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Doctoral Dissertations, 2011-2026 Population Studies

2022

Diversity From the Top Down: Relational Demography in the Teacher and School Leader Workforce

DelCorazon, Gina Russell

Princeton, NJ : Princeton University

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DIVERSITY FROM THE TOP DOWN: RELATIONAL DEMOGRAPHY IN THE TEACHER AND SCHOOL LEADER WORKFORCE

Gina Russell DelCorazon

A DISSERTATION
PRESENTED TO THE FACULTY
OF PRINCETON UNIVERSITY
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OF DOCTOR OF PHILOSOPHY

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Abstract

Increasing the racial and gender diversity of the teacher and school leader workforce in public schools has been the focus of policy efforts in dozens of states. Using administrative longitudinal data for all Texas public schools over a 20-year period, this dissertation consists of three chapters examining the role of relational demography and network connections in hiring and retention of Black and Hispanic male and female teachers and principals, drawing attention to the ways that racial and gender congruence between hiring managers and employees affect the composition of the teacher and school leader workforce. The first chapter estimates causal effects of school principal racial and gender congruence with teachers on the composition of new teacher hires, as well as on the probability of teacher attrition, finding that Black and Hispanic principals hire more Black and Hispanic teachers, respectively, relative to a white principal in the same school, and that effects are larger for hires of Black and Hispanic female teachers by Black and Hispanic female principals. Racial and gender congruence affect teacher attrition as well, with specific effects varying across race-sex groups. The second chapter examines the role of social closure in hiring into school leadership for individuals with principal certification, finding that Black and Hispanic candidates with employment network connections to a Black or Hispanic superintendent were more likely to be hired only when they shared a network connection with a same-race superintendent. The third chapter estimates causal effects of superintendent racial and gender congruence with principals on the racial and gender composition of new principal hires as well as on principal retention, finding that Black superintendents hire more Black principals of both sexes relative to a white superintendent in the same district, with effects on principal attrition differing across race-sex groups.

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Education Research Center Disclaimer:

The conclusions of this research do not necessarily reflect the opinions or official position of the Texas Education Agency, the Texas Higher Education Coordinating Board, the Texas Workforce Commission or the State of Texas.

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Introduction

Racial Diversity of the Teacher and Principal Workforces

Black and Hispanic students make up the majority of all public school students, yet they encounter a teaching workforce that is overwhelmingly white. Nationally, only around 21 percent of teachers are people of color, while students of color make up just over half of all students (NCES 2020, 2021). These gaps result in stark differences for white, Black, and Hispanic students in the likelihood of racial congruence with their teachers; in one year, 91% of white fourth grade students were taught by a white teacher, while only 23% of Black students had a Black teacher and 20% of Hispanic students had a Hispanic teacher (Yarnell and Bohrnstedt 2018). Even across the entirety of a Black or Hispanic student's educational career, the probability of having a same-race teacher remains low, with 56% of Black students in North Carolina never assigned to a Black teacher (Gershenson et al 2017).

Alongside persistent gaps in achievement between Black, Hispanic, and white students, a growing body of evidence demonstrates improved learning outcomes for Black students taught by Black teachers, as well as more positive assessments of student behavior and higher rates of assignment to gifted classes for Black and Hispanic students taught by racially congruent teachers (Redding 2019). Within this research, larger effects on student academic attitudes and perceptions have been identified when students match their teachers on both racial and gender dimensions, an important finding as educational attainment of male students has fallen behind that of female students in outcomes like reading performance and college attendance (Egalite and Kisida 2018, Robinson and Lubienski 2011). This motivates attention to both the racial and gender composition of teaching staffs rather than focusing on a single dimension in isolation.

The presence of Black and Hispanic school principals has also been shown to improve outcomes for same-race students, with evidence of increased achievement and lower disciplinary rates for Black and Hispanic students in these schools. Principal effects have been shown to operate directly on student achievement as well as indirectly through principals' ability to hire and retain more Black and Hispanic teachers (Bartanen and Grissom 2021, Grissom et al 2017, Lomotey 2019). Despite evidence of the benefits of their leadership, growth in the share of Black and Hispanic principals has been modest over the last two decades, and both groups are far outpaced by growth in shares of Black and Hispanic students in schools (Fuller and Young 2022). Black and Hispanic educators are more likely than their white peers to obtain principal certification, suggesting that the disparities in representation are due to differential selection and hiring once certified (Fuller et al 2007, Williams and Loeb 2012).

Female educators also make up a much smaller share of school principals than they do of the teacher workforce, raising concerns about gender equity (Fuller et al 2018). Women make up the majority of educators earning school leader certification, with studies suggesting that female educators are much less likely than male educators to be hired as principals (Bailes and Guthery 2020, Crawford and Fuller 2015, Davis et al 2017, Fuller et al 2018). Reduced access to principal roles for women has consequences beyond notions of fairness. Female school leaders engage in distinct leadership behaviors that are associated with positive outcomes for student achievement and collaboration within schools and wider communities (Eagly et al 1992, Gipson et al 2017, Hallinger et al 2016).

Few studies of school leaders examine the intersections of race and sex dimensions simultaneously. To date, research in school leader hiring has focused on race or sex separately, with only descriptive exploration of principal candidate outcomes within race-sex groups (Bailes

and Guthery 2020, Davis et al 2017). Smaller qualitative studies of Black and Hispanic female principals suggest that these educators face distinct challenges in selection into the principal role as well as once hired, motivating the focus of this study on the intersections of race and sex in principal hiring and retention (Fuller et al 2018, Perrone 2022). In addition, no studies include estimates of principal turnover by race and sex; prior work examining rates of principal attrition[1] by race or sex separately generally find that women leave the principal role at a higher rate than do men, with mixed results regarding principal exit rates by race (Gates et al 2006, Sun and Ni 2016).

Theoretical Frameworks for Educator Hiring and Retention

Policymakers have focused explicitly on expanding the racial diversity of teachers, with more than 30 states implementing policies to increase representation of Black and Hispanic educators over the past two decades. Education researchers have drawn attention to the importance of increasing racial and gender diversity among school leaders in the last few years as well (Perrone 2022). Progress in closing the representation gap between students and educators has been slow despite these efforts (Villegas et al 2012). Research on racial diversity in organizations more broadly offers insights that may guide development of future policies, with greater attention to representation across levels of management in schools and districts.

Relational demography provides frameworks useful in understanding how demographic congruence between hiring managers and potential employees impacts hiring and subsequent retention of employees. Specifically, within relational demography, similarity attraction suggests that hiring managers may be more likely to positively assess applicants with whom they share

[1] Attrition, turnover, and exit are used interchangeably throughout to refer to an individual not returning to the same role in the same campus (for teachers) or district (for principals) in the following year

ascriptive characteristics, with an assumption of shared values as a potential mechanism. The same logic suggests that applicants may be more likely to accept job offers from managers with whom they share observable characteristics (Riordan et al 2005). Once an applicant is hired, ideas of representative bureaucracy provide a framework in which racial and gender congruence influence employee satisfaction and retention. This idea from public policy and political science argues that governmental organizations better serve their constituents when representatives reflect the identities of the people they serve. While tracing its origins to studies of elected officials' decision making, the concept has been more broadly applied to unelected bureaucrats as well – where street-level bureaucrats enact what some researchers argue is a much larger share of policy decisions experienced by the public than those enacted by elected officials (Elmore 1979, Lipsky 1980). The concept is now generally understood to suggest that the specific characteristics of individuals who make up a bureaucracy determine to some extent the groups whose interests are reflected in their work for an organization (Mosher 1968, Selden 1997). Education researchers find this a useful framework for looking at the operations of public schools, which make up the largest component of the public sector (Grissom et al 2015).

Relational demography frameworks have been applied to identify effects of racial congruence between Black and white principals and teachers, but no studies to date have examined racial and gender congruence simultaneously in teacher hiring or retention (Bartanen and Grissom 2021). It may be that congruence on both dimensions has an additive effect on hiring and retention, such that Black female teachers, for example, are more likely than their male counterparts to be hired and stay in their roles when a Black female principal replaces a principal of another race or sex. This would align with expectations from representative bureaucracy that managers are more likely to actively work on behalf of similar subordinates

when they are members of a group that has historically faced discrimination, a characterization applicable to Black and Hispanic women in education (Fuller et al 2016, Grissom et al 2012, Perrone 2022). On the other hand, work exploring similarity attraction in hiring more broadly has found that women in male-dominated roles may be more likely to align themselves with male than female candidates, in which case gender congruence for female principals and teachers or female superintendents and principals may not increase hiring or retention of women in these roles (Goldberg 2005, Graves and Powell 1995

Effects of racial congruence in hiring and retention among Hispanic educators have not been examined. Descriptive work has identified that Hispanic teachers make up a larger share of staffs at schools led by Hispanic principals, so it may be that a Hispanic principal replacing a white principal could lead to more hires of Hispanic teachers (Perrone 2022). There are reasons to believe, however, that the effects of racial congruence between Hispanic educators and managers may be smaller than those observed between Black educators and managers. Positive effects of demographic congruence between Hispanic students and teachers are less consistent and of smaller magnitude than those between Black students and teachers, with some scholars pointing to significant diversity of origin and language within the Hispanic community as a possible explanation (Egalite et al 2015, Redding 2019).

The literature also does not address whether demographic congruence between superintendents and principals affects principal hiring and retention. Prior research finds that the racial composition of students at schools is associated with the race of both teachers and school leaders who are selected to serve them (Grissom et al 2019). Thus, both school demographics and demographic congruity between educators across district and school levels may affect hiring decisions at this level. Both factors may also influence retention of principals after they are hired.

It is less clear, however, whether and how superintendents influence principal job satisfaction and retention. In studies of principal turnover, superintendents are not identified as a key driver; this contrasts with findings that principals are a leading factor in teacher retention or attrition. Principals also have a great deal of autonomy in their roles and more physical distance from superintendents, which may reduce the impact superintendents have on principals' job satisfaction (Napier and Ferris 1993).

Other studies of principal hiring processes have found that employment network connections and mentoring are key factors in the likelihood that an educator pursues and obtains employment as a principal, as well as that female candidates and Black and Hispanic candidates are less likely to be hired into these roles (Bailes and Guthery 2020, Crawford and Fuller 2017, Davis et al 2017, Fuller et al 2016, Myung et al 2011, Young and McLeod 2001). Research outside of education finds that disparities in the likelihood of career advancement for female, Black, and Hispanic employees are partly the result of social closure processes, in which higher status individuals limit access to networks and mentoring for employees of other groups (Ibarra 1995, Reskin 2002, Reskin and Roos 1990). In addition, the racial and gender composition of employment networks have been shown to confer differential benefits to job-seekers within those networks, with membership in white-male dominated networks resulting in access to higher-wage jobs and more job offers for candidates (Elliot 1999, McDonald 2011, Smith 2000, Stainback 2008). Whether returns to membership in white male dominated employment networks are equal across individuals of different races and genders is relatively unexplored, with some evidence suggesting that the most intensive benefits, like personal referrals, are reserved for other men (McDonald 2011). Whether prior shared employment networks between principal candidates and superintendents affect the likelihood of hire for those seeking principal

roles has not previously been systematically explored, nor has whether these connections are differentially beneficial for Black, Hispanic, or female candidates overall or when the superintendent is of the same race or gender.

