and medication adherence for a large diverse patient population. The findings are consistent with previous research on racial and ethnic differences in risk factor control and also consistent with research examining racial and ethnic differences in adherence. Many previous studies do not examine adherence for Asian patients. This study provides evidence that like African American and Latino patients, Asian patients face barriers to medication adherence. Finally, this study adds substantial evidence to the literature on treatment intensification by examining racial and ethnic differences in medication intensification. The relationship between race/ethnicity and treatment intensification is complex and warrants future research. In several cases, patients from minority backgrounds received equal or better intensification, suggesting that addressing racial and ethnic disparities in CVD will require a range of strategies, not limited to the patient-provider clinical encounter. Future research to examine barriers to

medication adherence and intensification, including possible patient or physician cultural factors can inform targeted interventions to improve both medication adherence and appropriate titration of medications. Improving CVD risk factor medication management for patients with diabetes will reduce the CVD risk factors associated with diabetes and ultimately improve patient outcomes.

Now that the existence and extent of racial and ethnic differences in CVD outcomes (risk factor control, treatment intensification and medication adherence) has been established, I turn to examining the potential impact of race, ethnicity and language concordance on CVD outcomes. Prior to examining the influence of concordance on outcomes, in the next chapter, I conduct an analysis exploring the predictors of concordance. Chapter 3 contributes to the literature on physician practice patterns and the results of this study are useful for interpreting the findings of empirical analyses of the association between concordance and health outcomes.

Chapter 3:

What are the Predictors of Patient-Physician Racial and Ethnic Concordance?

Introduction

Several studies have explored the factors that affect a patients' choice of provider (Hoerger & Howard 1995; Feldman, Christianson & Schultz 2000; Hibbard 1997; Harris 2003) but few have directly examined the determinants of patient-provider racial match (Saha et al 2000, LaVeist & Nuru-Jeter 2002). This study examines whether the racial and ethnic makeup of physicians at a medical facility and whether patients can choose their doctors are predictors of patient-physician race concordance among a large cohort of diabetes patients in an integrated delivery system.

Currently, African-Americans and Latinos make up 25% of the US population, but only 6% of the US physician workforce (Cooper et al 2006). Due to the low proportion of underrepresented physicians, African-American and Latino patients are more likely than white patients to be treated by a physician from a dissimilar racial or ethnic background. At the core of efforts to diversify the medical workforce is the hypothesis that increasing the number of underrepresented minority physicians can reduce racial and ethnic health disparities by allowing for more race and ethnic concordance between patients and their physicians (Bureau of Health Professions 2006).

Increasing opportunities for racial match between minority patients and physicians can have important consequences. Studies have found that minority patients in race/ethnic concordant relationships are more likely to use needed health services, are less likely to postpone or delay seeking care and report a higher volume of use of health services (Saha et al 2000; LaVeist et al 2003). Patients in race concordant patient-provider relationships also report greater satisfaction (LaVeist & Nuru-Jeter 2002) and better patient-provider communication (Cooper-Patrick et al 1999, Cooper et al 2006).

Studies on patient preferences for a same race/ethnicity physician have found that African American and Latino patients who have a choice are more likely to choose a same race physician. Not surprisingly, patients who report that their choice in physician is influenced by race or ethnicity are also more likely to be in concordant relationships (Saha et al 2000, LaVeist & Nuru-Jeter 2002). Chen et al (2005) found that African Americans and Latinos with stronger beliefs about racial discrimination in health care were more likely to prefer a race/ethnic concordant physician (Chen et al 2005). Patients are not the only actors influencing disproportionate racial match for minority patients. Minority physicians often locate their practices in neighborhoods with larger minority populations and disproportionately care for disadvantaged patients with worse health and lower socioeconomic status (Moy & Bartman 1997).

Previous studies on the predictors of patient-physician race or ethnicity concordance have been constrained by small sample sizes or datasets that only include patient or physician level data (Saha et al 2000, LaVeist & Nuru-Jeter 2002, Chen et al 2005, Moy & Bartman 1995, Xu et al 1997, Stinson & Thurston 2002). Few previous studies have examined both patient and physician factor or the influence of medical facility workforce diversity on patient-physician race concordance. Nor have studies focused on patients

with chronic illnesses. Arguably, the predictors of concordance might differ in acute versus chronic care.

In this paper, I build on previous research on racial match by examining how patient race, language, socioeconomic and health status as well as physician characteristics are associated with patient-physician racial match for patients being treated for a chronic disease. I also examine whether the racial and ethnic makeup of physicians at a medical facility and whether patients can choose their doctors are predictors of patient-physician concordance by conducting a series of stratified logistic regression models. To account for geographic and medical facility factors associated with racial-match, I include the medical facility where a patient receives care as a fixed effect.

Literature Review

Explanations for racial match generally fall into one of three categories. First, some *patients* may have a preference for racial and ethnic congruity (Saha et al. 2000; LaVeist et al. 2002). Second, *primary care providers* may prefer to work with same race patients, locating their practices or choosing specialties that will increase the likelihood of racial match (Moy & Bartman 1995; Gray & Stoddard 1997). Third, geographic or *medical facility* segregation (independent of patient or provider preferences) may explain disproportionate patient-provider racial matching (Chandra & Skinner 2003).

Patients

Gray & Stoddard (1997) examined whether racial and ethnic congruity influenced the selection of a regular care physician by analyzing data from 30,038 respondents of the *1987 National Medical Expenditure Survey*. They estimate that minority patients are five times as likely as non-minorities to report that their primary care provider is a member of a racial or ethnic minority group. After controlling for patient age, poverty status, educational attainment, employment level, type of insurance, urban residence, region and gender, they found that minority patients were still more likely to have a minority primary care provider (Gray & Stoddard 1997).

Using data from the Commonwealth Fund 1994 Minority Health Survey, Saha et al (2000) examined data from 2045 African American, Latino and white respondents to predict the factors associated with patient-provider racial match. Main explanatory variables included whether a patient chose their physician, whether their choice was influenced by the physicians' demographic characteristics and whether the location of the provider's office was considered convenient by patients. Adjusters included patient age, gender, educational attainment, income, language, health insurance, birthplace, number of years in the US, geographic region, urban/rural status, HMO membership, primary care site, sex of physician and *self-perceived* health status. African American and Latino Patients that chose their physician were more likely to be in concordant relationships, and those who reported their choice in physician was influenced by race were also more likely to be in concordant relationships. Geographic accessibility was

not independently associated with race concordance. Based on these findings, Saha and colleagues posit that African American and Latino patients seek care from physicians of their own race because of personal preference and language, not solely because of geographic accessibility.

A study by LaVeist & Nuru-Jeter also used data from the *1994 Commonwealth Fund Minority Health Survey*. Their study examined a sub-sample of 2720 respondents who reported having a usual source of care. The dependent variable, race concordance, was specified as a binary variable indicating that a respondents' race is concordant with the race of their physician, while the main explanatory variables were patients' race/ethnicity and physician choice. LaVeist and Nuru-Jeter controlled for patients primary language, sex, age, income, education, and health insurance. Higher income for African American patients was associated with race concordance. Education had no effect for any racial or ethnic group. Language was also a significant predictor of race concordance for Latino patients. Finally, a strong predictor of race concordance was whether a patient had a choice in their provider (Laveist & Nuru-Jetter 2002).

Physicians

Underrepresented health professionals, particularly physicians, disproportionately serve minority and other medically underserved populations. Minority physicians often locate their practices in neighborhoods with larger minority populations and disproportionately care for disadvantaged patients with worse health and lower socioeconomic status (Moy & Bartman 1995). A study of a random sample of 2600 physicians used multiple regression to predict the percent of underserved patients controlling for physician characteristics (including gender, urban/rural background, childhood family income and outstanding financial obligations) and found an independent association between physician race and care for underserved patients (Xu et al 1997). A similar study by Rabinowitz et al (2000) also explored the factors that predict whether a physician treats underserved populations and found that provider race was a strong predictor of serving underserved populations.

Martha Harrison Stinson and Norman Thurston (2002) hypothesize that if doctors have a preference for patients of their own race, they will be located in areas with higher fractions of the population of patients from their same racial background and also have practice types and specialties that are correlated with potential patient race (Stinson & Thurston 2002). They explore these hypotheses using data from 6053 respondents of the *Practice Patterns of Young Physicians Survey of 1991*. Key physician variables in their analysis included zip code level language and racial demographics, urban area, provider gender, type of practice, board certified, specialty, type of medical school and whether they believe it is important that they serve a particular racial group. Stinson & Thurston find that after controlling for physician specialty, practice setting and location, differences in the proportion of minority patients compared with white patients by

doctor's race were significantly smaller. Meaning that specialty, setting and location all influence patient-provider concordance.

Geography

Some researchers argue that disproportionate racial match may simply be an artifact of geographic and medical facility segregation. Largely as a consequence of where people live, African American and Latino patients tend to seek care from different hospitals and from different physicians compared to non-Latino whites (Chandra & Skinner 2003). Few studies on the predictors of racial match have examined geographic location or medical facility effects directly and no study that I am aware of was able to compare the relative importance of medical workforce diversity, patient choice or medical facility/geographic variables in predicting patient-physician racial match.

Methods

The motivation of the current research is to examine the hypothesis that patients who choose their own provider are more likely to have a physician from the same racial background, after controlling for the racial composition of the medical facility where a patient receives care. In this study, I compare the results of standard logistic regression models and medical facility fixed effects models. I measure whether patients who chose their providers are more likely to be racially matched with their provider. I also measure the association between patient socioeconomic status and other patient characteristics and patient-physician racial match. This study will inform the evaluation of policy efforts to increase the diversity of the medical workforce and decrease the racial, ethnic and linguistic discordance between minority patients and their physicians.

Most previous studies do not directly measure patient preferences for same race physicians- this information is not widely available, and even if the question is asked directly of patients, it is highly plausible that patients may have implicit preferences they are not consciously aware of. Patients may also be unwilling to acknowledge or tell the truth about racial preferences (Dovidi et al 1997; Banaji, Hardin & Rothman 1993). Patient preferences aside, medical facilities may differ in how they assign patients and these differences are difficult to measure. For example, it may be standard practice in one facility to assign a patient to a provider based on language or other factors while another facility may assign a patient to a physician randomly.

Given the above challenges, there are several threats to validity to previous studies that may be of concern for the present study. Selection bias is a potential concern as it is difficult to make conclusions surrounding how patient-physician sorting occurs without directly knowing all the factors that patients and medical facilities take into account when choosing and assigning providers. Few previous studies on race/ethnic and linguistic concordance have used any selection bias modeling to understand the predictors of concordance simultaneously with predicting the influence of concordance

on outcomes and thus omitted variables associated with treatment selection may have biased the results.

Another potential threat is statistical conclusion validity, which concerns whether or not a study makes the appropriate conclusion around the size and significance of an effect. Threats to statistical conclusion validity occur when a study has low statistical power, violates the assumptions of statistical tests or has unreliable measures. Statistical power is less of a concern for the current study. If anything, due to the large sample size, it is possible to detect statistical significance, even if practical significance is low.

Another validity threat is the omission of relevant independent variables, including controlling for medical facility fixed effects or medical workforce diversity. I include these relevant variables, but there is still the potential for the omission of other important independent variables. For example, I am unable to measure patient racial preferences directly, which is major limitation of this and previous studies.

Study Population

This retrospective study uses cross sectional observational data from Kaiser Permanente's (KP) Northern California Diabetes Registry of 2005. KP is the largest, integrated pre-paid health care plan in the nation, operating over 30 hospitals and 437 medical centers across the country. Kaiser Permanente's 8.2 million members are served by 11, 275 physicians and over 100,000 employees. The Northern California region serves 3.2 million members from diverse racial, ethnic and socioeconomic backgrounds.

Patients were selected from the KP diabetes registry if they were identified as having diabetes and had been continuously enrolled in 2005. Patient race was obtained from KP member surveys, study surveys and hospitalization data. Physician data (including self-reported race) was obtained from physician demographic files. The validity and reliability of the KP diabetes registry and its laboratory and pharmacy databases have been documented previously (Schmittiel et al 2008).

Patients with missing racial and ethnic data or who were categorized as "mixed race" were excluded from the analysis (18% of patients). Due to small sample sizes, patients from Native American (<1%) and Pacific Islander backgrounds (<1%) were also excluded from the analysis. The final study population consisted of 109,991 Asian, White, Latino and African-American patients that received care from 1750 physicians in 49 facilities across Northern California.

Dependent Variable

Patient-physician racial/ethnic match or concordance was defined as the patient and physician having the same racial background. In this study, racial/ethnic match or

concordance was indicated by a binary variable of 1 if a patient had a same-race or ethnicity provider and 0 if a patient had a provider of a different race or ethnicity. It is important to note that race is not a biological reality but a social construction with fluid and contextual meaning. There is great heterogeneity within racial and ethnic groups. Because of limitations in the way that racial and ethnic data is collected, in this study, I was not able to differentiate the ethnic origin of patients within racial categories. For example, a Japanese patient with a Korean physician would be considered race concordant, despite significant linguistic and cultural differences. Likewise a Puerto Rican patient with a Mexican physician would be considered race concordant in this study. While this is a potential limitation of the current study, there is evidence that members of Latino and Asian ethnic groups often experience similar discrimination and are often treated as a monolithic race.

Main Explanatory variables

Patient-physician link: Two binary variables indicating how a patient was assigned to their physician were also included in all models. The first indicates whether a physician was chosen by the patient or assigned by Kaiser. Because patient-physician link was unknown for a substantial portion of the sample (45%), a second binary variable comparing patients with unknown link, to patients assigned to their physician by Kaiser, was also included. A significant limitation of this study is that I am not able to directly measure patient preference for a same race or ethnicity provider. However, it is unlikely that a direct measure of patient preferences would be unbiased. Research on racial bias suggests that we are often unaware of our racial preferences and even when we are aware of our preferences, we may not be willing to state them directly (Dovidio et al 1997; Banaji et al 1993).

Availability of a same race physician: To assess the extent to which patient-physician racial match is influenced by the diversity of the medical workforce, four continuous variables were calculated for the African American, Latino, Asian and white stratified analyses: 1) African-American physician availability: the percentage of all patients at each medical facility treated by African-American physicians, 2) Latino physician availability: the percentage of all patients at each medical facility treated by Latino physician, 3) Asian physician availability: the percentage of all patients at each medical facility treated by Asian physicians and 4) White Physician availability: the percentage of all patients at each medical facility treated by white physicians. As a sensitivity analysis, I perform additional analyses using the unweighted percentage of physicians from each background at each medical facility (the racial decomposition of the physician workforce) as main explanatory variables.