Texas State Context

This dissertation makes use of data on all public school students and employees in Texas over a 22-year period, from 1997 through 2019. Texas is an ideal setting to study racial diversity in schools and in the educator workforce, in particular how changes in school and district leader demographic characteristics impact employment of teachers and principals; at the same time, Texas is distinct from other states in ways that may limit external validity. Texas has been the site of tremendous population growth over the period of study; the overall population of the state increased by nearly 21% between the 2000 and 2010 Censuses, and again by another 16% between 2010 and 2020, ranking in the top five fastest-growing states over each period (Frey 2020). The growth in the state population has been particularly large among young people, with the population under age 18 growing the most in Texas of all states through 2018 (Garza et al 2020).

At the end of the study period, Texas enrolled more than 5.4 million students across just over 1,300 districts, up from around 4 million students in 1998. The growth in school-age population has led to a sizeable increase in the number of schools[2] in the state over the period studied, with the overall number of schools in the state increasing by 26% between 1998 and 2019. This period also included the growth of charter schools in the state; the share of such schools increased from under one percent in 1998 to nearly 9% in 2019. The growth in the

[2] The terms campus and school are used interchangeably throughout

overall number of schools, however, has been uneven across districts and geographic settings. While nearly a third of all districts in the state had more schools in 2019 than in 1998, just over one in five districts saw a decrease in the number of schools over this time period. Urban and suburban districts saw the most growth in number of schools, with the number of schools in the average suburban district increasing by more than 80%, and the number of schools in the average urban district more than doubling over the period (author calculations of administrative data from Texas Education Agency). This growth in number of schools far outpaces that of schools nationwide. Over the same period, the total number of public schools in the United States increased by 6%, less than a quarter the growth observed in Texas. Texas ranked 7th out of all states in the percent change in number of schools, with just over half of states seeing an increase in number of schools between 2000 and 2019 (NCES 2019).

These new schools in Texas expand the number of principal jobs available. In addition, approximately 20% of principals left their jobs in each year, either to transfer to become principal at another school, take on a new role in the Texas Education Agency, or to exit educational employment altogether. Taken together, principal exits and opening of new schools resulted in approximately 32,000 principal hires over the period of study. As with the growth in number of schools, principal exit rates varied across geographic settings, with principal vacancies due to exit higher in urban and rural districts than in districts in suburbs or towns (author calculations of administrative data from Texas Education Agency). The variation in school growth and principal exit across geographic settings allows for estimation of changing contexts over time that add to understanding of school leader hiring and motivates the inclusion of characteristics of districts in each year in the analyses. While annual principal turnover rates in Texas are similar to those observed in other settings, the significantly higher rate of increase in

number of schools results in a larger number of available principal jobs in Texas than in other states. This relatively larger supply of principal jobs likely increases the opportunity for Black, Hispanic and female candidates to be hired as school leaders, suggesting that estimated rates of hire among these groups in the state may be higher than those that would be observed in settings with relatively more scarce principal job growth.

The racial and ethnic composition of the state also makes Texas an ideal site to study diversity in the educator workforce, in particular the experiences of Hispanic teachers and school leaders. The student population in Texas is made up of a larger share of Hispanic students than is true in schools nationwide, with 53% of Texas students identified as Hispanic relative to 27% of students at all US schools (NCES 2021). However, many other states are seeing growth in the share of Hispanic students in their states, with the share of Hispanic students growing by double digits in 13 states between 2003 and 2013. For this reason, scholars point to studies of Texas as useful to "understand and potentially foreshadow how other states may need to adapt as our nation and schools experience racial transformation" (Crawford and Fuller 2017, p. 1169). The educator workforce in Texas has larger shares of Black and Hispanic teachers and principals than do US schools as well, with differences particularly large for Hispanic educators. Hispanic educators make up around three times the share of teachers and principals in Texas compared to US schools overall (NCES 2020, NCES 2018, Texas Education Agency 2022a, 2022b).

The spatial distribution of Black and Hispanic students and educators is uneven across districts in Texas, with the concentration of Black and Hispanic students in districts growing over the period. Between 1998 and 2019, the number of school districts with a majority of Black students grew by 50%, and the number of districts with a majority Hispanic student population more than doubled. By 2019, over 100 districts were made up of more than 90% Hispanic

students, representing 8 percent of all districts in the state (author calculations of administrative data from Texas Education Agency). Nationally, statistics on racial concentration of students within schools suggest that white and Hispanic students in Texas are more concentrated in campuses with higher shares of their own group than in the rest of the US. In 2016, over half of white students nationwide attended schools that were at least 75 percent white, compared to two-thirds of white students in Texas. The concentration of Hispanic students within Texas schools is also greater than in the country as a whole, with just under half of Hispanic students in the state attending schools with at least 75 percent Hispanic students relative to only a third of Hispanic students in the US overall attending such schools. By contrast, only 7 percent of Black Texas students attend schools that are at least 75 percent Black, less than a third of the rate observed nationally (author calculations of administrative data from Texas Education Agency, de Brey et al 2019).

Black teachers in Texas, however, are highly concentrated in a small share of all schools in the state, with 90% of Black male and female teachers working in only 11 percent of schools across the study period. Hispanic male and female teachers worked across a wider set of schools, with 90% of Hispanic male teachers working in 30% of schools and 90% of Hispanic female teachers working in just under 40% of schools across the period. Among principals, 90% of Black male and female principals worked in only 11% of all districts, and 90% of Hispanic male and female principals worked in 16% and 11% of all districts, respectively (author calculations of administrative data from Texas Education Agency). Relative to teachers in other states, Texas teachers are moderately segregated by race. In a calculation of dissimilarity indices for white and non-white teachers (including Hispanic as non-white) in each state using data from 2012, the value for Texas teachers was in the middle tier group (Hansen and Quintero 2018).

Overall, the larger number of majority Hispanic schools and districts in the state relative to the country may also provide greater opportunities for Hispanic educators to take on principalships than those observed elsewhere, suggesting that rates of hire into school leadership for Hispanic educators may be upper bounds relative to other settings. Despite this potential limitation to external validity, this distinction makes Texas an ideal site to examine career progressions of Hispanic educators, who have been understudied in prior work on the educator workforce relative to Black and white educators (Perrone 2022).

Present Contribution

This dissertation seeks to fill gaps in the literature noted above, making use of two decades of administrative individual and contextual data across all public schools in Texas. The first chapter uses school and year fixed effects to estimate causal effects of a change in principal race and gender following a leadership transition on the demographic composition of new teacher hires. Fixed effects models have notable limitations, particularly when used over long periods of time (Hill et al 2020). School-specific trends in teacher hiring are included as controls to attempt to mitigate this drawback, following Bartanen and Grissom (2021). The use of fixed effects in this setting is a significant improvement toward estimating causal effects of a change in principal race or sex over other specifications. Results suggest that racial and gender congruence between Black and Hispanic female principals and teachers affect the composition of new teacher hires more so than does racial congruence alone, but that only racial congruence increases the share of Black male teachers hired. Principal race and gender congruence affect teacher attrition as well, with effects varying across groups.

The second chapter focuses on the hiring process for individuals certified to become school principals across the state, using discrete-time hazard models to examine the associations

of a variety of individual and district contextual characteristics with the likelihood that a candidate is hired in each year following certification. These models include characteristics of the superintendents of each district in each year to assess whether an indicator of shared prior employment networks with superintendents is associated with greater likelihood of hire into school principal roles for administrative candidates, and whether these associations vary by candidate race and gender overall and when interacted with the race and gender of the superintendent. Using a variety of methodological improvements over prior work to better estimate associations of these characteristics with odds of hire, this study finds that Black and Hispanic candidates who share prior employment networks with superintendents are more likely to be hired than are other Black and Hispanic candidates, but only when the superintendent is also Black or Hispanic.

The third chapter focuses on racial and gender congruence between superintendents and principals by including district and year fixed effects to isolate the causal impact of this congruence above and beyond observable and unobservable characteristics of districts and educators. Using the same analytic strategy as the first chapter, this study finds that Black male and female principals make up larger shares of new hires in districts when they are led by Black superintendents, relative to when the same district is led by a white superintendent. Unlike principal hiring of teachers, there was no evidence of gender congruence increasing the share of female principals hired by female superintendents among either Black or Hispanic educators. There was also no evidence that Hispanic superintendents affected the share of Hispanic new principals.

Taken together, these studies suggest that efforts to increase the racial and gender diversity of teacher and school leader workforces should consider the representation of these

groups in the principals and superintendents who hire and manage them. Additionally, programs that seek to connect aspiring principals with racially congruent district leaders to build employment networks could benefit Black and Hispanic educators in pursuit of school leadership roles. Without attention to increasing the shares of Black, Hispanic, and female superintendents and principals, efforts to increase diversity in the educator workforces they manage may have limited effects.

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Chapter 1: Effects of Principal and Teacher Demographic Congruence on Teacher Hiring and Retention

Building on work finding that principal and teacher racial congruence affects the composition of new teacher hires among Black and white teachers and principals, as well as that shared race and gender between managers and employees influence job satisfaction and retention, this study estimates causal effects of principal racial and gender congruence with teachers on teacher hiring and retention, exploiting principal transitions where the new leader is a different race and/or sex than was the prior principal. Black female and Hispanic female principals hire greater shares of Black female and Hispanic female teachers, with effects larger than those for their co-racial male counterparts. There is some evidence that racial and gender congruence with principals affects teacher exit, with mixed results across teacher race and sex groups. These findings underline the importance of representational racial and gender equity among school principals in efforts to recruit and retain a racially diverse teacher workforce of men and women.

Introduction

Within research on how to build and maintain a diverse teacher workforce, one promising line of study focuses on school principals and their own demographic characteristics, noting their roles as key human capital managers of teachers within schools. Broader research on managerial dyads uses theoretical frameworks within relational demography, such as similarity attraction, to understand how and when shared characteristics between supervisors and subordinates influence employment outcomes like selection, job satisfaction, and retention (Goldberg 2005, Graves and Powell 1995, Tsui et al 2002). Within educational workforce research, representative bureaucracy has been used as a framework for studying congruence between teachers and principals. These ideas suggest that a manager who shares characteristics with some of their subordinates will be more likely to take actions benefiting those employees (Grissom et al 2015).

Prior work has studied outcomes of congruence between teachers and principals along racial and gender dimensions separately, with evidence that teachers are less likely to leave schools when they share race or gender characteristics with their principals (Fairchild et al 2012, Grissom et al 2012, Viano and Hunter 2017). Recent work by Bartanen and Grissom (2021) used school fixed effects to identify a causal effect of principal and teacher racial congruence on teacher hiring and retention among Black and white teachers. To date, only one study has looked simultaneously at racial and gender congruence between principals and teachers, finding effects only of racial congruence on the level of teacher trust in principals (Brezicha and Fuller 2019). These results on racial and gender congruence between principals and teachers, placed within the theoretical frameworks of relational demography and representative bureaucracy, leave open the question of whether teacher-principal congruence in race and gender simultaneously affect the likelihood that teachers will be hired into a school and that they will stay at that school.

Additionally, the research on racial congruence between teachers and principals to date is largely limited to studies of Black and white teachers and principals, leaving open the question of whether these results extend to Hispanic educators.

To address these gaps in the literature, this study investigates how racial and gender congruence between principals and teachers affect the share of newly hired teachers at a school who are Black or Hispanic men and women, as well as the probability of various types of teacher turnover among each race-sex group of teachers. Using administrative records for all public schools in Texas between 1998 and 2019, this study finds that Black and Hispanic principals replacing a white principal hired significantly more Black and Hispanic teachers, respectively, and that these effects were larger for Black and Hispanic women when the principals were also Black or Hispanic women. Results for teacher turnover were more complex. Black teachers of both sexes were less likely to leave their roles when led by a Black principal who replaced a white principal, but both Black and Hispanic women were more likely to exit when led by a female principal who replaced a male principal.

Literature Review

Principals and Relational Demography

Policy makers have engaged in a number of efforts to attract and retain more Black and Hispanic teachers over recent decades, with over 30 states enacting recruitment policies that specifically target these educators. Between 1987 and 2007, while the number of Black and Hispanic teachers increased, the level of parity between these teachers and students of the same race did not improve significantly (Villegas et al 2012). At the same time, other efforts have been focused specifically on recruiting and retaining male teachers, particularly Black male teachers, as the share of male teachers hit an all-time low in 2006 (Snyder 2008). Teacher workforce studies emphasize the key role of school principals in both hiring and retention of teachers, with their function as human capital managers increasing as many districts have decentralized teacher hiring processes (Engel et al 2017, Harris et al 2010). Attitudes about principal support and effectiveness have consistently been shown to be among the most important factors in teacher decisions of whether or not to remain in their schools (Boyd et al 2011, Grissom 2011).

Broader work on demography and organizational dynamics provides helpful frameworks for understanding how racial and gender congruence between principals and teachers operate in hiring. Specifically, the idea of similarity attraction, where individuals assume shared values and positive attributes when others are similar in observable ways, provides a mechanism through which managers are more likely to hire and positively evaluate similar applicants (Riordan et al 2005). These ideas suggest that principals will be more likely to hire teachers who are demographically similar to them, potentially via an assumption that same-race and gender teachers are more likely to share their own values. Candidates may also be more likely to apply for or to accept employment from demographically similar managers through the same

mechanism. Indeed, teachers have been shown to employ race-match seeking behavior in studies of where teachers apply to work (D'Amico et al 2017).

Once an employee is hired, the idea of representative bureaucracy suggests that a manager who shares characteristics with some of their subordinates will be more likely to take actions benefiting those employees who are similar. When managers and employees are members of groups that have faced historical discrimination, managers may be especially likely to take actions designed to compensate for this prior discrimination (Grissom et al 2012, Selden 1997). If employees and managers share experiences and values as a result of shared race or gender, they may be more likely to enter the working relationship with similar expectations, leading to greater levels of mutual trust and satisfaction (Alesina and La Ferrara 2000). This framework suggests that Black and Hispanic teachers are likely to be more satisfied and to stay at their schools when working for a racially congruent principal. The effects of gender congruence between teachers and principals may vary for male and female teachers, with the potential for more negative impacts on male teachers managed by female principals than for female teachers managed by male principals. Tsui and colleagues argue that when a manager is of a higher-status identity than is the subordinate, there may not be negative impacts of the dissimilarity between the two because the relative status levels match relational norms (Tsui and O'Reilly 1989, Tsui et al 2002). However, when the dissimilarity within dyads is not consistent with such norms, both employees and managers may be less satisfied.

Teacher and Principal Demographic Similarity Outcomes

Research within schools using these frameworks has demonstrated relationships between principal and teacher racial congruence on teacher hiring, satisfaction and retention, and between principal and teacher gender congruence on teacher satisfaction and retention; however, the

simultaneous effects of race and gender congruence on hiring or retention remain unknown. Additionally, the literature to date does not address how principal gender congruence affects the likelihood of hiring male or female teachers, a question important to consider considering efforts to increase the supply of male teachers.

Research on principal hiring of teachers has previously focused only on racial congruence, with Black principals hiring more Black teachers than white principals they replace at the same school, after inclusion of campus and year fixed effects (Bartanen and Grissom 2021). In general, teachers report greater satisfaction and lower likelihood of exit when working for racially congruent principals, with some evidence that Black teachers received greater material support from Black principals than when white principals led their schools, and other findings that white teachers received higher pay with white principals than with other principals (Bartanen and Grissom 2021, Grissom and Keiser 2011, Viano and Hunter 2017). Consistent with theories on potentially asymmetrical effects of gender incongruence in managerial dyads noted above, male teachers have been shown to be more likely to be dissatisfied and leave their schools when led by a female principal, while female teachers did not show the same pattern when at schools with a male principal (Grissom et al 2012). Only one study to date has examined the effect of teacher and principal gender and racial congruence simultaneously, finding that among a sample of Black and white teachers, racial congruence was associated with greater trust while there were not differences based on gender congruence (Brezicha and Fuller 2019).

Nearly all the research cited above on racial congruence focuses exclusively on Black and white teachers and principals, with only descriptive evidence that Hispanic teachers make up larger shares of staffs at schools led by Hispanic principals (Meier et al 2004). This study seeks to expand examination of the effects of racial congruence on hiring and retention to Hispanic

teachers and principals, with some expectation that effects may be different than those identified for Black teachers and principals. As noted above, positive impacts of racial congruence on student achievement outcomes have been found most consistently for Black students with Black teachers, with mostly null or negative results for Hispanic students with Hispanic teachers (Egalite et al 2015, Redding 2019). In one such study, the authors noted the significant diversity of national origin among the Hispanic population studied, suggesting that the broad definition of Hispanic may not necessarily signify cultural similarity of experience and background (Egalite et al 2015). Recent work has attempted to identify matches of students and teachers along native language dimensions in addition to identification as Hispanic, with evidence that students who share both language status and Hispanic identification with teachers are more positively evaluated by their teachers than are students matching on only one of those characteristics (Seah 2021). Effects of racial congruence on hiring and retention among Hispanic educators have not been studied to date, although the results above for student and teacher congruence suggest that effects among Hispanic teachers and principals may be smaller or less consistent than those among Black racially congruent teachers and principals.

Present Contribution

This study seeks to fill the gaps in the literature noted above, specifically to address the simultaneous effects of racial and gender congruence between principals and teachers on the race and sex of new teacher hires following a principal transition, as well as on the probability of campus exit. These findings will add to our understanding of how race and gender similarity may operate differently for men and women according to relational norms in managerial dyads, as well as whether racial congruence increases hiring and retention of Hispanic teachers as it has been demonstrated to between Black principals and teachers. Finally, examination of teacher

turnover may illuminate effects of principal race or gender congruence on the ability of schools to retain teachers.

Methods

To analyze teacher and principal hiring and employment patterns, teacher person-year files were constructed from administrative records of the Texas Education Administration (TEA) for the years 1998 through 2019[3]. These files include information on the demographic characteristics of employees, their years of experience overall and at their current campus or district, highest degrees earned, the role they held each year, and the campus and district location of that role, if applicable. Building on prior teacher placement and retention studies, characteristics of individual teachers, characteristics of their school principals, and characteristics of the campuses at which they teach were included as controls (Bartanen and Grissom 2021, Grissom et al 2012, Guarino et al 2006, Hanushek and Rivkin 2007). Characteristics of principals in each campus and year, including their race, sex, highest degree earned and years of experience, were constructed from the TEA administrative records and linked to the teacher records. Other contextual characteristics of the campuses were constructed from the Common Core of Data (CCD) to capture geographic and student demographic characteristics. The geographic locale of each campus from the CCD was collapsed into four categories, urban, suburban, town and rural. The percentage of students of each racial group in each campus was included for each year as well, with white, Hispanic, Black and race – other as the categories (the latter category including Asian, Pacific Islander, Native American, and two or more races).

To estimate relationships between change in principal race or sex and teacher hiring and retention, each teacher-year observation required that a unique principal be assigned to their campus in that year. Of the total of just over 7 million teacher-year observations, around 500,000

[3] Data on the share of students eligible for free or reduced-price lunch was missing for nearly all campuses in 1997; period of observation begins in 1998 when data are more compete.

did not have a unique principal associated with their campus over multiple observed years, suggesting a co-principal model of some kind. In cases where a single record could be determined to represent the principal of the campus for that year (either by using the number of days an individual held the role, or in the case where a pattern of transfer could be identified from one individual to another who then held the role in subsequent years), assignment to a single principal was completed prior to analysis. Otherwise, teacher-year observations for which a unique principal could not be determined were excluded, resulting in 6.45 million teacher-year observations meeting inclusion criteria. The outcomes of interest were the race and sex of teachers newly hired to each campus in each year, as well as whether a given teacher returned to the same campus the following year.

Analytic Strategy

A key contribution of this project is the specification of models to estimate causal effects of principal race and sex on teacher outcomes using campus and year fixed effects, as well as controls for campus-specific trends. Prior work demonstrates, as do descriptive statistics for this sample described below, that schools led by Black, Hispanic, or female principals often differ systematically from those led by white or male principals. It is likely that unobserved characteristics of a school that make it more likely to hire a Black male principal, for example, are also associated with employing more Black male teachers. This may reflect local labor markets or a willingness of the community to support Black men in education. The inclusion of school fixed effects can remove the effects of time-invariant unobservable characteristics of schools, which might otherwise inflate estimates of the effect of principal racial or gender congruence on the composition of new teacher hires. Specifically, these models estimate changes that follow a principal transition such that the new leader is of a different race and/or sex than the

prior principal. Fixed effects models used over long periods of time have several drawbacks, given the likelihood that unobserved characteristics related to outcomes of interest change over time. Including year fixed effects and controlling for campus-specific trends over time in the share of new female, Black or Hispanic teachers can help isolate effects of changes in principal race and sex from secular trends experienced in the state or in each district. Despite the drawbacks and limitations of fixed effects in this setting, evidence using this strategy removes much of the concerns present in other specifications.