Multivariate analyses

First, I conduct and compare three regression models with patient-physician concordance as the dependent variable. For each model, patient-provider link (whether a patient chose their provider) was the main explanatory variable. Model 1 follows Saha

et al 2000 and LaVeist & Nuru-Jeter 2002 and controls for patient demographic and socioeconomic variables including patient race, age, gender, geo-coded household income (the median household income of the census block a patient lives in) and geo-coded education (the percentage of individuals over 25 with a college degree in the census block a patient lives in). Unlike previous studies, Model 1 also includes measures of patient health status variables (number of comorbid conditions, number of visits and baseline blood glucose laboratory values (a measure of diabetes control). Model 2 adds to model 1 by also including physician variables (physician age, gender, language, specialty and panel size). In Model 3, the medical facility that a patient receives care is included as a fixed effect.

Because the predictors of race concordance likely differ by patient race and ethnicity, I also conduct a series of stratified logistic regression models to predict patient-physician racial match for African-American, Latino, Asian and White patients separately. In the stratified analyses, I compare the results of four models. In the first (and simplest model) I again follow the methodology employed by Saha et al 2000 and LaViest & Nuru-Jeter 2002 and analyze the patient characteristics associated with race concordance. Model 2 adds physician level variables. Models 3 and 4 add the main explanatory variable- availability of a same race physician. Model 3 is a standard logistic regression, while model 4 adjusts for medical facility fixed effects to adjust for clustering of patients and physicians within medical facilities.

To address any bias due to missing data (patient-physician link was unknown for 45% of the sample) I conduct a sensitivity analysis in which the full logistic regression models assessing the predictors of concordance for all patients were compared to restricted models that included only patients for whom the patient-physician link was known. I also conduct a sensitivity analysis using the racial decomposition (as opposed to a population weighted availability variable).

Results

Sample characteristics

Patients were more likely to be male (52%) and almost 97% reported speaking at least some English. Average patient age was 61. African American and Latino patients were younger than white patients. Over half of white patients were over the age of 65, while only 40% of African-American and Latino patients were over 65. Most patients over the age of 65 were covered by Medicare (87%). Spanish was the primary language of almost a quarter (22%) of Latino patients. African American and Latino patients came from census blocks with lower educational attainment and median household incomes than white patients. [Table 1]

Characteristic	Variable	African-American n=15,905 (%)	Latino n=17,750 (%)	White n=74,900 (%)	Asian N=22,722 (%)
Age	<i>(mean)</i>	60.8	60.1	63.8	60.1
Gender	<i>Male</i>	45	50	52.6	49.2
	<i>Female</i>	55	50	47.4	50.8
Language	<i>English not primary language</i>	.7	22	1.5	10.2
Income	<i>Median</i>	\$50,371	\$55,956	\$61,712	\$68,016
% College Degree		15.3	15	19.5	21.7
Doctor Choice	<i>Kaiser Linked</i>	17.3	23.7	22	22.5
	<i>Patient Linked</i>	32.4	32	32	30.2
	<i>Unknown Link</i>	50	44	45.7	47.3
Physician Specialty	<i>Internal Medicine</i>	82.4	75.9	76	85.7
	<i>Family Practice</i>	10.5	16.1	16.6	7
	<i>Other Specialty</i>	7	7.9	7.4	5.5
# of visits		6.44	6.2	6.3	5.3
Pill burden		8.3	7.4	8.2	7.6
Comorbid conditions		2.7	2.5	2.8	2.4
*Median household income variable is the geocoded median household income for the population over 25 years old in the census block where a patient lives.					
**Geocoded college education is the percent of the population over 25 years old in with a college education in the census block where a patient lives.					

More physicians were male (56% of physicians). Almost a quarter of physicians (23%) reported fluency in another language in addition to English. The majority of physicians were under 50 (average age of 45). Physicians were disproportionately White (47%) or Asian (40%). Less than 8% of physicians were either African-American or Latino. Most physicians were family practice (14 %) or internal medicine (58%). Approximately 28% were specialists or subspecialists. [Table 2]

TABLE 2: CHARACTERISTICS OF THE PHYSICIAN SAMPLE	
Characteristic	Physicians (N=1,750) n (%)
Gender: Male	972 (54%)
Female	769 (43%)
Missing	50 (3%)
Race/ethnicity: White	834 (47%)
African-American	66 (4%)
Latino	83 (4%)
Asian American/Pacific Is.	712 (40%)
Multiple	n/a
Native American	14 (1%)
Missing	81 (4%)
Mean Age (SD)	45 (8.9)
Mean No. of Patients in Panel (SD)	1904 (1,314)
Mean No. of Diabetes Patients in Panel (SD)	136 (113)
Family Practitioner	252 (15%)
Internist	999 (57%)
Specialist/Subspecialist	499 (28%)

Facilities varied significantly in the racial composition of their physician workforce. The percentage of patients seen by African-American physicians at each facility ranged from 0% to 21%, while the percentage of patients seen by Latino physicians ranged from 0% to 45%. On the other hand, the percentage of patients seen by white physicians at each facility ranged from 18% to 89% and the percentage of patients seen by Asian physicians at each facility ranged from (0% to 100%). Approximately 26% of all patients received care at facilities with no African-American physicians, while 20% of all patients received care at facilities with no Latino physicians and 3% of all patients received care at facilities with no Asian physicians. [Table 3]

TABLE 3: RACIAL DISTRIBUTION OF MEDICAL FACILITIES										
Facility	N= PCP	N= Patients	% White		% African American		% Latino		% Asian	
			PCP	Pts	PCP	Pts	PCP	Pts	PCP	Pts
A	12	850	34	39	0	27	8	9	50	20
B	24	2648	30	53	0	13	17	18	41	10
C	19	1965	46	60	17	7	6	20	33	5
D	15	1476	54	72	0	3	0	10	47	11
E	11	1076	52	71	0	3	0	13	45	7
F	29	2642	36	37	3	7	3	13	41	35
G	15	1892	10	59	0	9	13	14	60	13
H	17	1995	27	48	0	13	6	16	70	14
I	23	2798	39	49	13	17	13	11	30	16
J	24	2479	59	82	0	3	8	6	29	4
K	47	4504	31	50	2	4	4	14	59	24
L	40	3946	24	55	5	7	15	23	46	6
M	16	1588	49	53	6	1	6	30	44	7
N	86	8514	30	43	8	11	0	15	49	23
O	1372	1064	36	72	0	3	0	8	61	11
P	1171	1178	21	58	0	7	0	19	73	6
Q	3168	4004	28	32	0	5	0	21	71	36
R	2552	2051	13	56	8	7	0	21	68	5
S	2134	1762	64	57	0	5	0	11	52	23
T	26	2829	45	69	0	6	8	8	34	11
U	24	2220	71	81	0	1	8	10	21	3
V	18	1032	100	82	0	2	0	4	0	6
W	108	8245	40	22	6	48	7	7	35	17
X	3	374	43	89	0	1	33	5	33	1
Y	16	976	88	84	0	1	13	6	0	4
Z	28	2581	32	71	7	3	0	6	57	14
AA	37	4153	72	29	11	36	3	12	24	16
BB	14	1823	60	69	7	10	0	6	36	8
DD	91	8459	50	80	4	3	2	6	35	4
EE	10	912	86	80	0	2	20	7	0	4
FF	57	4558	37	54	4	9	5	12	46	18
GG	88	8245	34	62	1	11	6	11	43	9
HH	95	7886	39	52	3	4	2	15	51	22
JJ	9	1422	43	52	11	4	44	29	0	4
KK	92	7772	51	31	3	16	4	9	31	37
LL	22	2062	47	72	4	4	0	6	41	13
MM	65	2017	45	72	0	3	0	13	40	4
NN	37	2032	76	78	0	5	3	5	11	7
OO	54	4176	79	79	0	3	6	8	14	4
PP	71	7330	39	44	6	20	10	13	37	14
QQ	42	4581	39	37	0	6	8	14	50	33
RR	48	4810	15	54	6	11	2	15	64	13
SS	95	8295	25	47	3	5	1	23	61	17
TT	8	336	35	46	0	10	0	19	50	16
UU	18	1929	13	67	5	9	6	11	44	6
VV	59	5987	61	39	5	20	3	7	29	26
WW	63	3248	43	70	6	6	5	8	36	12

Prevalence of Racial Match

Patients from all racial and ethnic groups were disproportionately served by same race physicians, however underrepresented minority patients were less likely than white or Asian patients to have a same race physician. While Asian physicians made up 48% of the physician workforce, over 63% of Asian patients had Asian physicians. 41% of physicians were white, while nearly 48% of white patients were racially similar to their physicians. Only 9.7% of African-American patients and 11.2% of Latino patients were racially/ethnically matched. However, given that African-American and Latino physicians made up only 3.7% and 4.4% of physicians respectively, African-American and Latino patients were disproportionately served by concordant physicians. Latino patients who spoke Spanish as a primary language were also more likely to have a same ethnicity physician. Almost 26% of Spanish speaking Latino patients had a Latino physician, whereas less than 8% of English speaking Latino patients had a Latino physician [Table 4].

		African American	Latino	White	Asian
Physician Race	African American	9.7	3.4	3.3	2.2
	Latino	3.7	11.2	4.4	2.5
	White	40.4	35.6	47.4	31.5
	Asian	44	46.3	41.7	63.2

Conversely, viewed from the physician perspective, minority physicians disproportionately served minority patients. While only 11% of all patients were African-American, over 25% of the patients seen by African-American physicians were African-American. Likewise, while 12.5% of patients in the sample were Latino, 24% of patients seen by Latino physicians were Latino. Underrepresented Minority physicians also served twice as many patients from low-income backgrounds than white and Asian patients. [Table 5]

	African-American Physicians	White Physicians	Latino Physicians	Asian Physicians
% African American Patients	25	9.7	7	9
% White Patients	40	54	39	41
% Latino Patients	10	9.6	24	11
% Asian Patients	25	26.7	30	39
% Minority*	35	19.3	31	20
% Low income**	11.1	6.7	12.7	7.1
*African-American and Latino patients				
**Geocoded household income under \$30,000				

Predictors of Racial Match

Patient race and language were strong predictors of racial match in all multivariate logistic regression models. In the final model (Model 3), Asian patients were more likely to be racially matched with their physician than white patients OR 3.07 (CI 2.94,3.21). African American and Latino patients were less likely to have same race provider OR .078 (CI .07, .08) and OR .089 (CI .08, .09), respectively. In the final model, patients who spoke Spanish as a first language were more likely to be ethnically matched OR 4.02 (CI 3.61,4.48), as were patients who spoke Cantonese OR 11.9 (CI 9.67, 14.8) or another language OR 1.44(CI 1.08, 1.92).

Patients who chose their provider were more likely to be racially matched with their provider in all models with an OR 1.21 (CI 1.15,1.27) for the final model. Patients with an unknown link with their provider were also more likely to be racially matched with their providers than patients who were assigned their physician by Kaiser OR 1.12 (CI 1.07,1.18). Other variables that were significant in all models include geocoded college education OR 1.33(CI 1.07,1.66), baseline lab values OR .98 (CI .97, .99) and the following physician characteristics: female, younger, bilingual, or family practice. [Table 6]

TABLE 6: PREDICTORS OF RACE CONCORDANCE: RESULTS OF LOGISTIC REGRESSION MODELS

	Model 1 N=109,991	Model 2 N=109,155	Model 3 n=109,155
Main Explanatory Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)
Patient Chose their provider	1.13 (1.09, 1.17)	1.16 (1.11, 1.21)	1.21 (1.15, 1.27)
Unknown patient-provider link*	1.28 (1.24, 1.33)	1.08 (1.03, 1.12))	1.12 (1.07, 1.18)
Patient Demographic and SES Variables			
Asian	1.64 (1.59, 1.70)	2.94 (2.82, 3.07)	3.07 (2.94, 3.21)
African American	.11 (.10, .122)	.084 (.08, .09)	.089 (.08, .09)
Latino	.10 (.09, .108)	.07 (.07, .08)	.078 (.07, .08)
Geocoded median household Income	.99 (.99, .99)	.99 (.99, 1.00)	1 (.99, 1.00)
Geocoded College Education	3.7 (3.15, 4.48)	1.72 (1.40, 2.10)	1.33 (1.07, 1.66)
Female	.94 (.91, .96)	.98 (.95, 1.01)	.98 (.95, 1.01)
Age	1.00 (1.00, 1.00)	1.00 (.99, 1.00)	1.00 (.99, 1.00)
Spanish	3.64 (3.3, 4.02)	3.96 (3.56, 4.41)	4.02 (3.61, 4.48)
Cantonese	6.36 (5.19, 7.8)	12.5 (10.14, 15.4)	11.9 (9.67, 14.8)
Other	4.48 (2.71,4.48)	2.28 (1.73, 3.02)	1.44 (1.08, 1.92)
Patient Health Status			
Pill burden	1.001 (.99, 1.00)	1.00 (.99, 1.00)	1.00 (.99, 1.00)
# of visits to PCP	.99 (.99, 1.00)	.99 (.99, 1.00)	.99 (.99, 1.00)
# of comorbid conditions	.99 (.98, 1.01)	.99 (.97, 1.00)	.99 (.97, 1.00)
HgA1c lab values*	.98 (.97, .99)	.98 (.97, .99)	.98 (.97, .99)
Physician Characteristics			
Female		.99 (.95, 1.02)	1.03 (1.00, 1.07)
Physician speaks second language		1.04 (1.01, 1.08)	1.07 (1.03, 1.11)
Panel size		1.00 (.99, 1.00)	.99 (.99, .99)
Family practice specialty		1.11 (1.06, 1.16)	1.08 (1.03, 1.14)
Other specialty		.87 (.81, .94)	.87 (.80, .94)
Age			.99 (.99, .99)
R ²	.133	.285	.296
Model 1 is a logistic regression model controlling for patient characteristics Model 2 includes all variables in Model 1 and adds physician characteristics Model 3 includes all variables in Model 2 and includes medical facility fixed effects			

Predictors of Racial Match by Racial Group

African-American Patients

Compared with patients who were assigned a physician by the health care organization, African American patients who chose their physicians were more likely to have a same race provider in all models. The strength of the association between choosing a physician and racial match was strongest in models that controlled for medical facility fixed effects [OR 2.2 (CI 1.74-2.82)]. After adjusting for medical facility fixed effects, availability of a same race provider was also a strong predictor of racial match for African American patients [OR 2.7; CI 2.45-2.98].