To analyze teacher hiring, models were estimated following Bartanen and Grissom (2021) and Giuliano and colleagues (2009), with the additional interaction of sex with race of teachers and principals. For estimates of the effect of principal race and sex on teacher hiring, linear probability models were estimated of the following form for teachers new to each campus in each of the following race-sex groups (Black Female, Black Male, Hispanic Female, Hispanic Male):

1) $$\Pr(NewTeacherBlackFemale_{ijt} = 1) = \beta_1 FemalePrincipal_{jt} + \beta_2 BlackPrincipal_{jt} + \beta_3 FemalePrincipal_{jt} * BlackPrincipal_{jt} + \beta_4 HispanicPrincipal_{jt} + \beta_5 HispanicPrincipal_{jt} * FemalePrincipal_{jt} + \beta_6 OtherRacePrincipal_{jt} + \beta_7 FemalePrincipal_{jt} * OtherRacePrincipal_{jt} + P_{jt} + C_{jt} + \alpha_j + \gamma_t + \varepsilon_{ijt}$$

That is, the probability that a newly hired teacher *i* in campus *j* in year *t* is a Black female conditional on whether the principal in campus *j* in year *t* is Black female, Black male, Hispanic female, Hispanic male, other race female or other race male[4]. These models estimate the

[4] An alternative approach in hiring choice models would be to use a multinomial logit with each race-sex group as an outcome (as in Giuliano et al 2009). However, to estimate these models using campus fixed effects requires that only campuses with at least one hire in each group across the period be included. Across the entire sample, only 30% of campuses met this criterion, and they were systematically different from the distribution of campuses as a whole. In reality, principals are likely choosing from an applicant pool that does not include members of each race-sex group. Additionally, fixed effects probit models could be used by including a dummy variable for each campus; however, estimates from these models are only consistent if a sufficient number of new teacher hires are observed within each school. The average school observed in the

composition of newly hired teachers to each campus in each year, conditional on characteristics of the principal and campus. Each model was then repeated for the probability that a newly hired teacher is Black male, Hispanic female, and Hispanic male. Additionally, *P* is a vector of characteristics of the principal of campus *j* in year *t*, and C includes characteristics of campus *j* in year *t*. Campus fixed effects are included in α_j and year effects in γ_t. Campus-specific trends were also included as controls. Standard errors are clustered at the campus level due to the nested nature of the data. As in Bartanen and Grissom (2021), linear probability models are used to estimate binary choice marginal effects, following assumptions set forth in Angrist and Pischke (2008).

To examine whether teacher exit varies systematically with principal race and sex, the following model was estimated separately for teachers of each of the four race-sex groups:

2) $$\Pr(TeacherExit_{ijt} = 1) = \beta_1 FemalePrincipal + \beta_2 BlackPrincipal_{jt} + \beta_3 FemalePrincipal_{jt} * BlackPrincipal_{jt} + \beta_4 HispanicPrincipal_{jt} + \beta_4 HispanicPrincipal_{jt} * FemalePrincipal_{jt} + \beta_6 OtherRacePrincipal_{jt} + \beta_7 FemalePrincipal_{jt} * OtherRacePrincipal_{jt} + T_{ijt} + P_{jt} + C_{jt} + \alpha_j + \gamma_t + \varepsilon_{ijt}$$

This estimates the probability that teacher *i* in campus *j* in year *t* exits the campus, conditional on whether the principal in campus *j* in year *t* is Black female, Black male, Hispanic female, Hispanic male, other race female or other race male. This model was repeated for each teacher race-sex group. In addition to vectors *P* and *C* described above, vector *T* of characteristics of teacher *i* in campus *j* in year *t* are also added, including the teacher's total years of experience, number of years at that campus, and highest degree earned. Campus fixed effects are again

period had between 6 and 6.5 new teacher hires each year, insufficient for unbiased estimates from probit models of this type. Therefore, linear probability models were used, following Bartanen and Grissom (2021).

included in α_j and year effects in γ_t. Standard errors are clustered at the campus level due to the nested nature of the data.

Descriptive Statistics

Across the period, 813,704 unique teachers were observed for a total of 6.4 million person-year observations. In models estimating the effects of principal race and sex on the composition of new teacher hires, only those teachers who were new to their campus in year *t* were included, resulting in an analytic sample for hiring models of 572,027 unique teachers observed for a total of 890,631 teacher-years. Teachers were included in every year that they were new to a campus, regardless of whether they had worked as a teacher at a different campus previously. If a teacher worked at three distinct campuses across their career in Texas during the study period, they would contribute an observation in their first year at each of the three schools. Characteristics of these teachers are shown in Table 1 below. White female teachers made up half that group, with Hispanic female teachers the next largest share at 16%. Just over a third of newly-hired teachers had white female principals, with 30% in schools led by white male principals. Newly hired teachers worked in schools that served an average of 47% Hispanic students, 16% Black students, and with 47% of students eligible for free- or reduced-price lunch. Three quarters of teachers worked in urban or suburban schools across the period (see Table 1).

Models estimating the effects of principal race and sex on the likelihood of teacher exit included observations for all teachers in all years to determine if they exited their roles between years *t* and *t*+1. These models included 6.4 million person-year observations for 813,704 unique teachers. Sample characteristics of these teachers within race and sex groups are shown in Table 2 below. Average annual rates of exit for each race and sex group of teachers are shown in Table 3, with exit defined as a teacher not holding the same role in the same campus in year *t+1* as in

year *t*. This could include teachers who transferred to teach at another campus, teachers who took on a new role within the Texas Education Agency, or teachers who left educational employment entirely. Black male teachers were the most likely to leave, with just over 23 percent of these teachers exiting their roles in their campuses each year.

The race and sex composition of teachers within each campus differed systematically by the race and sex of the principals, as shown in Table 4. Black and Hispanic male and female teachers made up much larger shares of teachers in schools led by same-race-sex principals than of teachers overall; for example, Hispanic female teachers represented just under 17% of teachers overall but nearly 49% of teachers at schools led by Hispanic female principals. Campuses led by principals of each race-sex group differed on other characteristics as well (see Table 5). Student populations at schools led by Hispanic male and female principals were on average 80% Hispanic, while schools led by Black principals had the highest share of students eligible for free- or reduced-price lunch. Close to three-quarters of schools led by female principals of each racial group were elementary schools, and schools led by Black and Hispanic principals were more likely to be in urban areas than those led by white principals. These differences in characteristics of campuses led by principals of different race and sex groups emphasize the importance of including campus fixed effects to attempt to isolate effects of changes in principal race and/or sex on teacher hiring and retention.

To illustrate the mean trends in teacher hiring following a change in principal race or sex prior to modeling formally, as well as to identify evidence of potential pre-trends in teacher hiring prior to principal transitions, Figures 1 and 2 below show the share of new hires by sex

and race within campuses in the three years prior to and following a principal transition[5]. Figure 1 shows the share of newly hired female teachers in campuses before and after principal transitions; Figure 2 shows the share of newly hired Black (left) or Hispanic (right) teachers in campuses where each type of principal transition occurred. The samples in these figures were restricted to transitions where the outgoing and incoming principals each worked at the school for at least three years. In each case, the black dashed line indicates a change from male (white) to female (Black / Hispanic) principal. Across both gender and racial dimensions, the significant differences in share of own-group new hires at schools with principal transitions that do not involve a change in principal sex or race are striking. In the top panels of Figure 2, for example, the share of new hires who are Black or Hispanic at schools where the outgoing and incoming principal are both white are 10% or lower, while the corresponding shares for transitions where outgoing and incoming principals are both Black (left) or Hispanic (right) are 40% or more.

Transitions that do result in an incoming principal who is a different gender or race show some evidence of impacting the composition of newly hired teachers. As shown in Figure 1, the share of newly hired teachers who are female increases shortly after a female principal replaces a male principal before slightly decreasing in subsequent years. For the reverse, when a male principal replaces a female principal, there is a slight decline in share of female new hires in year $t + 1$. In Figure 2, similar evidence of an increase in share of newly hired Black teachers is shown on the left side, with a transition from a white (top) or Hispanic (bottom) principal to Black principal being followed by a marked increase in share of new teachers who are Black. Changes in the share of Hispanic new teachers are more subtle in the right side of Figure 2.

[5] Group Ns within race-sex groupings by year within these schools were too small to be shared due to data privacy guidelines, so race and sex are examined separately here

Missing Data

Across the 6.45 million teacher-year observations meeting the inclusion criteria noted above, 14,540 (0.2%) were missing at least one covariate used in modeling, resulting in the analytic sample of 6.4 million teacher-year observations. Comparisons of complete observations to those missing at least one covariate are shown in the Appendix; individuals missing data were more likely to be Hispanic males, have more years of experience and were much more likely to work at small schools with non-traditional grade spans (such as kindergarten to 12th grade) than were those with complete data. However, the small number of cases missing data suggests that the exclusion of these cases likely did not influence results[6].

[6] Imputation of missing data is less typical in studies using administrative data, particularly those with a small number of covariates that could be used for imputation. For this reason, as well as the relatively small incidence of missing data, imputation was not performed.

Table 1. Descriptive Statistics: Newly Hired Teachers

	Sample Characteristics	
Characteristic	Mean	SD
Teacher Characteristics		
White Female	0.50	
White Male	0.15	
Black Female	0.08	
Black Male	0.03	
Hispanic Female	0.16	
Hispanic Male	0.06	
Other Race Female	0.02	
Other Race Male	0.01	
n = 572,027 unique teachers		

	Sample Characteristics	
Characteristic	Mean	SD
Years of experience as teacher	3.8	6.3
Highest degree MA	0.17	
Highest degree doctorate	0.01	
Principal Characteristics		
White Female	0.36	
White Male	0.30	
Black Female	0.08	
Black Male	0.05	
Hispanic Female	0.12	
Hispanic Male	0.08	
Other Race Female	0.01	
Other Race Male	0.01	
0 prior years at campus	0.25	
1 to 4 prior years at campus	0.29	
5 or more prior years at campus	0.26	
Highest degree MA	0.86	
Highest degree doctorate	0.06	
Campus Characteristics		
Proportion Black	0.16	0.18
Proportion Hispanic	0.45	0.30
Proportion FRPL	0.47	0.26
Enrollment (100s)	9.2	7.00
Elementary school	0.44	
Middle school	0.24	
High school	0.28	
Other school	0.03	
Charter school	0.04	
Urban	0.41	
Suburban	0.32	
Town	0.10	
Rural	0.17	
n =890,631 teacher-year observations		

Note: Sample characteristics shown above for all teachers in their first year at each campus when they were a new hire. The above group represents all teachers included in models estimating effects of principal race and sex on composition of new teacher hires. Includes 572,027 unique teachers observed for a total of 890,631 teacher-years.

Table 2. Descriptive Statistics: All Teachers by Race and Sex

	Black Female	Black Male	Hispanic Female	Hispanic Male	White Female	White Male
Unique Teachers	63,413	22,565	133,704	46,826	422,886	119,716
Pct of Total	0.08	0.03	0.16	0.06	0.52	0.15
Person-year Observations	451,227	144,295	1,072,865	355,999	3,360,031	911,454
Characteristic	Mean / SD	Mean / SD	Mean / SD	Mean / SD	Mean / SD	Mean / SD
Years of experience as teacher	11.2	9.7	10.0	9.9	11.9	12.0
	(10.2)	(9.5)	(8.7)	(8.9)	(9.4)	(9.9)
Highest degree MA	0.34	0.27	0.19	0.18	0.22	0.27
Highest degree doctorate	0.01	0.01	0.003	0.006	0.004	0.01
Principal Characteristics						
White Female	0.24	0.19	0.25	0.18	0.46	0.28
White Male	0.15	0.22	0.13	0.17	0.33	0.48
Black Female	0.30	0.21	0.05	0.05	0.05	0.04
Black Male	0.16	0.2	0.02	0.03	0.03	0.05
Hispanic Female	0.08	0.07	0.36	0.3	0.07	0.06
Hispanic Male	0.06	0.08	0.18	0.26	0.04	0.07
Other Race Female	0.01	0.01	0.01	0.01	0.01	0.01
Other Race Male	0.01	0.01	0.003	0.004	0.01	0.01
0 prior years at campus	0.23	0.24	0.21	0.22	0.2	0.22
1 to 4 prior years at campus	0.49	0.51	0.5	0.51	0.47	0.5
5 or more prior years at campus	0.28	0.25	0.3	0.26	0.33	0.29
Highest degree MA	0.84	0.83	0.9	0.88	0.88	0.86
Highest degree doctorate	0.07	0.08	0.05	0.05	0.06	0.07
Campus Characteristics						
Proportion Black	0.38	0.35	0.08	0.08	0.13	0.14
	(0.27)	(0.27)	(0.12)	(0.12)	(0.14)	(0.14)
Proportion Hispanic	0.44	0.45	0.77	0.78	0.36	0.38
	(0.26)	(0.26)	(0.25)	(0.25)	(0.26)	(0.27)
Proportion FRPL	0.61	0.56	0.5	0.49	0.43	0.41
	(0.25)	(0.24)	(0.30)	(0.30)	(0.25)	(0.23)
Enrollment (100s)	9.3	12.2	8.6	11.4	8.6	12.0
	(6.6)	(8.4)	(5.8)	(7.7)	(6.6)	(8.9)
Elementary school	0.53	0.19	0.68	0.32	0.56	0.14
Middle school	0.26	0.33	0.16	0.26	0.21	0.27
High school	0.20	0.45	0.15	0.4	0.21	0.56
Other school	0.02	0.03	0.01	0.02	0.02	0.03
Charter school	0.05	0.05	0.03	0.03	0.01	0.02
Urban	0.06	0.62	0.6	0.59	0.36	0.37
Suburban	0.29	0.28	0.25	0.25	0.34	0.31
Town	0.04	0.04	0.09	0.09	0.12	0.12
Rural	0.04	0.05	0.07	0.08	0.19	0.2

Note: Sample characteristics shown above for 813,704 unique teachers for a total of 6,429,073 teacher-year observations. The above group represents all teachers included in models estimating effects of principal race and sex on probability of teacher exit.

Table 3. Average Rate of Teacher Exit by Teacher Race and Sex

	Black Female Teachers %	Black Male Teachers %	Hispanic Female Teachers %	Hispanic Male Teachers %	White Female Teachers %	White Male Teachers %
Avg Rate Teacher Exit	21.0	23.2	16.2	18.7	18.8	21.4
	n = 451,227	*n = 144,295*	*n = 1,072,865*	*n = 355,999*	*n = 3,360,031*	*n = 911,454*

Note: Average annual rate of exit for teachers within each race and sex group. Exit defined as teacher not holding a teacher role in the same campus in the subsequent year.

Table 4. Average Racial and Sex Composition of Teachers by Campus Principal Race and Sex: All Teachers and Newly-Hired Teachers

	All Principals	Black Female Principals	Black Male Principals	Hispanic Female Principals	Hispanic Male Principals	White Female Principals	White Male Principals
All Teachers							
% Black Female	6.9	**32.2**	26.9	4.2	4.2	4.2	3.1
% Black Male	1.9	6.7	**10.2**	1.0	1.7	0.9	1.2
% Hispanic Female	16.8	11.7	7.6	**48.6**	37.3	11.2	6.6
% Hispanic Male	4.8	3.4	3.4	11.5	**15.4**	2.3	2.7
% White Female	55.1	36.1	35.5	27.4	28.4	**69.9**	63.2
% White Male	12.7	6.9	13.7	5.6	11.0	9.7	**21.7**
Newly Hired Teachers							
% Black Female	6.5	**28.6**	24.2	3.9	3.7	4.2	3.0
% Black Male	2.2	7.3	**10.4**	1.1	1.9	1.2	1.7
% Hispanic Female	17.5	14.1	9.1	**47.1**	37.0	12.6	7.7
% Hispanic Male	5.5	4.3	4.2	12.5	**16.1**	3.0	3.6
% White Female	51.8	34.8	33.6	27.3	27.6	**66.0**	57.5
% White Male	14.3	7.5	15.0	6.1	11.4	11.0	**24.8**
Campus-years	*n = 153,074*	*n = 11,385*	*n = 5,717*	*n = 20,541*	*n = 11,663*	*n = 57,943*	*n = 43,841*
Unique campuses	*n = 19,759*	*n = 1,860*	*n = 1,173*	*n = 2,796*	*n = 2,154*	*n = 6,527*	*n = 5,249*

Note: Above table shows race and sex composition of all teachers observed across all years within campuses led by principals of each group listed in column headers.

Table 5. Average Student Demographic Composition, School Level, and Geographic Locale by Principal Race and Sex

Characteristic	Black Female Principals	Black Male Principals	Hispanic Female Principals	Hispanic Male Principals	White Female Principals	White Male Principals
	Mean	Mean	Mean	Mean	Mean	Mean
Campus Characteristics						
Proportion Black	0.43	0.42	0.06	0.06	0.13	0.11
Proportion Hispanic	0.40	0.37	0.83	0.80	0.38	0.33
Proportion White	0.30	0.31	0.47	0.43	0.61	0.65
Proportion FRPL	0.64	0.61	0.52	0.55	0.45	0.43
Enrollment	609.2	723.2	638.8	706.00	601.80	612.40
Charter school	0.10	0.07	0.05	0.06	0.03	0.03
Elementary school	0.70	0.35	0.76	0.45	0.72	0.34
Middle school	0.18	0.33	0.14	0.27	0.15	0.27
High school	0.10	0.27	0.09	0.23	0.10	0.33
Other school	0.03	0.06	0.01	0.04	0.03	0.05
Urban	0.66	0.63	0.61	0.55	0.34	0.23
Suburban	0.25	0.22	0.22	0.19	0.31	0.23
Town	0.05	0.07	0.10	0.13	0.12	0.17
Rural	0.05	0.08	0.07	0.12	0.22	0.37
Campus-years	*n = 11,385*	*n = 5,717*	*n = 20,541*	*n = 11,663*	*n = 57,943*	*n = 43,841*
Unique campuses	*n = 1,860*	*n = 1,173*	*n = 2,796*	*n = 2,154*	*n = 6,527*	*n = 5,249*

Note: Above table shows characteristics of campuses led by principals of each group listed in column headers across all years.

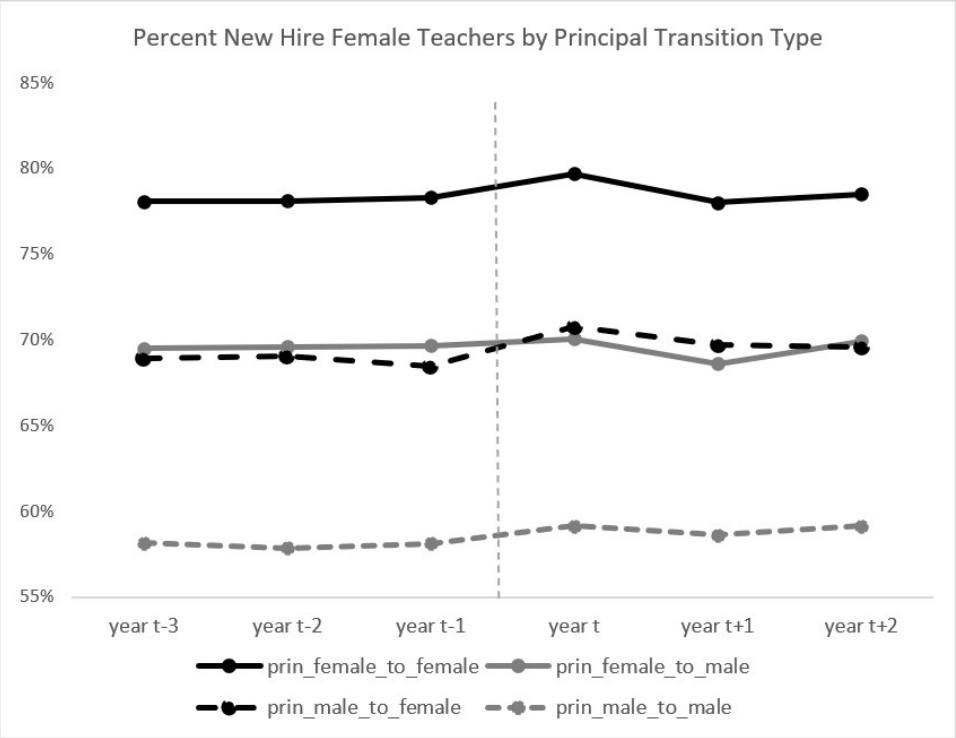


Figure 1. Percentage of Female Teacher Hires Before and After Principal Transition

Note: This figure plots event studies (six-year window) of the share of a school's newly hired teachers that are female in each year. Transitions are limited to cases where each principal stayed at least three years in the school.