Several variables were significant in models 1 and 2, but insignificant after controlling for physician availability and medical facility fixed effects in model 3 and 4. These variables were female gender, lower geocoded income, number of visits to pcp and higher geocoded education. Patient health status variables were not significant predictors of concordance for African American patients. In models that adjust for physician characteristics, younger physician age, family practice, larger panel sizes, female gender and monolingual English language were physician variables associated with patient-physician racial/ethnic match for African-Americans. [Table 7]

TABLE 7: PREDICTORS OF RACIAL MATCH FOR AFRICAN AMERICAN PATIENTS: RESULTS OF STRATIFIED LOGISTIC REGRESSION MODELS				
	Model 1 N=12,982	Model 2 N=12,982	Model 3 N=12,982	Model 4 N=11,202
Main Explanatory Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Patient Chose their physician	1.45 (1.21, 1.73)	1.58 (1.32, 1.90)	1.51 (1.23, 1.64)	2.22 (1.74, 2.85)
Unknown patient-physician link*	1.09 (.92, 1.30)	1.09 (.90, 1.32)	1.06 (.69, 1.64)	1.39 (1.08, 1.78)
Availability of concordant physician	-	-	1.29 (1.26, 1.31)	2.71 (2.45, 2.98)
Demographic & SES Variables				
Median household Income*	.99 (.99, .99)	.99 (.99, .99)	.99 (.99, 1.00)	1 (.99, 1.00)
College Education*	2.22 (1.04, 4.71)	3.77 (1.71, 8.31)	3.12 (1.36, 7.14)	1.33 (.56, 3.14)
Female	1.7 (1.04, 1.32)	1.19 (1.05, 1.35)	1.10 (.96, 1.26)	1.07 (.93, 1.22)
Age	check	1.00 (.99, 1.00)	.99 (.99, 1.01)	.99 (.99, 1.00)
Primary Language, NOT English	-	-	-	-
Patient Health Status				
Pill burden	1.00 (.99, 1.01)	1.00 (.99, 1.01)	1.00 (.99, 1.01)	1.00 (.99, 1.01)
# of visits to PCP	.98 (.98, .99)	.99 (.98, .99)	.99 (.98, 1.00)	.99 (.98, 1.00)
# of comorbid conditions	.96 (.91, 1.01)	.97 (.92, 1.02)	.98 (.93, 1.04)	.98 (.93, 1.04)
HgA1c lab values*	.98 (.95, 1.02)	.98 (.94, 1.01)	.97 (.94, 1.01)	.97 (.94, 1.01)
Physician Characteristics				
Female		1.12 (.98, 1.28)	1.43 (1.24, 1.65)	1.62 (1.39, 1.89)
Physician speaks second language		.15 (.12, .19)	.13 (.10, .16)	.12 (.09, .15)
Panel size		1.00 (.99, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Family practice specialty		1.60 (1.35, 1.89)	1.63 (1.36, 1.96)	1.83 (1.48, 2.27)
Other specialty		.76 (.51, 1.13)	1.06 (.69, 1.65)	.78 (.50, 1.22)
Age		.95 (.94, .96)	.94 (.94, .96)	.94 (.94, .95)
R ²	.006	.088	.1934	.1938
<p>Model 1 is a logistic regression model controlling for patient characteristics Model 2 includes all variables in Model 1 and adds physician characteristics Model 3 includes all variables in Model 2 and includes “availability” of a race concordant provider Model 4 includes all variables in Model 3 and includes medical facility fixed effects *Median household income variable is the geocoded median household income for the population over 25 years old in the census block where a patient lives. **Geocoded college education is the percent of the population over 25 years old in with a college education in the census block where a patient lives.</p>				

Latino Patients

Compared with patients who were assigned a physician by the health care organization, Latino patients who chose their physicians were more likely to have a same race provider in all models. This relationship was strongest in model 4 which controlled for availability of a same race provider and medical facility fixed effects [OR 1.71 (CI 1.44-2.04)]. Availability of a same race provider was also a significant predictor of racial match for Latino patients [OR 1.02; CI 1.00-1.04] In the final model, Spanish as the primary language spoken was the strongest predictor of racial/ethnic match for Latino patients [OR 4.81; CI 4.2, 5.51].

Several variables were significant in models 1 and 2, but insignificant after controlling for physician availability and medical facility fixed effects in model 3 and 4. These variables were lower geocoded income and higher geocoded education. With only one exception (number of visits to a PCP in Model 1), patient health status was not a significant predictor of racial match. In models that adjust for physician characteristics, younger physician age, family practice, male gender and bilingual language were physician variables associated with patient-physician racial/ethnic match. [Table 8]

TABLE 8: PREDICTORS OF RACIAL MATCH FOR LATINO PATIENTS: RESULTS OF STRATIFIED LOGISTIC REGRESSION MODELS				
	Model 1 N=14,892	Model 2 N=14,890	Model 3 N=14,890	Model 4 N=11,561
Main Explanatory Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Patient Chose their physician	1.31 (1.14, 1.49)	1.40 (1.22, 1.61)	1.47 (1.26, 1.70)	1.71 (1.44, 2.04)
Unknown patient-physician link*	.53 (.46, .61)	.59 (.50, .69)	.80 (.68, .94)	.97 (.80, 1.18)
Availability of concordant physician	-	-	1.09 (1.09, 1.10)	1.02 (1.003, 1.04)
Demographic & SES Variables				
Median household Income*	.99 (.99, .99)	.99 (.99, .99)	.99 (.99, 1.00)	1.00 (.99, 1.00)
College Education**	1.46 (.69, 3.09)	2.55 (1.17, 5.55)	3.27 (1.45, 7.37)	.54 (.21, 1.37)
Female	.89 (.80, .99)	.93 (.83, 1.04)	.88 (.78, .99)	.89 (.78, 1.01)
Age	1.003 (.99, 1.01)	1.003 (.99, 1.01)	1.00 (.99, 1.01)	1.002 (.99, 1.01)
Primary Language, NOT English	4.17 (3.74, 4.64)	3.72 (3.33, 4.17)	4.86 (4.31, 5.48)	4.82 (4.2, 5.5)
Patient Health Status				
Pill burden	.99 (.98, 1.00)	.99 (.98, 1.00)	.99 (.98, 1.00)	.99 (.98, 1.01)
# of visits to PCP	.99 (.99, .99)	.99 (.98, 1.00)	.99 (.98, 1.00)	1.00 (.99, 1.00)
# of comorbid conditions	.99 (.94, 1.04)	.99 (.94, 1.05)	.99 (.94, 1.05)	.98 (.92, 1.03)
HgA1c lab values*	1.01 (.97, 1.04)	1.01 (.98, 1.05)	1.01 (.98, 1.05)	1.02 (.98, 1.06)
Physician Characteristics				
Female		.68(.60, .77)	.75 (.65, .86)	.74 (.64, .86)
Physician speaks second language		3.56 (3.2, 4.0)	3.8 (3.37, 4.28)	4.15 (3.64, 4.72)
Panel size		.99 (.99, .99)	1.00 (1, 1.00)	.99 (.99, 1.00)
Family practice specialty		1.76 (1.53, 2.02)	1.9 (1.65, 2.19)	2.07 (1.75, 2.46)
Other		.28 (.17, .46)	.40 (.24, .66)	.33 (.19, .55)
Age		.98 (.97, .99)	.97 (.96, .98)	.96 (.95, .97)
R ²	.11	.176	.251	.283
<p>Model 1 is a logistic regression model controlling for patient characteristics Model 2 includes all variables in Model 1 and adds physician characteristics Model 3 includes all variables in Model 2 and includes “availability” of a race concordant provider Model 4 includes all variables in Model 3 and includes medical facility fixed effects *Median household income variable is the geocoded median household income for the population over 25 years old in the census block where a patient lives. **Geocoded college education is the percent of the population over 25 years old in with a college education in the census block where a patient lives.</p>				

Asian Patients

Compared with patients who were assigned a physician by the health care organization, Asian patients who chose their physicians were more likely to have a same race provider in all models. This relationship was strongest in model 4 which controlled for availability of a same race provider and medical facility fixed effects [OR 1.38 (CI 1.23, 1.55)]. Availability of a same race provider was also a significant predictor of racial match for Asian patients [OR 1.05; (CI 1.03,1.07)] Cantonese or another Asian language as the primary language spoken was the strongest predictor of racial/ethnic match for Asian patients [OR 9.8; CI 7.67, 12.6].

Several variables were significant in models 1 and 2, but insignificant after controlling for physician availability and medical facility fixed effects. These variables were fewer comorbid conditions, lower baseline lab values, and lower geocoded education. After adjusting for availability and medical facility fixed effects, higher geocoded education was associated with racial match for Asian patients. In models that adjust for physician characteristics, younger physician age, internal medicine, female gender and bilingual language were physician variables associated with Asian patient-physician racial/ethnic match. [Table 9]

TABLE 9: PREDICTORS OF RACIAL MATCH FOR ASIAN PATIENTS: RESULTS OF STRATIFIED LOGISTIC REGRESSION MODELS				
	Model 1 N=19,527	Model 2 N=19,527	Model 3 N=19,527	Model 4 N=19,316
Main Explanatory Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Patient Chose their physician	1.21 (1.11, 1.31)	1.35 (1.23, 1.48)	1.44 (1.31 1.58)	1.38 (1.23, 1.55)
Unknown patient-physician link*	.69 (.64, .75)	1.18 (1.08, 1.3)	1.27 (1.16, 1.39)	1.18 (1.05, 1.32)
Availability of concordant physician	-	-	1.04 (1.03, 1.4)	1.05 (1.03, 1.07)
Demographic & SES Variables				
Median household Income*	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	.99 (.99, .99)	.99 (.99, 1.00)
College Education**	.41 (.27, .61)	.62 (.40, .97)	2.23 (1.49, 3.54)	2.29 (1.4, 3.7)
Female	1.11 (1.05, 1.18)	.96 (.89, 1.03)	.99 (.92, 1.06)	.98 (.91, 1.05)
Age	.99 (.99, 1.00)	1.001 (.99, 1.00)	1.00 (.99, 1.00)	1.00 (.99, 1.00)
Primary Language, NOT English	7.89 (6.2, 9.88)	9.25 (7.31, 11.7)	11.3 (8.9, 14.3)	9.8 (7.67, 12.6)
Patient Health Status				
Pill burden	.99 (.99, 1.00)	.99 (.99, 1.00)	.99 (.98, 1.002)	.99 (.99, 1.00)
# of visits to PCP	1.00 (.95, 1.14)	1.00 (1.00, 1.01)	1.003 (.99, 1.009)	1.004 (.99, 1.01)
# of comorbid conditions	.95 (.91, .97)	.96 (.92, .99)	.96 (.93, 1.00)	.96 (.93, 1.00)
HgA1c lab values*	.97 (.96, .99)	.97 (.95, .99)	.97 (.95, 1.002)	.98 (.95, 1.00)
Physician Characteristics				
Female		1.68 (1.56, 1.81)	.99 (.92, 1.06)	1.83 (1.69, 1.9)
Physician speaks second language		2.23 (2.06, 2.4)	2.09 (1.93, 2.26)	1.94 (1.79, 2.10)
Panel size		1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Family practice specialty		.66 (.58, .75)	.70 (.61, .80)	.66 (.57, .77)
Other specialty		.74 (.62, .87)	.62 (.52, .74)	.68 (.56, .81)
Age		.91 (.91, .92)	.91(.91, .92)	.91 (.90, .91)
R ²	.053	.181	.213	.233
<p>Model 1 is a logistic regression model controlling for patient characteristics Model 2 includes all variables in Model 1 and adds physician characteristics Model 3 includes all variables in Model 2 and includes “availability” of a race concordant provider Model 4 includes all variables in Model 3 and includes medical facility fixed effects *Median household income variable is the geocoded median household income for the population over 25 years old in the census block where a patient lives. **Geocoded college education is the percent of the population over 25 years old in with a college education in the census block where a patient lives.</p>				

White Patients

The relationship between patient choice in provider and racial match was inconsistent for white patients across all models. Patients who chose their providers were more likely to be racially matched in Model 1 [1.08 (CI (1.04, 1.13))] and Model 2 [OR 1.11, CI (1.04, 1.18)], whereas in models 2 and 3, the relationship was insignificant. In all models, patients with an unknown patient link were more likely to be racially matched, compared to patients who were linked by Kaiser Permanente. In the final model, availability was marginally significant for white patients [OR 1.05, CI (1.03, 1.05)].

Lower income and higher education was associated with racial match in models 1 through 3, but insignificant in model 4. Age was a significant predictor in model 1, but insignificant in models 2-4. In models 2-4, greater pill burden, number of comorbid conditions and baseline lab values were also predictors of racial match between white patients and physicians. Significant physician variables included older age, male gender, family practice, larger panel size, and monolingual language. [Table 10]

TABLE 10: PREDICTORS OF RACIAL MATCH FOR ASIAN PATIENTS: RESULTS OF STRATIFIED LOGISTIC REGRESSION MODELS				
	Model 1 N=62,581	Model 2 N=62,557	Model 3 N=62,557	Model 4 N=61,907
Main Explanatory Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Patient Chose their provider	1.08 (1.04, 1.13)	.99 (.94, 1.04)	.99 (.95, 1.04)	1.11 (1.04, 1.18)
Unknown patient-provider link*	1.61 (1.54, 1.68)	1.12 (1.07, 1.18)	1.13(1.08, 1.19)	1.19 (1.12, 1.27)
Availability of concordant provider	-	-	1.00 (1.00, 1.004)	1.02 (1.01, 1.03)
Demographic & SES Variables				
Median household Income	.99 (.99, .99)	.99 (.99, .99)	.99 (.99, .99)	.99 (.99, 1.00)
College Education	9 (7.26, 11.1)	7.34 (5.7, 9.4)	7.51 (5.85, 9.63)	1.3 (.98, 1.72)
Female	.90 (.87, .93) check	1.01 (.97, 1.05)	1.01 (.97, 1.05)	1.03 (.99, 1.07)
Age	1.00 (1.00, 1.005)	1.00 (.99, 1.00)	1.00 (.99, 1.00)	1.00 (.99, 1.00)
Primary Language, NOT English	-	-	-	-
Patient Health Status				
Pill burden	1.00 (.99, 1.00)	1.00 (1.00, 1.00)	1.005 (1.001, 1.008)	1.008 (1.00, 1.01)
# of visits to PCP	.99 (.99, 1.00)	.99 (.99, 1.00)	.99 (.99, 1.00)	.99 (.99, 1.00)
# of comorbid conditions	1.01 (1.00, 1.2)	1.01 (.99, 1.02)	1.01 (.99, 1.02)	1.01 (.99, 1.02)
HgA1c lab values*	.98 (.97, .99)	.98 (.97, .99)	.98 (.97, .99)	.98 (.96, .99)
Physician Characteristics				
Female		1.01 (.97, 1.05)	.57 (.55, .60)	.51 (.48, .53)
Physician speaks second language		.32 (.31, .34)	.32 (.31, .34)	.35 (.34, .37)
Panel size		.99 (.99, .99)	.99 (.99, .99)	.99 (.99, .99)
Family practice specialty		1.31 (1.24, 1.37)	1.28 (1.22, 1.34)	1.24 (1.16, 1.31)
Other specialty		1.09 (.99, 1.21)	1.12 (1.01, 1.24)	.96 (.86, 1.07)
Age		1.00 (1.10, 1.11)	1.10 (1.10, 1.11)	1.11 (1.10, 1.11)
R ²	.0156	.1945	.1949	.2583
<p>Model 1 is a logistic regression model controlling for patient characteristics Model 2 includes all variables in Model 1 and adds physician characteristics Model 3 includes all variables in Model 2 and includes "availability" of a race concordant provider Model 4 includes all variables in Model 3 and includes medical facility fixed effects *Median household income variable is the geocoded median household income for the population over 25 years old in the census block where a patient lives. **Geocoded college education is the percent of the population over 25 years old in with a college education in the census block where a patient lives</p>				

Discussion

African American and Latino patients were least likely to be racially matched with their providers, while White and Asian patients were more likely to be racially matched. Latino and Asian patients with language barriers were more likely to be racially matched with their physicians, compared with English speaking Latino and Asian patients. Spanish as the primary language spoken was the strongest predictor of racial match for Latino patients and physicians in both standard and fixed effects models. Cantonese as the primary language spoken was the strongest predictor of racial match for Asian patients.