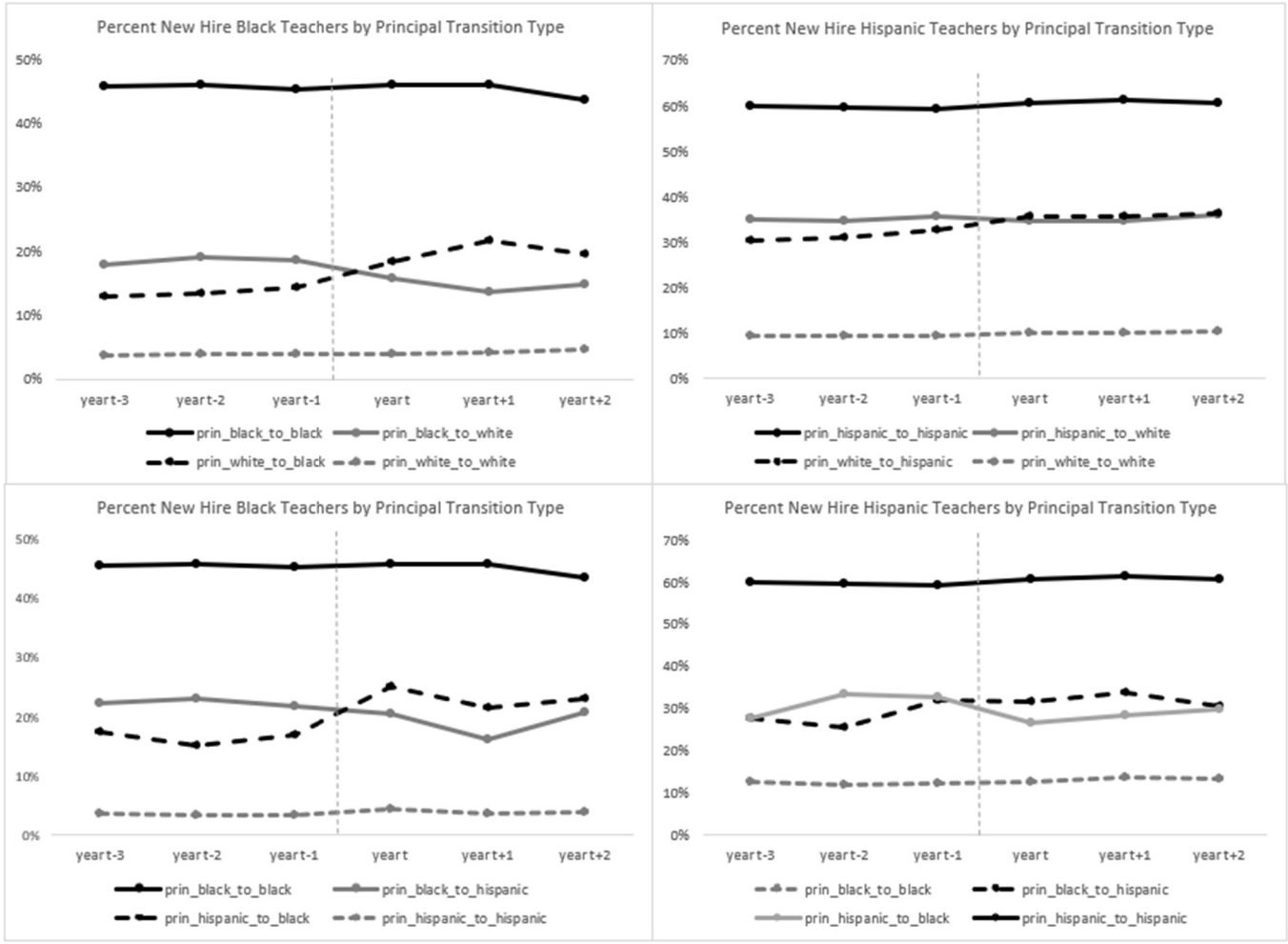


Figure 2. Percentage of Black and Hispanic Teacher Hires Before and After Principal Transition

Note: This figure plots event studies (six-year window) of the share of a school's newly hired teachers that are Black (left panels) / Hispanic (right panels) in each year. Transitions are limited to cases where each principal stayed at least three years in the school.

Results

To determine the effects of principal race and sex on the hiring of Black and Hispanic male and female teachers, linear probability models were estimated of the likelihood that a newly hired teacher was a member of each of four race-sex groups. Results of these models are shown in Table 6 below. Black male and female teachers make up a larger share of new hires at schools when they are led by Black principals who replaced white principals, and this effect is even larger for Black female teachers at schools with Black female principals. As shown in the first column, Black female principals hire 5.2 percentage points more Black female teachers relative to when those same campuses are led by white male principals. Black principals hired 1.4 percentage points more Black male teachers, with no differences by gender of the principal. Estimates of the effect of Hispanic principals replacing white principals on the hiring of Hispanic male and female teachers are shown in the third and fourth columns of Table 6. Hispanic female principals hired 2.1 percentage points more Hispanic female teachers than when the same school was led by a white male principal. Hispanic principals hired 0.7 percentage points more Hispanic male teachers, with no effect of principal gender. None of these effects was detected based on an indicator for principal race and sex in the subsequent year, an important nullification test (see Appendix). A change in the race or sex of the principal next year should not affect hires of teachers in the current year, so measures of change in the principal race or sex in the following year are not expected to be significant.

Change in the demographic makeup of the student body at schools was also associated with increases in the share of newly hired Black and Hispanic male and female teachers, as shown in the bottom half of Table 6. Increases in the share of Black students at the same campus led to more Black teachers hired, with larger effects for female than male teachers. Hispanic

teachers made up smaller shares of new hires at schools when the share of Black students increased. Increases in the share of Hispanic students at a campus similarly led to more Hispanic teachers hired, again with larger effects for female than male teachers, as well as small increases in the share of Black teachers among new hires.

To assess whether principal race and sex affect the likelihood of teacher retention, linear probability models of teacher exit were estimated within teachers of each race-sex group, as shown in Table 7 below. Black teachers of both sexes were less likely to leave their schools when led by a Black principal relative to when the same school was led by a white principal. Black female teachers were more likely to leave their schools when they were led by female principals relative to male principals, but there were no effects of principal gender on turnover among Black male teachers. Hispanic female teachers were slightly more likely to leave their roles when their school was led by a Hispanic principal who replaced a white principal, and they were also more likely to exit when led by a female principal who replaced a male principal. There were no effects of principal race or sex on probability of turnover among Hispanic male teachers.

Change in student demographics at the school were associated with changes in likelihood of teacher exit for some groups of teachers. Black female teachers were less likely to exit schools when the share of either Black or Hispanic students increased at the school, while Black male teachers were less likely to exit when the share of Hispanic students increased. Hispanic female teachers were slightly more likely to exit their schools when the share of Hispanic students increased. Change in student demographic characteristics did not exhibit effects on the likelihood of Hispanic male teacher exit.

Table 6. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Black Female, Black Male, Hispanic Female, or Hispanic Male

	New Teacher Black Female	New Teacher Black Male	New Teacher Hispanic Female	New Teacher Hispanic Male
Principal Characteristics				
Female principal	0.000	0.000	-0.002	-0.000
	(0.004)	(0.001)	(0.001)	(0.001)
Same race principal	**0.041*** **	**0.014*** **	**0.015*** **	**0.007*** **
	(0.004)	**(0.003)**	**(0.003)**	**(0.002)**
Same race principal * Female principal	**0.011** **	-0.002	**0.006***	-0.002
	(0.005)	(0.003)	**(0.003)**	(0.002)
Campus Characteristics				
Pct Black students	**0.309*** **	**0.107*** **	**-0.042** **	**-0.030*** **
	(0.02)	**(0.02)**	**(0.02)**	**(0.01)**
Pct Hispanic students	**0.04*** **	**0.03*** **	**0.216*** **	**0.06*** **
	(0.01)	**(0.007)**	**(0.02)**	**(0.01)**
Observations	890,631	890,631	890,631	890,631
R^2	0.189	0.08	0.187	0.107

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends. Models also control for other principal characteristics (years of experience, prior years as principal at the campus, highest degree earned – MA or PhD indicators) and school characteristics (total enrollment, proportion Black students, proportion Hispanic students, proportion students eligible for free- or reduced-price lunch, geographic locale). Full model results in the Appendix.

** p < 0.10, ** p <0.05, *** p<0.01*

Table 7. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover

	Teacher Exit: Black Female	Teacher Exit: Black Male	Teacher Exit: Hispanic Female	Teacher Exit: Hispanic Male
Principal Characteristics				
Female principal	**0.01****	0.004	**0.011*****	0.004
	(0.004)	(0.006)	**(0.003)**	(0.004)
Same race principal	**-0.012****	**-0.02*****	**0.006***	0.004
	(0.006)	**(0.008)**	**(0.003)**	(0.005)
Same race principal * Female principal	0.004	0.01	-0.005	0.003
	(0.007)	(0.01)	(0.004)	(0.01)
Campus Characteristics				
Pct Black students	**-0.102*****	-0.036	0.016	0.060
	(0.03)	(0.05)	(0.03)	(0.05)
Pct Hispanic students	**-0.15*****	**-0.124*****	**0.029***	-0.005
	(0.03)	**(0.05)**	**(0.02)**	(0.03)
Observations	450,707	143,627	1,072,563	355,387
R^2	0.067	0.096	0.049	0.08

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects and control for other teacher characteristics (years of experience, years at current campus, highest degree earned – MA or PhD indictors), other principal characteristics (years of experience, prior years as principal at the campus, highest degree earned – MA or PhD indicators) and school characteristics (total enrollment, proportion Black students, proportion Hispanic students, proportion students eligible for free- or reduced-price lunch, geographic locale). Full model results in the Appendix. Among Black female teachers, 520 were singleton observations within their campus and dropped, resulting in the included n = 450,707. Among Black male teachers, 668 were singleton observations and dropped; among Hispanic female teachers, 302 were singleton observations and dropped; among Hispanic male teachers, 612 were singleton observations and dropped.

** p < 0.10, ** p <0.05, *** p<0.01*

Discussion

This study adds to literature on relational demography and representative bureaucracy in the education workforce by estimating the causal impact of racial and gender congruence between teachers and principals on teacher hiring and turnover, as well as by working to extend findings on racial congruence among Black and white teachers and principals to a sample with a significant share of Hispanic teachers and principals. A key finding is that gender congruence has an additive effect on teacher hiring above and beyond that of racial congruence among Black and Hispanic female teachers. Black principals hired around 4 percentage points more Black female teachers relative to white principals they replaced, but Black female principals hired an additional 1.1 percentage points more Black female teachers than did Black male principals. The magnitudes of effects were smaller for hires of Hispanic female teachers, but the additive effect of race and gender matching was present as well.

There was not a significant effect of principal gender on likelihood of hiring Black or Hispanic male teachers, suggesting no differences beyond the racial congruence. This suggests evidence of similarity attraction along both racial and gender dimensions for female principals but not for male principals. It is possible that gender identity is more salient to women who hold these positions than it is for men, as the principalship remains more male-dominated relative to the teacher workforce (Riordan et al 2005). Additionally, the idea from representative bureaucracy that managers who are members of groups that have historically faced discrimination may actively work to counter that discrimination by providing material support to similar subordinates suggests that Black and Hispanic women who have been able to accede to these positions of leadership may actively work to hire other Black and Hispanic women (Grissom et al 2012, Selden 1997).

That Black teachers were less likely to leave their schools when led by a Black principal who replaced a white principal aligns with theory and prior work, most directly findings from Bartanen and Grissom (2021). Several other findings on teacher turnover were unexpected, particularly that Black and Hispanic women were more likely to exit their roles when led by a female principal relative to when a male principal led the same school. Prior work on principal and teacher gender congruence has demonstrated consistently negative effects on satisfaction and likelihood of retention among male teachers led by female principals, but no other work has identified negative effects of female principals on outcomes for female teachers (Grissom et al 2012). Additionally, the finding that Hispanic female teachers were more likely to exit schools when a Hispanic principal replaced a white principal was counter to expectations from representative bureaucracy suggesting more positive work experiences for employees with racially congruent managers (Grissom and Keiser 2011). It is possible that these exits could represent promotions to other roles, which would be consistent with representative bureaucracy; indeed, follow up analysis of the type of teacher transition showed that Hispanic female teachers were specifically more likely to take on new roles within education when a Hispanic principal replaced a white principal, rather than to transfer to a new campus or to leave educational employment.