Compared with patients who were assigned a physician by the health care organization, patients who chose their physicians were more likely to have a same race provider. While statistically significant for all racial/ethnic groups, this relationship was strongest for African American and Latino patients. Availability of a same race provider was a strong predictor of racial match for African-American and Latino patients and marginally significant for Asian and White patients. After controlling for facility fixed effects, availability became an even stronger predictor of concordance for all racial groups.

Patient age and gender were not significant predictors of concordance for patients from any racial group. Patient health status was not a predictor of concordance for African-American and Latino patients. However, a lower baseline hgA1c value (a measure of diabetes control) was a significant predictor of race concordance for white patients. After controlling for facility fixed effects, geocoded median household income and education were not significant predictors of concordance. These results suggest that socioeconomic differences between concordant and discordant patients within facilities are smaller than patient socioeconomic differences between medical facilities.

This study makes a number of contributions to the existing literature on race concordance. First, while other studies explored race concordance across a general population, I assessed the predictors of race concordance among a large cohort of patients with diabetes. Arguably, the effects of concordance should be most pronounced in the treatment and management of chronic diseases such as diabetes, where the patient-provider relationship plays a prominent role (Kaplan, Greenfield and Ware 1989). Another unique aspect of this study is the use of the "availability" variable to understand the extent to which patient-physician racial match is influenced by the diversity of the medical workforce. It should be noted that while availability was a strong predictor, even after controlling for availability, minority patients who had a choice in physician were more likely to have a same race provider.

Consistent with previous research on racial match, minority patients in this study were disproportionately served by minority physicians and Spanish speaking patients were more likely to have Latino, Spanish speaking physicians (Moy & Bartman 1995, Xu et al 1995, Stinson & Thurston 2002). African- American and Latino physicians also served lower income patients. This is consistent with research suggesting that minority

physicians are more likely to care for economically disadvantaged and underserved populations (Moy & Bartman 1995, Bach et al 2004).

To my knowledge, this is the largest study examining predictors of race concordance after controlling for patient, provider and facility effects simultaneously. However, there were some important limitations. This study utilized quantitative data available in existing clinical databases; patient and physician perspectives were not measured directly. Also, how a patient was linked to their physician was unknown for a substantial portion of the study population. In a sensitivity analysis, logistic regression models assessing the predictors of concordance for all patients were compared with models assessing patients for whom the provider link was known. This did not alter the direction or magnitude of the results (Results not shown). However, there may still have been some unmeasured bias due to missing data. Another potential concern is that I was unable to assess important variables that could influence racial match such as cultural competency or communication styles of physicians. Future qualitative research would be useful for understanding the considerations that patients take into account when choosing a physician.

Conclusion

The results of this study lend support to the hypothesis that racial match is at least partially explained by the availability of a same race physician, and also lend support to the theory that patients may choose their physicians based on race. The findings presented here provide evidence that efforts aimed at diversifying the medical workforce may increase racial match for African-American and Latino patients. If, as some of the literature suggests, race concordance improves outcomes, increasing the availability of minority physicians can reduce racial and ethnic disparities in health.

In the next chapter, I review the empirical analysis examining race, ethnicity and language concordance on health outcomes. I then examine the association of patient-physician race, ethnicity and language concordance on cardiovascular disease medication management.

Chapter 4:

Patient-Physician Racial and Ethnic Match and Cardiovascular Disease Medication Management for African American and Latino Patients with Diabetes

Introduction

Interpersonal barriers resulting from language or cultural differences between patients and physicians may explain a portion of disparities in cardiovascular disease risk factor management for patients with diabetes. Physicians engage in less patient-centered communication and have shorter visits with patients of color than with white patients (Johnson et al 2004). Patient race/ethnicity has been associated with physicians' assessment of patient intelligence, feelings of affiliation toward the patient, and beliefs about the patients' likelihood of risk behavior and adherence with medical advice (Abreu 1999, vanRyn & Burke 2000). Patients of color are also more likely to be negatively perceived by their physicians. For example, physicians tend to perceive African-Americans and members of low socio-economic status [SES] groups more negatively than they do white and upper SES patients.

Potentially as a response to the barriers noted above, African-American and Latino patients are less likely to trust the medical system and more likely than white patients to perceive they would have received better medical care if they belonged to a different racial and ethnic group (Johnson et al 2004, Blanchard et al 2007). Patients of color are also more likely to believe that medical staff judged them unfairly or treated them with disrespect based on race and ethnicity (Gamble 1993, Chen et al 2005, Malat 2001). Other obstacles more likely to confront minority patients include language and communication barriers, distrust of providers and the medical system, physician stereotypes and bias, and disparities in the interpersonal quality of care (IOM 2002, Cooper et al 2006, Chen et al 2005, Johnson et al 2004).

Patient-physician race/ethnicity and language concordance (the patient and health care provider having the same race/ethnicity and/or language) may help bridge interpersonal barriers in care for minority patients. According to the race/ethnicity and language concordance hypothesis, physicians from racial and ethnic minority backgrounds are more likely to possess culturally specific knowledge, skills and experience that reduce barriers to the patient-physician relationship for racial/ethnic and linguistic minority patients (Saha et al 2000, Bureau of Health Professions 2006, LaVeist & Nuru-Jeter 2002) Race, ethnicity and language concordance are thought to foster trust, communication and better patient-provider interaction. For example, race/ethnicity concordance is associated with better trust in physician (Malat 2001), higher patient ratings of physicians' participatory decision-making and higher patient satisfaction (Cooper et al 2003, LaVeist & Nuru-Jeter 2002). Compared to patients whose primary physicians are of a different race/ethnicity, patients who are of the same racial or ethnic group as their physicians are more likely to use needed health services, are less likely to postpone or delay seeking care and report a higher volume of use of health services (Saha et al 2000, LaVeist et al 2003). Other studies have found that language concordance and interpreter use positively affects patients' perceived understanding of

their disease and is positively associated with a range of health outcomes (Wilson et al 2005, Baker et al 1996).

However, the evidence that race/ethnicity concordance is an important factor in the quality of health care is mixed (Bureau of Health Professions 2006). In Chapter 2, I found significant differences in CVD risk factor control, treatment intensification and medication adherence. No studies have examined the association between race/ethnicity or language concordance, cardiovascular disease processes of care and levels of intermediate outcomes. In chapter 4, I examine the association of patient-physician race/ethnicity concordance for African American and Latino patients on CVD risk factor levels, medication adherence and treatment intensification in a large cohort of diabetes patients in an integrated delivery system. In addition, I examine whether language concordance for Spanish-speaking Latino patients is associated with improved cardiovascular processes of care and level of intermediate outcomes. This study builds on previous research using a large sample size, among patients with a chronic illness and in an integrated delivery system where almost all patients have medication drug benefits.

Literature Review

Concordance and Patient Satisfaction:

Many studies on the relationship between race, ethnicity and/or language concordance have examined how concordance influences the perception of quality of care and/or satisfaction with care. The methodological rigor of these studies varies- some studies examine bivariate relationships, while others use multiple regression to control for potential confounders. Many studies survey or interview patients directly and a few use focus groups or direct observation. Regardless of research design, the majority of the studies examining the perception of quality and satisfaction of care have found positive impacts of concordance on patient ratings of quality and satisfaction with care.

For example, studies have examined the influence of concordance on patients perception of their care. Saha et al (1999) used a cross sectional telephone survey of 3120 African American, latino and white adults in the US in 1994 to look at satisfaction with physician and with health care and found that race concordance for African American patients was associated with higher ratings of physicians on providing good health care overall, treating patients with dignity and respect, listening, explaining and being accessible. Latinos with race concordant physicians reported greater satisfaction overall (Saha et al 1999). Using the same data source as above, two studies by LaVeist et al (2002, 2003) examined whether race concordance was associated with satisfaction and utilization measures and found race concordance was a significant predictor of both outcomes (Laveist & Nuru-Jeter 2002, LaVeist et al 2003)

Malat (2001) also found that concordance influenced rating of physician respect. Using face-to-face interviews of 586 African American and 554 mostly white adults in 1995 in

Detroit to study the influence of race concordance with PCPs, Malat found that while African American patients had lower patient ratings of physicians showing respect, race concordance was associated with higher rating of physicians showing respect for African American patients (Malat 2001).

A possible explanation for the benefits of concordance on satisfaction discussed above is that concordance might make a difference for patients who have perceived discrimination in medical care or have stated a preference for a same race provider. Indeed, a study by Chen et al (2005) used a cross sectional telephone survey of 3884 African American, Latino and white adults in the US in 1999 and found race concordance was associated with greater satisfaction for all racial groups examined who explicitly preferred a race concordant PCP. For those with no preference, race concordance was not associated with satisfaction (Chen 2005). However, this study is subject to bias, as it did not adjust for potential confounders.

Not all studies have found an association between concordance and patient ratings of care. Saha's 2003 study of race concordance with regular doctor among 6299 African American, Latino, Asian and White adults in the continental US in 2001 did not find any race concordance effects on patient ratings of the quality of the most recent physicians' interaction, cultural sensitivity or satisfaction with health care. It is important to note that this study asked patients to rate their most recent visit, which may not have been the patients regular provider. It is possible that concordance effects occur in patient-provider relationships that are longer term, such as with a patients primary care provider (Saha et al 2003).

Patient-Provider Communication

Another potential explanation for improved satisfaction and ratings of care for race/ethnic and language concordant patients is that concordance is hypothesized to improve patient-provider communication. Studies on concordance and patient-physician communication generally support the hypothesis that concordance improves patient-physician communication (Cooper et al 2003). Using direct observation and face-to-face interviews with 51 Spanish speaking patients, Seijo, Gomez & Freidenberg (1991) found that language concordance was associated with more questions asked by patients and better recall of information (Seijo et al 1991). Another study using 116 face-to-face interviews with Spanish-speaking patients visiting a general medicine or family practice clinic at a public hospital in San Francisco in 2000 focused on language concordance and patient perceptions of the quality of communication. This study found that language concordance was associated with greater perceived responsiveness to patient problems and concerns (Fernandez et al 2004).

Results of studies on race/ethnicity concordance and patient-provider communication are consistent with those on language concordance. For example, Cooper et al (2003,)

used cross-sectional written surveys and audiotape analysis of 142 African American and 110 white patients in 16 primary care practices in the Washington DC areas from 1998 to 1999 to understand how race concordance was associated with patient-physician communication content, ratings of physicians participatory decision making. Race concordance was associated with longer visit duration, slower speech speed, and more positive patient affect. Patients in race concordant relationships also rated the physicians participatory decision making higher (Cooper et al 2003).

Another study used cross-sectional focus groups of 49 African American, Latino, and White patients in California from 1998 to 1999 to examine the impact of race concordance on the quality of patient-primary care provider interactions and found that African American men and women generally perceived better communication with race concordant primary care providers due to greater interpersonal comfort and cultural understanding. The impact of race concordance on Latinos was mixed. Latino men perceived better communication with race concordant primary care providers while Latina women did not. Non-English proficient Latino men and women expressed the importance of language concordance on communication between themselves and their providers (Garcia et al 2003).

Concordance and clinically appropriate care

While the studies above mostly suggest that concordance improves the patient rating of care and patient-provider communication, few studies have examined whether concordance improves the clinical appropriateness of care and the results of the few studies on clinical appropriateness and concordance have found mixed results. One study found a positive association between concordance and clinically appropriate care for patients with HIV. Using a prospective study of chart reviews and surveys, King et al (2001) examined time to receipt of protease inhibitor therapy for 1241 African American and white adults with HIV infection who made at least one non-emergency department visit to a medical care from in the US in 1996. King found that after adjusting for confounders, race concordance was associated with shorter time to receipt of protease inhibitors among African American patients (King et al 2001).

Another study by Chen et al (2005) found no relationship between concordance and appropriateness of care. Chen et al conducted a retrospective cohort medical record review of 35,676 white and 4,039 African American Medicare beneficiaries over 65 hospitalized for acute myocardial infarction from 1994-1995. This study looked at whether having a same race attending physician during the hospital stay was associated with receipt of cardiac catheterization or mortality. Race concordance was not associated with differences in outcomes. However, the attending physician during a hospital stay is most likely not the patient's primary provider and a long-term relationship with one's hospitalist is uncommon. In addition, during a hospitalization, the patient interacts more with attending nurses and other hospital staff than the attending

physician. It is possible that the length of the interaction during the hospitalization and the patient-provider relationship is too short for any concordance effects to occur.

Concordance and Utilization and Outcomes

I found more studies examining concordance, utilization and outcomes in the mental health professional-client relationship than any other patient-provider relationship. This is probably because mental health patient-provider relationships are hypothesized to be heavily influenced by the patient-provider relationship and relationships between mental health professionals and their clients are often long term with more frequent interaction than the patient-physician relationship.

The bulk of the evidence on utilization points to positive impacts of concordance while the evidence on concordance and outcomes have been mixed. Flakerud & Liu (1991) conducted retrospective cohort administrative database analyses of 1746 episodes of Chinese, Korean, Japanese and Filipino outpatients in Los Angeles county from 1983 and 1988 and found that ethnic and language concordance were predictive of higher number of visits. Ethnic and language concordance together was predictive of lower dropout rates from therapy. However, there was no association between concordance and improved mental health scores for either language or ethnicity. Other studies using data from Los Angeles county mental health facilities during the same time period had similar findings. For example, Fujino, Okazaki & Young (1994) found that joint ethnic and gender concordance was associated with lower drop out rates and longer duration of therapy for Asian and White women. Ethnic concordance was associated with longer duration of therapy and improved mental health scores for Asian men (Fujino et al 1994). Gamst et al (2000) conducted a study with 4554 African American, Latino, Asian and White mental health outpatients in Los Angeles county between 1994-1998. They found that patient concordance with mental health professionals (Psychologists, social workers, counselors etc) was not consistently associated with mental health visits or improved mental health scores. For example, concordance was associated with improved outcomes for African American patients with schizophrenia but with worse outcomes for African American patients with mood disorders. Concordance for Latino and Asian patients was associated with improved outcomes for both schizophrenia and mood disorders (Gamst et al 2000).