Turning to comparisons of effect sizes of racial congruence on hiring between Black principals and teachers and those between Hispanic principals and teachers, effects for Black principals and teachers were larger than those for Hispanic principals and teachers, consistent with findings on racial congruence between students and teachers (Redding 2019). This may suggest different levels of similarity identification between Hispanic principals and teachers relative to that between Black principals and teachers, or it may be a function of the

demographics of local labor markets around schools led by Hispanic relative to Black principals. Other studies of Hispanic students and teachers point to significant diversity of populations within those identified as Hispanic along linguistic and national origin dimensions, suggesting that assumptions of shared cultural understanding and experience based on such a broad identifier may be faulty (Egalite 2015, Seah 2021). The Hispanic population in Texas, however, is much more homogenous in national origin than are samples from studies cited above, with more than 80% of Hispanics in the state of Mexican origin (Egalite 2015, Texas Demographic Center 2021). Local labor markets may be a larger factor, with significant concentration of Hispanic individuals in districts where Hispanic principals lead schools. Indeed, as shown in Table 3 above, more than 80% of students are Hispanic at schools led by Hispanic principals; by comparison, just over 40% of students are Black at schools led by Black principals. As reasonable proxies for demographics of local communities, the concentration of Hispanic students in schools led by Hispanic principals suggest that these schools are located in areas where local labor markets are likely also largely made up of Hispanic individuals. This may limit the potential pool of teachers such that additional effects of a Hispanic principal on the likelihood that a newly hired teacher is Hispanic may be constrained.

Conclusions

In sum, these findings reinforce the notion that a racially diverse principal workforce is critical to recruiting greater numbers of Black – and based on this study, Hispanic – teachers to better serve an increasingly diverse student population. Inclusion of race and sex interactions in this study illuminate stronger hiring effects for Black and Hispanic women by principals who are both racially and gender congruent, but the findings on principal gender effects on teacher retention are more complex. Further studies of determinants of teacher retention within race and sex groups are merited to determine what policies and practices might help schools keep more of their Black and Hispanic male and female teachers. There is increasing evidence that students, particularly those with greater obstacles to academic success, are more likely to experience school positively and achieve at higher levels when taught by a teacher of the same race and gender. In light of the low odds that a Black or Hispanic student, particularly a male student, will be taught by such a teacher, efforts to understand hiring and retention dynamics across school workforce levels is an essential part of building toward educational equity.

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Appendix

Table A1. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Black Female

New Black Female Teacher	Main Model	Main Model - with *t+1* principal characteristics
Principal Characteristics		
Female principal	0.000	0.000
	(0.001)	(0.001)
Black principal	0.041***	0.026***
	(0.004)	(0.005)
Black principal * Female principal	0.010**	0.007
	(0.005)	(0.006)
Hispanic principal	0.002	0.001
	(0.002)	(0.003)
Hispanic principal * Female principal	0.001	0.004
	(0.003)	(0.003)
Other race principal	0.003	0.004
	(0.006)	(0.003)
Other race principal * Female principal	0.008	0.000
	(0.008)	(0.008)
Principal Characteristics - following year		
Female principal (next year)		0.000
		(0.001)
Black principal (next year)		0.001
		(0.004)
Black principal (next year) * Female principal (next year)		0.009
		(0.006)
Hispanic principal (next year)		-0.001
		(0.002)
Hispanic principal (next year) * Female principal (next year)		-0.004
		(0.003)
Other race principal (next year)		-0.002
		(0.006)
Other race principal (next year) * Female principal (next year)		0.003
		(0.009)
Other Principal Characteristics		
Principal years of experience	-0.000	-0.000
	(0.0001)	(0.0001)
Principal 0 prior years at campus	0.002	0.001
	(0.002)	(0.002)
Principal 1 to 4 prior years at campus	0.003**	0.003**
	(0.001)	(0.001)
Principal highest degree Masters	0.000	0.000
	(0.002)	(0.002)
Principal highest degree PhD	-0.002	-0.002
	(0.003)	(0.003)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A1. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Black Female - Continued

New Black Female Teacher	Main Model	Main Model - with *t+1* principal characteristics
Campus Characteristics		
Pct Black students	0.309***	0.29***
	(0.02)	(0.02)
Pct Hispanic students	0.04***	0.05***
	(0.01)	(0.01)
Pct students eligible FRPL	0.002	-0.002
	(0.005)	(0.005)
Total student enrollment (100s)	0.001*	0.001*
	(0.0003)	(0.0004)
Observations	890,631	890,631
R^2	0.192	0.191

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A2. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Black Male

New Black Male Teacher	Main Model	Main Model - with *t+1* principal characteristics
Principal Characteristics		
Female principal	-0.000	-0.001
	(0.001)	(0.001)
Black principal	0.016***	0.006**
	(0.002)	(0.003)
Black principal * Female principal	-0.002	0.006
	(0.003)	(0.004)
Hispanic principal	0.002	0.001
	(0.002)	(0.002)
Hispanic principal * Female principal	-0.002	-0.001
	(0.002)	(0.002)
Other race principal	-0.001	0.003
	(0.004)	(0.006)
Other race principal * Female principal	0.002	-0.002
	(0.005)	(0.007)
Principal Characteristics - following year		
Female principal (next year)		0.001
		(0.001)
Black principal (next year)		0.010
		(0.03)
Black principal (next year) *		
Female principal (next year)		-0.012
		(0.03)
Hispanic principal (next year)		0.005
		(0.03)
Hispanic principal (next year) *		
Female principal (next year)		0.005
		(0.03)
Other race principal (next year)		0.005
		(0.03)
Other race principal (next year) *		
Female principal (next year)		0.005
		(0.03)
Other Principal Characteristics		
Principal years of experience	-0.000	-0.000
	(0.0001)	(0.0001)
Principal 0 prior years at campus	-0.001	-0.001
	(0.0001)	(0.0001)
Principal 1 to 4 prior years at campus	0.0002	0.0001
	(0.001)	(0.001)
Principal highest degree Masters	-0.002*	-0.002*
	(0.001)	(0.001)
Principal highest degree PhD	-0.001	-0.001
	(0.002)	(0.002)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A2. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Black Male - Continued

New Black Male Teacher	Main Model	Main Model - with *t+1* principal characteristics
Campus Characteristics		
Pct Black students	0.107***	0.113***
	(0.02)	(0.01)
Pct Hispanic students	0.03***	0.03***
	(0.007)	(0.007)
Pct students eligible FRPL	0.004	0.003
	(0.003)	(0.003)
Total student enrollment (100s)	0.0003	0.0003
	(0.0002)	(0.0002)
Observations	890,631	890,631
R^2	0.08	0.08

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A3. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Hispanic Female

New Hispanic Female Teacher	Main Model	Main Model - with *t+1* principal characteristics
Principal Characteristics		
Female principal	-0.003*	-0.001
	(0.001)	(0.002)
Black principal	-0.002	0.004
	(0.001)	(0.004)
Black principal * Female principal	0.002	-0.001
	(0.004)	(0.004)
Hispanic principal	0.015***	0.010***
	(0.003)	(0.004)
Hispanic principal * Female principal	0.005*	0.004*
	(0.002)	(0.002)
Other race principal	-0.006	-0.003
	(0.006)	(0.008)
Other race principal * Female principal	-0.003	-0.008
	(0.01)	(0.01)
Principal Characteristics - following year		
Female principal (next year)		0.0002
		(0.002)
Black principal (next year)		-0.003
		(0.003)
Black principal (next year) *		
Female principal (next year)		-0.001
		(0.004)
Hispanic principal (next year)		0.003
		(0.004)
Hispanic principal (next year) *		
Female principal (next year)		0.008
		(0.005)
Other race principal (next year)		-0.003
		(0.007)
Other race principal (next year) *		
Female principal (next year)		-0.001
		(0.01)
Other Principal Characteristics		
Principal years of experience	-0.000	-0.000
	(0.0001)	(0.0001)
Principal 0 prior years at campus	-0.003*	-0.003
	(0.0018)	(0.002)
Principal 1 to 4 prior years at campus	-0.003*	-0.003*
	(0.0015)	(0.0015)
Principal highest degree Masters	-0.0002	0.0003
	(0.002)	(0.002)
Principal highest degree PhD	-0.002	-0.001
	(0.003)	(0.003)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A3. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Hispanic Female - Continued

New Hispanic Female Teacher	Main Model	Main Model - with *t+1* principal characteristics
Campus Characteristics		
Pct Black students	-0.042**	-0.046**
	(0.02)	(0.02)
Pct Hispanic students	0.216***	0.229***
	(0.02)	(0.02)
Pct students eligible FRPL	-0.025***	-0.027***
	(0.006)	(0.006)
Total student enrollment (100s)	-0.0003	-0.0003
	(0.0003)	(0.0003)
Observations	890,631	890,631
R^2	0.254	0.257

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A4. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Hispanic Male

New Hispanic Male Teacher	Main Model	Main Model - with *t+1* principal characteristics
Principal Characteristics		
Female principal	0.001	-0.001
	(0.001)	(0.001)
Black principal	-0.004*	-0.008**
	(0.002)	(0.003)
Black principal * Female principal	0.005	0.008**
	(0.004)	(0.003)
Hispanic principal	0.006**	0.006*
	(0.002)	(0.002)
Hispanic principal * Female principal	-0.002	0.001
	(0.003)	(0.004)
Other race principal	0.004	-0.001
	(0.005)	(0.007)
Other race principal * Female principal	-0.003	0.005
	(0.01)	(0.01)
Principal Characteristics - following year		
Female principal (next year)		0.0001
		(0.001)
Black principal (next year)		0.003
		(0.002)
Black principal (next year) *		
Female principal (next year)		-0.001
		(0.002)
Hispanic principal (next year)		-0.003
		(0.003)
Hispanic principal (next year) *		
Female principal (next year)		-0.004
		(0.004)
Other race principal (next year)		-0.003
		(0.006)
Other race principal (next year) *		
Female principal (next year)		0.004
		(0.01)
Other Principal Characteristics		
Principal years of experience	-0.000	-0.000
	(0.0001)	(0.0001)
Principal 0 prior years at campus	-0.001	-0.001
	(0.001)	(0.001)
Principal 1 to 4 prior years at campus	0.0004	0.0003
	(0.001)	(0.001)
Principal highest degree Masters	-0.002	-0.002
	(0.001)	(0.002)
Principal highest degree PhD	-0.003	-0.002
	(0.002)	(0.002)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A4. Estimates of the Effect of Principal Race and Sex on the Probability that a Newly Hired Teacher is a Hispanic Male - Continued