Another study examining mental health outcomes, Rosenheck, Fontan & Cottrel (1995) used a prospective cohort of 910 African American and 3816 white US military veterans with post-traumatic stress disorder treated at 53 different sites found that race concordance between mental health patients and mental health providers and clients was associated with lower likelihood of African American patients to terminate treatment. Race concordance was also associated with higher attendance, greater commitment to treatment and clinician rated improvement in violent behavior for African American patients (Rosenheck et al 1995).

In a study on race concordance and substance abuse treatment outcomes, Sterling (1998) used a retrospective cohort analysis of data from a clinical trial with 967 African American patients admitted to a 12-week public outpatient cocaine treatment program in a large Northeastern US city between 1990 and 1993 to examine differences in return visits after initial intake, treatment retention, utilization assessment and 9-month outcomes. In this study the main therapeutic modality was group therapy. The study found that return rates were not improved with race concordance. However, race concordance was associated with lower rates of post-counseling inpatient treatment use and with more medical and legal problems at 9 months. It is possible that the race of other group members may have also had an impact on outcomes, and this was unmeasured (Sterling et al 1998). In a similar study (Sterling et al 2001) examining one-on-one counseling of 116 African American patients, race concordance was associated with lower rates of post-counseling outpatient treatment and with lower rates of being jailed in 9 months (Sterling et al 2001).

In addition to the above studies on mental health or substance abuse outcomes, several studies have examined concordance with other health outcomes. A study by Porter and Beuf (1994) using face-to-face interviews of 90 African American patients with vitiligo receiving care at two different speciality clinics—one with largely African American staff and physicians and the other with largely white staff and physicians — found that African American patients treated in the clinic with a predominately African American staff perceived they better adjusted to vitiligo than patients treated in the predominately white clinic. Patients in the predominately African American clinic were also more satisfied with their care, and reported better trust and comfort with staff. A limitation of this study was the small sample size of clinics (2) and the inability to control for all potential confounders. For example, the qualitative interviews also found that African American patients at the predominately African American clinic attributed some of their higher ratings of care to the fact that there were also more African American patients at the predominately African American staff clinic. Perhaps having more African American patients increases comfort level and provides more peer support for African American patients with vitiligo (Porter & Beuf 1994).

Another study, Lasater et al (2001), using a retrospective cohort administrative/clinical database analysis and telephone and written surveys of 79 Spanish-speaking and 104 English-speaking Latino patients age 35-70 with diabetes in a public health care system in Denver from 1995-1997 found Spanish language concordance was positively (but not significantly) associated with better glycemic control (Lasater et al 2001) .

Concordance and Medication Adherence

There is evidence that language concordance influences patient adherence to medication. For example, Wilson et al (2005) used a cross-sectional telephone survey of 1200 adults in California expressing a preference to complete a survey in one of 11 non-English languages to study whether language concordance was associated with patients understanding of medical situations, confusion about medications, understanding medication labels and adverse drug reactions. Wilson et al found that limited English proficiency patients with language discordant physicians were substantially more likely than English speaking patients to have difficulty understanding medical situations and medication labels and to have had an adverse drug reaction. Spanish language concordant patients were somewhat more likely than English speaking patients to have difficulty understanding medical situations but no more likely to have problems with medication labels or to have had a bad reaction due to not understand medication instructions (Wilson et al 2005).

Manson (1988) used a retrospective cohort chart review and administrative database analysis to examine the influence of language concordance between patients and their primary care providers on medication adherence, kept appointments, emergency department visits and hospitalization. Language concordance was associated with fewer missed appointments and non-significant associations of language concordance with greater medication adherence and fewer emergency department visits.

Perez-Stable, Napoles-Springer & Miramontes (1997) used cross-sectional self-administered surveys and chart reviews of 226 Latino and non-Latino white patients with hypertension or diabetes at an academic general medicine clinic in San Francisco to study the association of patient-primary care provider language concordance on health status and satisfaction with health care services. Perez-Stable found that language concordance was associated with better physical and psychological functioning, health perceptions and pain but was not associated with differences in patient satisfaction (Perez-Stable et al 1997).

There is less evidence to suggest that race concordance influences whether patients adhere to medications. Howard et al (2001) used cross-sectional face-to-face interviews of 1416 African American and 1451 white patients 65 and older with Hypertension in five counties in Northern California between 1986 and 1987 to examine the association of race concordance between patients and their usual care physician on medication prescription and adherence. Howard found that for African American patients 65 and older, race concordance was not associated with any of the outcome measures after accounting for potential confounders. The African American physicians in this study were less likely than white physicians to be board certified and more likely to work in primary care and community health centers. It is possible that these differences in African American PCP's may have masked any concordance effects (Howard et al 2001).

Like many of the above studies, the current study relies on retrospective cohort analysis of administrative databases, but unlike previous studies, this study benefits from a large sample size and focuses on patients in a single integrated system where patient-physician relationships are long and where patients are being treated for a chronic disease.

Any study examining the impact of race/ethnicity or language concordance is limited by the fact that patients cannot be randomly assigned a concordant versus discordant provider. Unmeasured differences between patients who choose a same race/ethnicity or language provider and those who do not, might explain differences in outcomes. In addition, concordance is a proxy, not a direct measure of cultural resonance between patients and providers. Despite these methodological challenges, this study adds to a growing body of literature on the association of race/ethnicity and language concordance on medical outcomes by being the first to simultaneously to examine measures of appropriateness of care and patient adherence in the medication management of cardiovascular disease risk factors for patients with diabetes.

Research Design and Methods

Study Population

The study population consisted of a cohort of African American and Latino adult diabetes patients in Kaiser Permanente Northern California (KPNC) Diabetes Registry, described in previous chapters. Physician self-reported race/ethnicity and language data was obtained from physician demographic files and was available for 93.5% of physicians. The final study population consisted of 15,905 African-American and 17,750 Latino adult diabetes patients. Patients with missing racial/ethnic data were excluded from the analysis.

Definition of Dependent Variables

Good versus Poor Risk Factor Control: Three measures of risk factor control were used as dependent variables in this study. They were previously described in chapter 2. Good A1c risk factor control for diabetes was defined as a patient having an A1c lab value of less than 8.0% throughout 2005; this level is in accordance with quality guidelines at KPNC. Good risk factor control for patients with hypertension was defined as not having two or more consecutive SBP readings greater than 140 mm Hg at any time during the year. This blood pressure cut-off point is higher than the ADA guideline, but is generally agreed-upon and consistent with the Veteran's Affairs quality goal for diabetes patients and one that clearly needs therapy modification. Good risk factor control for patients with hyperlipidemia was defined as an LDL-c value less than 100 mg/dL during the year. Lab and blood pressure values for 2005 were obtained from automated KPNC databases.

Medication Adherence: Treatment adherence for CVD risk factor controlling medications (diabetes, cholesterol and hypertension medications) was calculated with KP prescription databases using Continuous Multiple interval measures of Gaps in therapy (CMG). CMG is the proportion of days a patient was prescribed medication and did not have the medication available (most often because the patient did not pick up their medications) (Steiner & Prochazka 1997). For each individual condition (hyperglycemia, hypertension and hyperlipidemia), CMG was first calculated separately for each medication class filled at least twice in the 12 months prior to the last date when above target levels were observed in 2005. Individual class adherence was then combined into a single measure for all medications prescribed for a single condition, weighting the estimate for each medication class by the number of days from the first to last fill in the 12 month period. Medications filled only once were not included in the analysis because CMG can not be calculated from single fills. Because many prior studies have found significant clinical effects when cumulative days of refill gaps equal or exceed 20%, I defined good adherence for each condition as a non-adherence measure less than 20% (Steiner & Prochazka 1997). Individual condition adherence was then combined into a single measure of adherence for all medication classes a patient was prescribed for diabetes, hypertension and/or hyperlipidemia. Patients who had 80% of their medications available for each condition for which they were being treated were coded as 1. Patients who had less than 80% of their medications available for any condition were coded as 0.

Treatment Intensification: A binary variable was created to indicate whether pharmacy databases indicated an intensification of pharmacotherapy within six months following an instance of poor risk factor control during 2005. A six-month period was chosen because the high visit rate of diabetes patients within KPNC, and the use of primary care teams who can reach out to initiate therapy modification on the physician's behalf via phone or mail, give sufficient opportunity for therapy modification in this setting. Intensification was defined as an increase in the number of drug classes, an increase in dosage of at least one drug class or a switch to a different drug class within six months. Daily doses were categorized as low (near initial starting doses), medium (maintenance range), or high (high end or above maintenance range) based on package insert recommendations and inspection of actual dosage distributions. Patients who were already using insulin were excluded from the treatment intensification for hyperglycemia analysis because treatment intensification for insulin cannot be measured in automated pharmacy databases.

Main Explanatory Variables

Patients-physician race and ethnicity concordance: Patient-physician race/ethnicity concordance was defined as the patient and primary care provider/physician being from the same racial/ethnic background. The patients' primary care provider was defined as the physician linked to the patient the most months in 2005. It is important to note that linguistic, national background, immigrant status, acculturation and cultural diversity

exists within each racial and ethnic category. I was unable to assess concordance beyond broad racial/ethnic categories.

Patient-Physician language concordance: Patient-physician Spanish language concordance was defined as the patient reporting Spanish as the preferred language spoken and the physician reporting Spanish language fluency. Physician language proficiency was obtained through physician self-report at the onset of employment with the medical group. Because less than 1% of African American and less than 2% of white patients report a primary language other than English, our Spanish language analyses focus on Latino patients (23% of Latino patients report Spanish as their primary language).

Probit Models for Patient Race and Ethnicity Analysis

Stratified multivariable models assess the marginal effect of patient-physician race/ethnicity and language concordance on A1c, LDL-c and SBP control, medication intensification and medication adherence using probit regression. The resulting marginal effects were converted into adjusted percentages of patients in good CVD risk factor control, patients at above target CVD risk factor levels who received treatment intensification and patients in adherence to A1c, LDL-c and SBP medications. All models controlled for patient demographics (age, gender, language, and U.S census 2000 geo-coded education and income) as well as measures of health status and utilization (number of comorbid conditions, number of primary care visits in 2005, Medicare status, and number of medication classes across the three conditions). Risk factor values were used as explanatory variables in the adherence and treatment intensification analysis. The models also controlled for physician age, gender, language proficiency, panel size and number of diabetic patients in panel as fixed effects.

To account for patient clustering within physician panels, multivariable models adjusted for physician as a random effect. Mixed models take into account the nested nature of hospital data. Outcomes for patients receiving care from the same physicians may be influenced by individual patient characteristics but also by the characteristics of the physicians providing them care.

Sensitivity analysis

It is possible that patients in concordant relationships differ from patients in discordant relationships in important ways that may influence their health outcomes. As a sensitivity analysis, I use instrumental variable analysis for the stratified race concordance models. Instrumental variable (IV) analysis is an econometric tool that researchers can use to adjust for selection bias. An IV analysis, takes advantage of naturally occurring instances of an observable phenomenon to approximate or duplicate the properties of a controlled experiment (Kennedy 2003). A valid instrument is highly correlated with treatment (having a same race or language physician) and does not independently affect the outcome in question (risk factor control, medication

intensification or adherence). I test whether the racial and linguistic composition of the physician workforce at the patients' medical facility can be a valid instrument. In chapter 3, I found that the racial decomposition of the physician workforce was one of the strongest predictors of concordance for patients of color and thus meets the criteria for influencing selection into the treatment group for minority patients. Some patients received care in facilities where few or no providers in the study were from their same racial or ethnic background. These patients would be dropped from medical facility fixed and multilevel models. However, in the IV analysis, patients are not compared based on whether they are discordant and concordant with their physician but based on their likelihood of race and language concordance.

All analyses were performed using STATA version 10.

Results

Sample Characteristics

Most patients in the sample (94%) were being treated for more than one CVD risk factor and almost three-quarters of patients (72%) were being treated for all three conditions (diabetes, high cholesterol, and hypertension). Approximately half of the patients in the sample were male (52%). Spanish was the preferred language of almost a quarter (23%) of Latino patients. Patient preferred language was obtained through patient self-report.

Physicians were disproportionately White (47%) or Asian (40%). Less than 8% of physicians were either African-American or Latino. While almost a quarter of physicians (23%) reported proficiency in a non-English language, less than 5% of physicians spoke Spanish. African American patients had longer relationships with their physicians (6.3 years for African American) than Latino patients (5.6 years for Latino patients). Spanish speaking patients had the shortest relationship with their physicians (4.5 years). Only 9.7% of African American and 11% of Latino patients were in race/ethnic concordant relationships. 24% of Spanish speaking patients were linguistically concordant with their physicians. [Table 1]

TABLE 1: PATIENT CHARACTERISTICS			
	AFRICAN AMERICAN N=15,905 (%)	LATINO N=17,750 (%)	SPANISH LANGUAGE N=6,712 (%)
Patient Demographic Characteristics			
Age (Mean)	60.8	60.1	56.8
Male	45	50	50.9
Female	55	50	49.1
English not primary language	.7	22	100
Median household Income (Geocoded)**	\$50,371	\$55,956	\$51,709
% College Degree in census block (Geocoded)* **	15.3	15	14.8
Physician Race			
African American	9.7	3.4	3.2
Latino	3.7	11.2	25.3
White	40.4	35.6	34.9
Asian	44	46.3	36.1
Health Status Variables			
# of visits (Mean)	6.4	6.2	5.7
# of years with physician	6.3 years	5.6 years	4.5 years
# Comorbid conditions (Mean)	2.7	2.5	2.2
Pill burden (Total number of drug classes)	8.3	7.4	5.9

Race/Ethnicity Concordance and CVD outcomes

Risk Factor Control

Risk factor control varied little and non-significantly by patient-provider race/ethnicity concordance or by patient-provider language concordance in models that adjusted for patient and physician characteristics. Race/ethnicity and language concordance effects on risk factor control were consistent regardless of whether patient's preferred language was included in the model, and when cutpoints of A1c <7% and SBP <130 were used (data not shown). In the instrumental variable sensitivity analysis race and language concordance were not associated with risk factor control except for among Latino patients where concordance was associated with worse LDL control. [See Appendix D]

TABLE 2: ADJUSTED PERCENT OF PATIENTS WITH GOOD CVD RISK FACTOR CONTROL BY RACE/ETHNICITY CONCORDANCE			
	African American Patients	Latino Patients	Spanish Patients
	Adjusted %	Adjusted %	Adjusted %
A1c <8%			
Concordant	65	63	66.4
Discordant	64	62	69.1
LDL-c <100mg/dL			
Concordant	40	48	48.5
Discordant	40	49	47.4
SBP < 140 mmHg			
Concordant	69	76	77.7
Discordant	70	77	77.1
<p>* p < 0.05, ** p < 0.01, *** p < 0.001 Probit model examined minority patient-physician race/ethnicity interactions. Model adjusted for patient age, gender, preferred language, number of comorbidities, # of primary care visits in 2005, Medicare status, # of medication classes taken for condition, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and # of diabetic patients in panel. Odds ratios are compared to concordance.</p>			

Treatment Intensification

Treatment intensification was also not significantly associated with patient-physician race/ethnicity or language concordance in adjusted models [Table 3]. Race/ethnicity concordance effects on treatment intensification were consistent regardless of whether patient's preferred language was included in the model, and when cutpoints of A1c <7% and SBP <130 were used (data not shown). They were also consistent in instrumental variable models. [See appendix D].

TABLE 3: ADJUSTED PERCENT OF PATIENTS RECEIVING TREATMENT INTENSIFICATION BY PATIENT-PHYSICIAN RACE/ETHNICITY CONCORDANCE			
	African American Patients	Latino Patients	Spanish Patients
	Adjusted %	Adjusted %	Adjusted %
A1c <8%			
Concordant	73	75	76.3
Discordant	74	75	76.5
LDL-c <100mg/dL			
Concordant	46	46	49.5
Discordant	44	47	49.5
SBP < 140 mmHg			
Concordant	76	80	74
Discordant	78	74	72.2
* p < 0.05, ** p < 0.01, *** p < 0.001 Probit random effects model examined minority patient-physician race/ethnicity interactions. Model adjusted for patient age, gender, preferred language, number of comorbidities, # of primary care visits in 2005, Medicare status, # of medication classes taken for condition, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and # of diabetic patients in panel.			

Medication Adherence

Race /ethnicity concordance for African American patients was marginally associated with good combined adherence to all risk factor medications for which a patient was being treated in both unadjusted and adjusted models (53.2 vs. 49.8, p<.05). Race/ethnicity concordance was not significantly associated with adherence to CVD medications for Latino patients. Language concordance was also associated with improved medication adherence for Latino patients (50.6% vs. 44.8%, p-value< 0.05). While in the same direction, these results were insignificant when each condition/risk factor was assessed separately [Table 4]. They were also insignificant, due to larger standard errors in instrumental variable models [Appendix D].

TABLE 4: PERCENT OF PATIENTS IN GOOD MEDICATION ADHERENCE BY PATIENT-PHYSICIAN RACE/ETHNICITY CONCORDANCE			
	African American Patients	Latino Patients	Spanish Patients
	Adjusted % SE	Adjusted % SE	Adjusted % SE
A1c <8%			
Concordant	79.8 (1.5)	76.1 (1.2)	77.3 (2.4)
Discordant	77.6	76.6	76.6
LDL-c <100mg/dL			
Concordant	79.6 (1.2)	78 (1.1)	80.5 (2.1)
Discordant	78	77.3	77.5
SBP < 140 mmHg			
Concordant	76.6 (1.3)	77 (1.6)	81 (2.1)
Discordant	76.6	78.8	79.3
All CVD Medications			
Concordant	53.2* (1.7)	50.7 (2.7)	50.6* (2.5)
Discordant	49.8	52.5	44.8
* p < 0.05, ** p < 0.01, *** p < 0.001 Probit random effects model examined minority patient-physician race/ethnicity interactions. Model adjusted for patient age, gender, preferred language, number of comorbidities, # of primary care visits in 2005, Medicare status, # of medication classes taken for condition, pill burden, geocoded education and income, physician age, gender, race/ethnicity, language, panel size and # of diabetic patients in panel.			

Discussion

In this study, patient-physician race/ethnicity concordance was not significantly associated with improved intermediate cardiovascular diabetes outcomes for patients with diabetes. Previous research has found that equal or better care for minority patients does not necessarily close gaps in health outcomes between minority and white patients, so it is quite possible that potential benefits of concordance would not translate into (immediate) intermediate outcome improvement. In IV analysis, Latino patients with Latino providers were in worse LDL-c control than those in discordant relationships.

Previous research suggests that African American and Latino providers care for sicker and more disadvantaged patients. It is possible that the risk factor results reflect differences in underlying illness between patients treated by Latino physicians and non-Latino physicians. Indeed, when models adjust for physician random effects, there were no significant differences between concordant and discordant Latino patients.

This study found a modest association between race/ethnicity concordance and treatment adherence for African American patients. Race/ethnicity concordance for African American patients was significantly associated with improved adherence to CVD medications. A long history of discrimination, legal and de facto segregation in the United States health care system, infamous medical trials (e.g. The Tuskegee Syphilis trials) and under-representation of racial and ethnic minority groups in health care professions present unique challenges to the patient-physician relationship for African American patients (Tatum 1997, Gamble 1993). African-American patients, then, may be more likely to benefit from racially concordant patient-provider relationships, insofar as these relationships alleviate barriers to the patient-physician relationship.

Contrary to the race/ethnicity concordance hypothesis, Latino concordance was not associated with good adherence. This too is not entirely surprising, given the diversity within all racial and ethnic groups, and particularly within the Latino population. Primary language spoken, dialect, level of acculturation and cultural differences among patients from different national backgrounds within each racial and ethnic group may mask concordance effects.

While Latino concordance was not associated with improved outcomes, language concordance for Spanish speaking Latino patients was associated with good treatment adherence for CVD risk factor medications. This study cannot ascertain whether concordance effects occur because of better patient-physician communication and reduced language barriers or because language may be a proxy for the patients' level of acculturation. It is possible that less acculturated patients are more likely to benefit from concordance.

While this study is the first to examine the association of race/ethnicity and language concordance with risk factor control and medication management for a large cohort of patients with diabetes, a few limitations of the study should be noted. First, as an observational study, random assignment of patients to treatment and control groups was impossible. Unobserved factors correlated with adherence may have influenced the selection of a same race, ethnicity or language physician. Second, while race/ethnicity may be an approximate proxy for cultural concordance, a great deal of diversity exists within each racial/ethnic and linguistic group. Third, patients and physicians were from a single large, integrated healthcare delivery system; it is possible that patients and physicians in this setting may be different from patients and physicians in other settings. However, the patient and physician populations studied were fairly diverse, and the delivery system population is demographically similar to the region it serves (Gordon 2006). Based on previous research comparing insured and uninsured

patients (Piette et al 2004), I hypothesize that patients in this study were less likely to be very low income or have very low levels of education. Adherence and the impact of concordance may very well differ in the more general population.

Although I adjusted for a comprehensive set of variables, I only had access to socio-economic status indicators from geo-coding; individual-level data on education and income were not available in this study. The language variable was limited in that I was not able to directly measure English proficiency. Nor did I have access to a direct measure of health literacy, immigrant status or level of acculturation, all potentially important predictors of medication adherence. Another potential concern is that our measurement of adherence does not include adherence to other treatment recommendations, such as diet, exercise and other lifestyle changes. I may have underestimated the concordance effect because patients may also receive care from nurse care-managers in addition to their primary care provider, and have access to diabetes care classes provided by health educators. I was unable to assess patient race/ethnicity concordance with these and other medical care staff and these relationships may have played a role in predicting risk factor control, medication adherence and medication intensification.

Conclusion

In this study, patient-physician race/ethnicity concordance was not associated with either control or treatment intensification for any risk factor. Future studies should try to illuminate the specific barriers to intensification, including possible patient or physician cultural factors that would inform targeted interventions to improve both risk factor control and treatment intensification.

Race/ethnicity and language concordance were modestly associated with improved medication adherence for African American and Spanish-speaking Latino patients, suggesting that efforts to improve opportunities for concordance such as race/ethnicity based recruitment and retention efforts could reduce disparities in medication adherence. Reducing medication adherence disparities can ultimately improve health outcomes and reduce disparities for African American and Spanish speaking Latino patients. Future research to examine the particular aspects of the concordant patient-physician relationship that make a difference can inform efforts to reduce disparities in medication management.

Chapter 5:
**Summary, Research Limitations, Directions for Future Research and Policy
Implications**

Summary of major findings

This study examined racial disparities in CVD medication management and explored the potential impact of patient-physician race/ethnicity and language concordance on CVD medication management outcomes. The study also examined the predictors of race/ethnicity concordance.

Like many previous studies, I found significant racial differences in CVD risk factor control, treatment intensification for patients in poor control and CVD medication adherence. These differences occurred in a patient population where every patient was insured and differences persisted after adjusting for potential confounders such as geocoded education and household income. For analyses of racial and ethnic differences in risk factor control, without exception, African American patients were less likely to be in good control, compared to white patients. Outcomes for Latino and Asian patients were less consistent and in some cases Latino and Asian patients had better risk factor control (Asian and Latinos patients had better hyperlipidemia control than white patients). Spanish and English speaking patients had similar rates of risk factor control for cholesterol and blood pressure, but Spanish-speaking patients were in worse risk factor control for diabetes/glucose.

Several factors may help explain racial and ethnic differences in risk factor control, even among patients with similar insurance and socioeconomic status. Patient factors such as whether a patient takes medications as prescribed, lifestyle factors, different levels of occupational stress and differences in the quality of care are all potential factors underlying differences in intermediate outcomes such as risk factor control.

In this study, racial, ethnic and linguistic differences in the likelihood to receive treatment intensification were complex. African American and Asian patients were less likely than white patients to have treatment intensified for diabetes when they were in poor control. However African American patients were more likely to have treatment intensified for hypertension and Asian patients were more likely than white patients to have treatment intensification for cholesterol lowering and anti-hypertensive medications. There were no disparities between Latino and white patients in treatment intensification. In fact, Latino patients were more likely to have treatment intensified for hyperlipidemia. Similarly, Spanish-speaking patients were more likely than English speaking patients to receive treatment intensification for hyperlipidemia.

Many factors weigh into a physician's decision to modify treatment when a patient is above target glucose, cholesterol or blood pressure levels. It is likely that physicians are more likely to intensify patients with worse underlying health and risk factor control. Indeed, this study found that for every risk factor, the further away from target, the more medications and the more comorbid conditions, the more likely patients were to receive intensification. One reason this may be the case is that there is less uncertainty facing

the physician when a patient is extremely above target than if a patient is only above target slightly. Another reason could be that physicians weigh several factors when they decide to intensify treatment and the benefits of intensifying medication compared with the costs may be less for patients that are only slightly above target.

I also found consistent racial, ethnic and language differences in rates of medication adherence. African American, Latino and Asian patients all had lower medication adherence rates than white patients. Spanish-speaking patients also had lower adherence rates, while Cantonese speakers had higher adherence rates. Differences in attitudes and beliefs about medication, affordability of drug regimens, different levels of trust in physicians and or the health care system may explain a portion of adherence disparities. While it is tempting to suggest that these differences in patient behaviors may explain racial and ethnic disparities in care, other studies have found strong evidence that treatment adherence rates are impacted by the quality of the patient and physician interaction and these interactions vary by patient race and ethnicity. For example, studies have found that a poor therapeutic relationship between provider and patient can lead to suboptimal medication adherence (Okuno et al 2001, Lacro et al 2002). When providers prescribe complex regimens and fail to explain the benefits and side effects of medications, adherence suffers. All of these factors rest on the quality of the patient-physician interaction and communication, which studies have found is lower for African American and Latino patients (IOM 2002).

Given the disparate outcomes described above, this study attempted to understand how one potential policy lever- increasing the number and proportion of underrepresented minorities-might reduce CVD disparities. The literature on workforce diversity points to several potential benefits of a diverse workforce including reducing organizational, structural and clinical barriers to care. A more diverse workforce is thought to shift service patterns. African American and Latino providers are more likely to locate their practices in underserved areas, which likely leads to improved access to care for underserved populations. A more diverse workforce also leads to increased opportunities for racial, ethnic and language match between patients and providers, which is hypothesized to improve communication, trust and the patient-provider relationship and interaction. In addition, proponents of efforts to diversify the medical workforce suggest that increased minority representation would likely increase trust in the health care system and increase professional advocacy to address the needs of minority populations.

The structural benefits of a diverse workforce such as access to care in underserved areas and reduced need for interpreter services, have been measured extensively. Adding to this research, chapter 3 of this study examined service patterns of minority physicians and examined the predictors of race and ethnicity concordance. Understanding the predictors of concordance can help us contextualize the concordance effects examined in chapter 4. In chapter 3, I found that African American and Latino patients were least likely to be racially matched with their providers. Non-English proficient speakers were more likely than English-speaking minority patients

have a same race physician. Consistent with previous research, African American and Latino patients were disproportionately served by minority physicians. Compared with patients who were assigned a physician by the health care organization, patients who chose their physicians were more likely to have a same race provider. While statistically significant for all racial and ethnic groups, this relationship was strongest for African American and Latino patients. Availability of a same race provider was the strongest predictor of race concordance with a provider, and strongest for African American and Latino patients.

In Chapter 4, I examined the empirical research on the clinical benefits of a diverse workforce. The literature on the clinical benefits of concordance points to positive benefits of concordance, but the literature is far from unequivocal. There are relatively few empirical studies on concordance and health outcomes, and of these, few have found significant results. In the current study, having a same race/ethnicity or language provider did not make a difference in risk factor control and treatment intensification. However, concordance was associated with patient adherence to medication for African American patients and for Spanish-speaking Latino patients.

The results of the analysis examining concordance and risk factor control were not surprising. Previous research has found that African American and Latino physicians are more likely to treat disadvantaged and sicker patients so it is possible that similar or worse risk factor control for African American patients with concordant providers could simply reflect service patterns. The results of the analysis examining concordance and treatment intensification are difficult to interpret. Perhaps the fact that patients are being treated “equally” regardless of physician race is an indication that physicians, regardless of race and ethnicity treat patients similarly. In the most positive interpretation, this means that physician race doesn’t matter and that white physicians do just as well as non-white physicians in treating patients of color. In the most negative interpretation, underrepresented minority physicians may also have difficulty relating with their patients of color, especially if the power dynamic and socioeconomic status differences impede the patient-provider relationship. It is possible that all physicians, not just white physicians, have stereotypes and biases towards African American and Latino patients, for example, that impact the quality of care.

This studies finding that adherence to medication is associated with having a same race/ethnicity provider for African American patients is not entirely surprising. In a nationally representative survey of 3884 randomly sampled US residents, 56.7% of African American respondents said they believed that racism occurs when the patient and physician are from different backgrounds and 50% believe that concordance will reduce racism faced by patients. More African American respondents than any of other racial group reported they had faced unfair treatment in the medical system (Schnittker & Liang 2006). The results on the language concordance analysis for Spanish speaking Latino patients were also not surprising. Adherence to medication increases when patients understand the reasons for taking their medication, understand the side effects of their medication and when they know how and when to take their medications

(Osterberg, Lars & Blaschke 2005). It does not require a huge leap to hypothesize that these factors may improve when patients and physicians communicate in the same language.

Research Limitations

At this point it is important to note several limitations of the current research. First, patients in this study were all from the same health care organization in Northern California. While this patient population is diverse and fairly reflective of the Northern California population, it is quite possible that the results would be different with a different patient population. Also, all patients were insured and in a managed care organization where you would expect more uniform treatment than with patients that receive care in other settings. Because the sample was not randomly drawn from across the United States population, I cannot measure to what extent the relationship between variables would hold with a different patient population, in a different setting or with different treatments and outcomes.

Another validity concern is that I may have omitted relevant independent variables in each analysis. While I was able to adjust for many important variables, in each analysis, there were several unmeasured variables that could be significant predictors of outcomes. For example, I was unable to measure patient and physician preferences, nor was I able to adjust for patient attitudes or experiences of racism.

While other studies confirm the reliability of my choices for risk factor control targets (Schmittiel et al 2008) these measures are subject to change. For example, cutoffs for risk factor control are subject to change as the knowledge and evidence base grows. The fact that each dependent variable was dichotomous is useful for interpretation in public health, as we are often working towards a specific target (sick or not, in control of risk factors or not, in adherence or not), however, the restriction of the range on a variable usually weakens the relationship between it and another variable. Future research should include sensitivity analyses that include continuous variables when possible.

In addition, the definition of treatment adherence is not perfect. I cannot measure ingestion of a pill, only whether or not a patient had a prescription filled and presumably had access to the pill. In addition, I was only able to capture data on medication adherence, not adherence to other medical advice such as nutrition, exercise and other lifestyle advice. Likewise, I was only able to capture medication treatment intensification, but not other therapy modification such as referrals to a nutritionist, health education classes or counseling about weight loss.

My main explanatory variables for each analysis may also have considerable flaws. I only had access to very broad definitions of race and ethnicity. Concordance analyses that do not take into account the vast linguistic, acculturation, religious and national

backgrounds within racial and ethnic groups are unable to fully measure the level of concordance between patients and physicians. Like my dependent variables, concordance in this study is a dichotomous variable. However, one could imagine a continuum of concordance (age, gender, race, language, religion, national background, socioeconomic status). I am unable to measure concordance at that level of granularity. Because my language variable is based on self-report, it is possible that patients and physicians may underestimate or over-estimate their level of language proficiency. For example, physicians may report they are proficient in a language when they are hired, when in fact they are not.

In addition, the concordance variable examines concordance between patients and physicians. However, it is well known that patients with diabetes receive care from several health professionals. Patients may not have a PCP of the same race or ethnic background, but have other key relationships with same race professionals. Similarly, a patient with a same race PCP, may have relationships with other discordant professionals.

The primary threat to internal validity of the concordance analysis is the potential for selection bias. The major drawback of observational data is the inability to control the selection of participants into treatment and control. It is possible that significant concordance effects might reflect differences between patients who choose a same-race physician versus those who do not. Perhaps significant concordance effects reflect satisfaction with finding a concordant provider and not a better patient-physician interaction. Similarly, selection bias may mask the impact of race concordance if patients who choose a race, ethnicity or language provider are sicker, have less trust in medical care or are less acculturated.

Directions for future research

The results of this study point to several future areas of research. First, more research on CVD medication management disparities is needed, including research on uninsured patients and patients not receiving care in a managed care setting. This research should also examine, where possible, the impact of organizational and structural barriers to care for patients of color. In addition, given that much of the disparities in health have to do with factors outside of the clinical encounter, more research on how patients of color experience the health care system is needed. For example, studies suggest that African American and Latinos believe that disparities in care are as much a result of an unequal health system as they are from behaviors of individual physicians (Schnittker & Liang 2006). More research on how patients of color interact and experience care at a system level would inform efforts to reduce disparities. In addition, while understanding clinical disparities is crucial, especially for health care organizations, more research on the social determinants of CVD risk factor control and medication management is needed.

More research on how patients choose their physicians would instruct the studies on the predictors of concordance. Because many people are hesitant to state racial and ethnic preferences explicitly, research on concordance might benefit from using implicit association tests or other methods of measuring preferences. While it is highly improbable that a study on concordance could use random assignment, future studies should use selection bias modeling where appropriate and when possible. In addition, studies of concordance would benefit from controlling for patient familiarity with provider. Perhaps the effects of concordance are mediated by the length of the patient-physician relationship. For example, studies have found that patient satisfaction is higher the longer the patient-provider relationship. A longer-term discordant patient-provider relationship may be more satisfying than a new concordant patient-provider relationship.

More studies on concordance between patients and other health providers would help illuminate the impact of concordance with other health professionals. Patients in an integrated health system often receive care from a combination of primary care providers, specialists, nurses, medical assistants and other medical professionals. These relationships should be further explored. Programs using paraprofessionals to conduct outreach and education in African American and Latino communities have been implemented and these programs should be vigorously evaluated to understand if same race paraprofessionals can make a difference.

In addition, more qualitative research on race, ethnicity and medical care is warranted. While the current study can provide information on racial, ethnic and linguistic differences, service patterns and concordance outcomes, more research is needed to understand how and why these outcomes were different for patients from various racial and ethnic groups. Few studies have examined what factors of a concordant patient-provider relationship make a difference and even fewer have directly examined how patient and provider race and ethnicity contributes to perceptions of quality of care for diabetes and CVD management.

Finally, while I found several disparities of concern, there were a few cases where minority patients received equal or worse treatment and had equal or better outcomes. Research examining how and when outcomes for racial, ethnic and linguistic minorities are equal or better than outcomes for white patients would inform interventions to reduce disparities.

Policy Implications

The results of this study point to several policy implications. First, the results suggest that efforts to measure, understand and address racial and ethnic disparities are necessary. Second, there are several policy levers through which policy makers, health care organizations, and foundations can reduce disparities, understanding the predictors of CVD outcomes can inform these potential policy efforts. Finally, the studies findings on race concordance and outcomes suggest that efforts to increase the

diversity of the medical workforce can help reduce disparities. However, the results also suggest that diversity efforts alone will not eliminate racial, ethnic and linguistic disparities entirely.

Below, I discuss the policy implications of this study and my proposed recommendations in further detail:

Recommendation 1: Continue efforts to collect racial and ethnic data and measure racial and ethnic disparities

This study found several differences in outcomes based on patient race and ethnicity. These differences were complex and complicated and efforts to understand them better could inform efforts to improve health outcomes for minority patients. In order to understand disparities and implement interventions that can reduce disparities, we must first collect racial and ethnic data on a host of health utilization, quality and health outcome and measure where there are disparities.

Recommendation 2: Continue efforts to understand why disparities exist and the policy levers that can reduce them

Health care organizations are often focused on the clinical experience of care as a source of disparities and a potential area for intervening to reduce disparities. These efforts should continue. However, as the research examining the social determinants of care has shown, the clinical encounter is only one potential area for intervention. Health care systems should examine how they might influence education, housing, environmental and health policy to improve the conditions that contribute to racial and ethnic disparities. This study examined one potential policy lever thought to reduce disparities, increasing the diversity of the medical workforce. While measuring disparities and implementing quality improvement to reduce disparities should remain a key focus of health care organizations as they try to reduce disparities in care and outcomes, these organizations must also look at the social, economic and cultural factors that contribute to disparities.

Recommendation 3: Increase the proportion of minority physicians and health care providers:

There is general consensus that increasing the diversity of the medical workforce is a worthy goal for medical schools and health care organizations to pursue. A growing literature documents the equity and public health arguments in favor of race conscious workforce policies to increase parity. A diverse workforce is thought to increase access to health care for underserved populations and increase the linguistic and cultural capacity of the health care system to provide quality care to all patients. However, while some evidence supports these claims, more research on the impact of culturally competent health care and the other benefits of a more diverse workforce is needed.

Most major medical associations have stated their support of efforts to increase the diversity of the medical workforce. These efforts have included targeted recruitment efforts, enrichment and outreach programs for young scholars from racial and ethnic minority backgrounds and affirmative action programs in medical schools and health care organizations. (Saha & Shipman 2008, Cohen 2003, Lakhani 2003). Several policy options are available to increase the racial, ethnic and linguistic diversity of the medical workforce. In medical school admissions and hiring decisions, these include race-based affirmative action programs. Medical schools can also use class-based preferences and percentage programs or outreach programs targeting minority students to either pursue a career in the health workforce or recruit and retain students from diverse backgrounds. For example, the federal government's Minority Faculty Fellowship Programs aim at increasing the pool of minority faculty at medical schools and many universities use applicant racial and ethnic background as a component of admissions decisions.

Conclusion

This study, which used a large dataset of patients from diverse racial and ethnic groups to understand CVD management and the impact of race, ethnicity and language concordance, adds to the literature on racial and ethnic disparities in health in several areas:

1. To my knowledge, this is the largest study examining the association of patient race, ethnicity and language on CVD risk factor control, adherence and modification of treatment. It is also one of few studies to compare African American, Latino and Asian patients with white patients separately. I was also able to adjust for a comprehensive set of patient and physician variables.
2. The analysis of the predictors of concordance adds to the body of literature in two distinct areas. First, the study adds to the literature on physician practice patterns and second, adds to the literature on the patient factors associated with race concordance. In addition, the results of this study are useful for interpreting the findings of empirical analyses of the association between race concordance and health outcomes.
3. This was the first study to examine the association of concordance on CVD medication management. My large dataset and comprehensive set of variables make this study one of the largest to examine race concordance and its effects on health outcomes.

This dissertation found significant disparities in CVD management for patients with diabetes. Every racial and ethnic group studied had worse outcomes compared to whites for at least one measure. However, this study found that in some cases, African American, Latino and Asian patients had equal or better outcomes compared to whites.

This dissertation also aimed to understand how patient-physician race/ethnicity and language concordance might impact CVD management. For most outcomes, race and language concordance did not make a difference. However, for treatment adherence, there were marginally significant benefits associated with concordance for African American and Spanish-speaking Latino patients.

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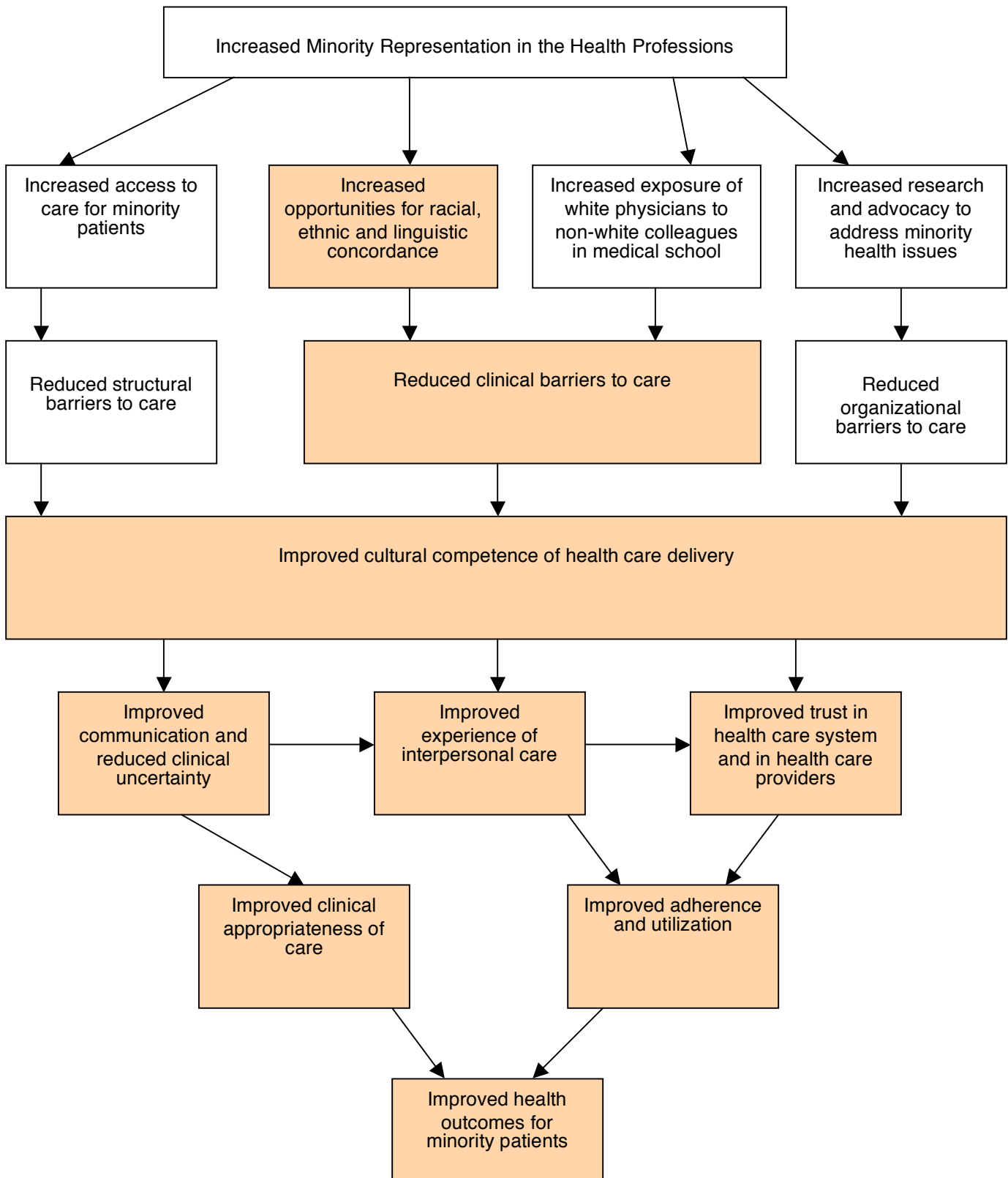
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Appendix A: Conceptual Framework for understanding how a diverse medical workforce can improve health outcomes for minority patients



APPENDIX B. Diagnostic Criteria for Diabetes Mellitus, Hypertension, and Dyslipidemia

Diabetes Mellitus (*one of the following*):

- 1) at least one prescription of insulin or an oral hypoglycemic agent; **or**
- 2) at least two outpatient diagnoses of diabetes mellitus; **or**
- 3) one outpatient diagnosis of diabetes mellitus plus ≥ 1 Hb A1c $\geq 7\%$; **or**
- 4) at least one hospital discharge with a primary DM-related diagnosis (ICD-9 code 250.X).

Hypertension (*one of the following*):

- 1) at least one prescription for an anti-hypertensive medication plus an outpatient diagnosis of hypertension; **or**
- 2) at least two outpatient diagnoses of hypertension; **or**
- 3) at least one prescription for an anti-hypertensive medication plus one or more elevated outpatient blood pressure readings (≥ 140 mm Hg systolic, or ≥ 90 mm Hg diastolic); **or**
- 4) at least one outpatient diagnosis of hypertension plus at least one blood pressure reading of ≥ 140 mm Hg systolic or ≥ 90 mm Hg diastolic;

Dyslipidemia (*one of the following*):

- 1) at least one prescription for an anti-lipemic agent; **or**
 - 2) Outpatient diagnosis of hyperlipidemia/hypercholesterolemia with an LDL-cholesterol value \geq risk-appropriate cutpoint value¹; **or**
 - 3) Outpatient diagnosis of hyperlipidemia/hypercholesterolemia with a prior LDL-cholesterol value \geq risk-appropriate cutpoint value¹ (within 2 years prior to 7/01/00).
-

Appendix C: Data and Model Descriptions

MODELS – Predictors of Adherence, TI and Control

OBSERVATION PERIOD

2005 (Jan 1 – Dec 31)

COHORTS

Eligible diabetics: Diabetics with a notification date on or prior to Dec 31, 2004.
(those notified in 2004 can be defined as incident cases)
active with drug benefit for 24 months in 2004-2005' (due to rolling year adherence window)

with hypertension: diabetics that meet the criteria for HTN in July 1, 2003 – Dec 31, 2004 (18 months).

with dyslipidemia: diabetics that meet the criteria for DL in July 1, 2003 – Dec 31, 2004 (18 months).

CRITERIA FOR CONDITION

Diabetes: In the diabetes registry at end of 2004. Same criteria as for 3D(appendix B) except accepts: an A1c ≥ 7 alone (no diagnosis needed), ≥ 2 abnormal outpatient glucose values, Member Health Survey self-report; and does various exclusions (PCOS, GDM, others).

Hypertension: Criteria used in the 3D study (see below). Since all patients have diabetes use risk specific cutpoints: SBP ≥ 130 and DBP ≥ 85 for all (note: for some pts, high readings may occur just prior to DM notification).

Dyslipidemia: Criteria used in the 3D study (see below). Since all patients have diabetes use risk specific cutpoint: LDL ≥ 100 for all (note: for some pts, high readings may occur just prior to DM notification).

NOTE: Do not calculate Framingham CHD risk score. No need to get other risk factors since all have DM.

OUTCOME VARIABLES

I. Three categories of poor control within each condition:

- a) poor adherence
- b) good adherence, no TI
- c) good adherence, TI

Note: due to two sets of lab cutpoints defining poor control (A1c/LDL/SBP: 7/100/130 and 8/130/140) there are two sets of variables for outcomes and some predictors such as baseline lab values, insulin at baseline, and # of med classes.

PREDICTOR VARIABLES

I. I focused on predictors readily-available to most health plans via claims data:

- a) Age as of Jan 2005
- b) Gender
- c) Facility
- d) Primary care provider (PCP) - linked to patient the most months in 2005 (if tie, choose latest).
- e) Baseline HbA1c, SBP, LDL value (Baseline date for poor ctl: last hi lab in 2005; for good ctl: last lab in 2005)
- f) Comorbidities – diagnosis and procedure codes during July 1, 2003 – Dec 31, 2004 (18 mths prior to 2005)

Diabetes - study cohort, defined above
Hypertension - study cohort, defined above
Dyslipidemia - study cohort, defined above

Depression

Heart failure

Stroke

CAD (coronary artery disease) – myocardial infarction, angina pectoris, atherosclerotic heart disease, coronary revascularization

Osteoarthritis

COPD (chronic obstructive pulmonary disease)

Atrial fibrillation

Renal failure/insufficiency

Current smoker

- g) Race as of 2002 (KP sources)
- h) Geocoded SES – median HH income, education, poverty status (address in Feb 2005, Census 2000 vars)
- i) Preferred language
- j) How linked to PCP – patient chose PCP or was assigned

- k) # of visits to a Primary Care department in 2005 (medicine, family practice, ob/gyn)
- l) # of visits to relevant specialists in 2005 – endocrinologists, cardiologists, others?
of months on Medicare in 2005
- m) Duration of DM – # of days with DM prior to 2005 (Jan 1, 2005 minus DM notification date)
- n) On insulin at baseline
- o) Old: Overall pill burden – during 6mths prior to baseline; look at drugs for all comorbidities and for the subset for DM, HT, DL
New: # of drug classes for DM,HT,DL: 1)during the 6mths prior to baseline and 2) on the day 6mths prior to baseline (Baseline date for poor ctl: last hi lab in 2005; for good ctl: last lab in 2005; for no lab: 6/30/2005)

Note: Endocrinology and cardiology are sub-depts under the Medicine dept, so visits to these sub-depts are captured in the Primary Care visits. Only 5% of the cohort have visits to endocrinology or cardiology. Instead of counting visits to departments, we can count visits to physicians who specialize in endocrinology or cardiology, but since some PCPs are specialists we cannot distinguish visits for specialty services from those for PCP services.

- II. In a second-stage analysis, physician-level predictors were added:
- a) Age as of Jan 2005
 - b) Gender
 - c) Race
 - d) Old: Board certification - date and area of focus: of main practice and up to 2 additional areas
New: changed to specialty
 - e) Panel size in 2005
 - f) # of diabetics in the panel in 2005
 - g) Medical facility
 - h) Languages spoken

III. System level Variables

- a) facility-level racial breakout of patients and PCPs
- b) facility-level average SES
- c) facility has Care Management program or not

DATAFILE FOR MODELING

10/26/2007 Patient File

MDLVRPT_v2.sas7bdat n = 161,697

Patient level variables. No 'BMI', 'SES', 'visits to specialists', 'pill burden' vars. Will add in later versions.

CAD includes proc codes 36.01, 36.02, 36.05 (PTCA). 67 more pts have CAD per a procedure (from 2851 to 3018).

9/22/2007 Physician File

MDLVRPH_v1.sas7bdat n = 1,791

03/05/2008 Patient File – addendum (only additional vars)

MDLVRPT_v2_add.sas7bdat n = 161,697

Additional vars: SES, adherence/TI info for good control, # of DM/DL/HTmed classes

03/18/2008 Patient File – addendum #2 (only re-created vars, !!same names as original vars)

MDLVRPT_v2_add2.sas7bdat n = 161,697

Re-created vars: adherence/TI group vars with poor adh broken out to TI/no TI

ADHERENCE

Look at drug fills in year 2005 plus last fills in 2004 and first fills in 2006.

Based on drug class with **worst** adherence:

For each drug class, calculate:
$$\frac{\text{covered days}}{\text{days from [date of first fill] to [date of last fill]}}$$

First fill: fill date just before Jan 2005 (fill A) or first fill in 2005 if fill A does not exist

Last fill: fill date just after Dec 2005 (fill Z) or last fill in 2005 if fill Z does not exist

For each patient, use the worst adherence of all drug classes.

Based on all drug classes **weighted** by days from first fill to last fill:

For each patient, calculate:

$$\frac{\text{Sum of (percent covered days for each drug class * days from 1st to last fill for the drug class)}}{\text{Sum of (days from 1st to last fill for the drug class)}}$$

Good/Poor Adherence:

Good: $\leq 20\%$ adherence gaps (or < 2 fills or insulin only. Need to keep these in for possible Tx Int.)

Poor: $> 20\%$ adherence gaps

NOTE:

Drug classes with only 1 fill will not be included in any adherence calculation.

Therefore, drug classes with < 2 fills will have missing adherence data.

Account for stockpiling for future use. Begin stockpiling count with fill prior to 2005 (fill A). No cap on stockpile.

Days supply > 0 , dispense amount > 0 , no returned-to-stock, combo meds split out.

Days supply ≥ 999 changed to 100 days. (56 disps out of $\sim 2,800,000$).

Same disp date, drug class: days supply are summed.

No attempt to account for switching of meds within a drug class (days supply of first med is not truncated). If meds within a drug class overlap, the overlapping days are stockpiled.

3/17/2007: Change to looking at adherence in year prior to 2005 lab (rolling year).

Main look back year is 2004 with last fill in prior year going back to sep2003 and first fill in next year going to apr 2005.

Use hi lab for poor ctl (lo and hi cutpts), last lab for good ctl and 6/30/2005 for no lab.

Therefore, had to change elig criteria to 'active with drug ben for 24 mths in 2004-2005'.

TX INTENSIFICATION

Poor Control:

Look in year 2005 for poor control events (11/2006 – hi cutpts, 12/2006 – back to lo cutpts, pgm can do either):

DM: One A1c ≥ 7 Will also look at **A1c ≥ 8** (3D poor ctl).

HTN: Two consecutive SBP ≥ 130 . Will also look at **SBP ≥ 140** (3D poor ctl for diabetics).

DL: One LDL ≥ 100 . Will also look at **LDL ≥ 130** (3D poor ctl for diabetics).

For DM: Want to exclude pt with hi A1c but already on insulin.

First method: Exclude pts with insulin disp date within 4 months prior to hi lab.

But conflicts with baseline date (date 3m prior to hi lab). So,

Second method 2/2007: Calculate TI for all with hi A1c. Exclude those on insulin at baseline later as desired.

Good Control:

Remaining pts are Good control. Use last reading in 2005.

This group includes 'in-betweens': HT – 2 non-consecutive hi SBPs. DM used to have an in-btwn group (hi A1c but on insulin), but with new method above, all pts with hi A1c are in poor control group.

Look for TI from 3 mths before to 3 and 6 mths after **last** poor control event (for SBP, use date of 2nd reading).

Baseline date (Time 0): date that is 3 months prior to poor control event.

Assessment periods (Time 1): from 3 months prior thru 3 and 6 months after the poor control event.

Baseline drugs: started before Baseline date and end on or after Baseline date

Assessment drugs: started on or after Baseline date

Types of intensification from Baseline (Time 0) to Time 1:

Increase in number of drug classes

Same number of drug classes but switched classes

Increase in daily dose of same medication

Switched to med in same class with increase in bioequivalent dose category (lo/med/hi)

For diuretics, count all classes. (AIM counted all diuretic classes, did not collapse into one)

MAXIMUM THERAPY (MMT)

New definitions (2/2007)

DM – on insulin

HT – 4 med class, and get % on hi dose of all 4

DL – on Ezetimibe (Zetia) any dose OR simvastatin ≥ 80 mg (≥ 40 is hi dose cat) OR atorvastatin ≥ 40 (hi dose cat)

DRUGS

KHP THER CLS

DM meds: 501005, 501010, 501015

HT meds: 250505, 251005, 251010, 251015, 251020, 251025, 251030,
252510, 252520, 252525, 252530

LDL meds: 251500

Drug Classes

DM (from 3D):

- I Insulin (501005)
- S Sulfonylureas
- M Metformin
- T Thiazolidinediones
- O Other

All drugs round to 1.0mg per day.

HT (from AIM):

- A Ace inhibitors
- R Angiotensin antagonists
- B Beta adrenergic blockers
- C Calcium channel blockers
- T Thiazides & related diuretics
- D Potassium sparing diuretics (Note: 3D combined K+ sparing and loop diuretics)
- L Loop diuretics
- O Other (Antiadrenergics (KHP class), Direct vasodilators (use AHFS class, KHP does not have this class))

KHP has class 'Combinations diuretics': components were put into above categories.

Exclude: tamsulosin and minoxidil

Round Clonidine, Deserdipine, Reserpine and Bumetanide to 0.1 mg per day. All other drugs round to 1.0 mg per day.

DL (from 3D):

- S Statins
- B Bile acid resins
- F Fibrates
- N Niacin
- E Ezetimibe
- O Other

Round Cerivastatin Sodium to 0.1 mg per day. All other drugs round to 1.0 mg per day. Change any grams to milligrams (1 gm => 1000 mg): Cholestyramine and colestipol hydrochloride (pills).

Cholestyramine and colestipol hydrochloride also come in packs/pwd – cannot calc daily dose.

NOTE:

523 of 5 million dispensings in the TI analysis have a daily dose $\geq 10,000$ mgs.

59 of 5 million have a daily dose $\geq 100,000$ mgs.

346 of the 523 disps have a days supply ≤ 10 days.

313 of the 523 disps are for metformin

101 are for colestipol hydrochloride

41 drugs are involved: 23 DM, 11 DL, 7 HT

LAB TESTS

Lab test codes:

LDL: 1001250, 1001255, 1001275, 9507464 (CPT 83721)

HbA1c: 1002030, 1001145, 1002000, 1002010 (CPT 83036)

OSCR codes:

BP: ICD9_CD = 'V811'

ICD9_CD_ = '006' – '011' for SBP

'012' – '017' for DBP

SBP	Continuous	DBP	Continuous
006: <=120	120	012: <=80	80
007: 121 – 129	125	013: 81 – 84	83
008: 130 – 139	135	014: 85 – 89	87
009: 140 – 159	150	015: 90 – 99	95
010: 160 – 179	170	016: 100 – 109	
105			
011: >=180	180	017: >=110	110

Note: OSCR BPs started in Nov 2000, values existed earlier (June, July) but not fully populated.

APPENDIX C: ASSOCIATION BETWEEN RACE/ETHNICITY AND LANGUAGE CONCORDANCE AND CVD MEDICATION MANAGEMENT RESULTS OF INSTRUMENTAL VARIABLES SENSITIVITY ANALYSIS			
	African American Coefficient (SE, p-value)	Latino Coefficient (SE, p-value)	Spanish Speaking Coefficient (SE, p-value)
Risk Factor Control			
A1c <8%	0.032 (.056, 0.57)	0.062 (.053, 0.25)	-0.0004 (.026, 0.98)
LDL-c <100mg/dL	0.039 (.063, 0.53)	-0.132 (.060, 0.028)	0.023 (.028, 0.40)
SBP < 140 mmHg	-0.003 (.055, 0.95)	-.0005 (.049, 0.99)	0.020 (.024, 0.39)
Treatment Intensification			
A1c <8%	-.079 (.095, 0.40)	-0.025 (.084, 0.76)	.005 (.042, .90)
LDL-c <100mg/dL	-.050 (.082, 0.54)	0.034 (.085, 0.69)	.012 (.039, .75)
SBP < 140 mmHg	0.131 (.09, 0.15)	-0.004 (.10, 0.97)	.052 (.052, .31)
Medication Adherence			
A1c <8%	-.008 (.055, .88)	.026 (.051, .61)	.023 (.024, .35)
LDL-c <100mg/dL	-.042 (.055, .43)	-.038 (.052, .46)	.029 (.024, .24)
SBP < 140 mmHg	.066 (.052, .15)	.026 (.049, .59)	.026 (.024, .27)
All medications	.048 (.078, .31)	-.055 (.059, .35)	.054 (.028, .06)