New Hispanic Male Teacher	Main Model	Main Model - with *t+1* principal characteristics
Campus Characteristics		
Pct Black students	-0.030***	-0.032***
	(0.01)	(0.01)
Pct Hispanic students	0.06***	0.059***
	(0.01)	(0.01)
Pct students eligible FRPL	0.009*	0.011**
	(0.004)	(0.004)
Total student enrollment (100s)	-0.0002	-0.0003
	(0.0002)	(0.0002)
Observations	890,631	890,631
R^2	0.124	0.125

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year when that teacher was newly hired at a campus, representing the total pool of new hires at schools in each year. The dependent variable is an indicator for whether the teacher is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include campus and year fixed effects, as well as controls for campus-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A5. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Black Female Teachers

Black Female Teacher	Teacher Exit
Principal Characteristics	
Female principal	0.010***
	(0.004)
Black principal	-0.14***
	(0.006)
Black principal * Female principal	0.004
	(0.007)
Hispanic principal	-0.01
	(0.007)
Hispanic principal * Female principal	0.019**
	(0.008)
Other race principal	0.02
	(0.02)
Other race principal * Female principal	-0.03
	(0.02)
Teacher Characteristics	
Teacher years of experience	-0.0004***
	(0.0001)
Teacher 0 prior years at campus	0.098***
	(0.003)
Teacher 1 to 4 prior years at campus	0.053***
	(0.002)
Teacher highest degree Masters	0.048***
	(0.002)
Teacher highest degree PhD	0.082***
	(0.01)
Other Principal Characteristics	
Principal years of experience	-0.001**
	(0.0004)
Principal 0 prior years at campus	0.018***
	(0.004)
Principal 1 to 4 prior years at campus	0.004
	(0.003)
Principal highest degree Masters	0.004
	(0.005)
Principal highest degree PhD	0.01
	(0.007)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Black female teachers, 520 were singleton observations within their campus and dropped, resulting in the included n = 450,707.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A5. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Black Female Teachers - Continued

Black Female Teacher	Teacher Exit
District Characteristics	
Pct Black students	-0.114***
	(0.03)
Pct Hispanic students	-0.15***
	(0.03)
Pct students eligible FRPL	-0.007
	(0.01)
Total student enrollment (100s)	-0.0003
	(0.0001)
Observations	450,707
R^2	0.07

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Black female teachers, 520 were singleton observations within their campus and dropped, resulting in the included n = 450,707.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A6. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Black Male Teachers

Black Male Teacher	Teacher Exit
Principal Characteristics	
Female principal	0.007
	(0.006)
Black principal	-0.02***
	(0.008)
Black principal * Female principal	0.011
	(0.01)
Hispanic principal	0.006
	(0.008)
Hispanic principal * Female principal	-0.008
	(0.01)
Other race principal	0.042
	(0.03)
Other race principal * Female principal	-0.048
	(0.03)
Teacher Characteristics	
Teacher years of experience	-0.0006***
	(0.0001)
Teacher 0 prior years at campus	0.114***
	(0.006)
Teacher 1 to 4 prior years at campus	0.068***
	(0.004)
Teacher highest degree Masters	0.031***
	(0.004)
Teacher highest degree PhD	0.031**
	(0.01)
Other Principal Characteristics	
Principal years of experience	-0.0003
	(0.0001)
Principal 0 prior years at campus	0.023***
	(0.006)
Principal 1 to 4 prior years at campus	0.002
	(0.005)
Principal highest degree Masters	-0.008
	(0.007)
Principal highest degree PhD	-0.008
	(0.009)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Black male teachers, 668 were singleton observations within their campus and dropped, resulting in the included n = 143,627.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A6. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Black Male Teachers - Continued

Black Male Teacher	Teacher Exit
District Characteristics	
Pct Black students	-0.036
	(0.05)
Pct Hispanic students	-0.124***
	(0.05)
Pct students eligible FRPL	-0.032*
	(0.02)
Total student enrollment (100s)	-0.001
	(0.001)
Observations	143,627
R^2	0.098

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Black male teachers, 668 were singleton observations within their campus and dropped, resulting in the included n = 143,627.

Table A7. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Hispanic Female Teachers

Hispanic Female Teacher	Teacher Exit
Principal Characteristics	
Female principal	0.011***
	(0.003)
Black principal	0.007
	(0.006)
Black principal * Female principal	-0.009
	(0.01)
Hispanic principal	0.006*
	(0.003)
Hispanic principal * Female principal	-0.005
	(0.004)
Other race principal	0.014
	(0.01)
Other race principal * Female principal	-0.016
	(0.01)
Teacher Characteristics	
Teacher years of experience	0.0006***
	(0.0001)
Teacher 0 prior years at campus	0.088***
	(0.002)
Teacher 1 to 4 prior years at campus	0.042***
	(0.001)
Teacher highest degree Masters	0.055***
	(0.001)
Teacher highest degree PhD	0.051***
	(0.01)
Other Principal Characteristics	
Principal years of experience	0.0002
	(0.0003)
Principal 0 prior years at campus	0.016***
	(0.003)
Principal 1 to 4 prior years at campus	0.007***
	(0.002)
Principal highest degree Masters	0.001
	(0.004)
Principal highest degree PhD	0.006
	(0.005)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Hispanic female teachers, 302 were singleton observations within their campus and dropped, resulting in the included n = 1,072,563.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A7. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Hispanic Female Teachers - Continued

Hispanic Female Teacher	Teacher Exit
District Characteristics	
Pct Black students	0.016
	(0.03)
Pct Hispanic students	0.029*
	(0.02)
Pct students eligible FRPL	0.003
	(0.006)
Total student enrollment (100s)	0.004***
	(0.001)
Observations	1,072,563
R^2	0.053

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Hispanic female teachers, 302 were singleton observations within their campus and dropped, resulting in the included n = 1,072,563.

Table A8. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Hispanic Male Teachers

Hispanic Male Teacher	Teacher Exit
Principal Characteristics	
Female principal	0.006
	(0.004)
Black principal	0.020**
	(0.008)
Black principal * Female principal	-0.011
	(0.01)
Hispanic principal	0.002
	(0.004)
Hispanic principal * Female principal	0.005
	(0.006)
Other race principal	0.028
	(0.02)
Other race principal * Female principal	-0.033
	(0.02)
Teacher Characteristics	
Teacher years of experience	0.0008***
	(0.0001)
Teacher 0 prior years at campus	0.11***
	(0.004)
Teacher 1 to 4 prior years at campus	0.050***
	(0.002)
Teacher highest degree Masters	0.048***
	(0.003)
Teacher highest degree PhD	0.042***
	(0.01)
Other Principal Characteristics	
Principal years of experience	0.0002
	(0.0004)
Principal 0 prior years at campus	0.02***
	(0.004)
Principal 1 to 4 prior years at campus	0.009***
	(0.003)
Principal highest degree Masters	-0.005
	(0.006)
Principal highest degree PhD	-0.011
	(0.008)

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Hispanic male teachers, 612 were singleton observations within their campus and dropped, resulting in the included n = 355,387.

* p < 0.10, ** p <0.05, *** p<0.01

Table A8. Estimates of the Effect of Principal Race and Sex on the Probability of Teacher Turnover Among Hispanic Male Teachers - Continued

Hispanic Male Teacher	Teacher Exit
District Characteristics	
Pct Black students	0.066
	(0.05)
Pct Hispanic students	-0.005
	(0.03)
Pct students eligible FRPL	-0.003
	(0.008)
Total student enrollment (100s)	0.0002
	(0.0007)
Observations	355,387
R^2	0.076

Note: School-level clustered standard errors in parentheses. Each observation is a teacher-year, representing the total pool of teachers at schools in each year. In each column the dependent variable is an indicator for whether the teacher in the group listed in the header exited their role in the school between years *t* and *t+1.* Models are linear probability models estimated via OLS. Models include district and year fixed effects. Among Hispanic male teachers, 612 were singleton observations within their campus and dropped, resulting in the included n = 355,387.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A9. Sample Characteristics for Complete Observations and Observations Missing Data

	Complete Observations	Missing Covariate(s)
Percent of total teacher-year observations	99.8	0.2
	(n = 6,436,389)	(n = 14,540)
Characteristic	Mean	Mean
Teacher Characteristics		
White Female	0.52	0.45
White Male	0.15	0.19
Black Female	0.08	0.09
Black Male	0.03	0.04
Hispanic Female	0.16	0.18
Hispanic Male	**0.06**	**0.12**
Other Race Female	0.02	0.02
Other Race Male	0.01	0.008
Years of experience as teacher	11.3	15.4
0 prior years at campus	0.14	0.13
1 to 4 prior years at campus	0.34	0.31
5 or more prior years at campus	0.53	0.56
Highest degree MA	0.23	0.26
Highest degree doctorate	0.01	0.01
Principal Characteristics		
White Female	0.36	0.28
White Male	0.29	0.31
Black Female	0.07	0.07
Black Male	0.04	0.06
Hispanic Female	0.13	0.13
Hispanic Male	0.09	0.13
Other Race Female	0.01	0.01
Other Race Male	0.01	0.01
0 prior years at campus	0.21	0.26
1 to 4 prior years at campus	0.48	0.48
5 or more prior years at campus	0.31	0.26
Highest degree MA	0.87	0.86
Highest degree doctorate	0.06	0.07
Campus Characteristics		
Proportion Black	0.14	0.09
Proportion Hispanic	0.47	0.58
Proportion FRPL	0.46	0.64
Enrollment (100s)	**9.4**	**2.6**
Elementary school	0.49	0.2
Middle school	0.22	0.1
High school	0.27	0.11
Other school	**0.02**	**0.59**
Charter school	0.02	0.01
Urban	0.44	0.59
Suburban	0.31	0.3
Town	0.10	0.07
Rural	0.15	0.05

Chapter 2: Employment Network Connection in Principal Candidate Hiring

Research on career advancement has demonstrated persistent disparities in the likelihood of promotion for women, Black, and Hispanic individuals across a variety of industries. Public school leadership is no exception, with educators in these groups consistently less likely to be hired as school principals despite being more likely to seek certification for these roles than their white and male counterparts. Social closure processes in which higher status individuals exclude others from accessing the most lucrative positions through reduced networking and mentoring opportunities may be particularly important in advancement to school leadership. Prior research has highlighted differences in job-seeking benefits of employment networks based on the racial and gender composition of the networks, as well as on the race and gender of the individual job seeker in those networks. This study seeks to estimate the association of a measure of potential employment network connection between individuals with administrative certification and superintendents of the districts in which they work with the likelihood of hire into school principal roles. Using administrative data for public schools and districts in Texas between 1998 and 2019, this study finds evidence that employment network connections with district superintendents were associated with increased likelihood of hire for Black and Hispanic candidates only when the superintendent with whom they shared that connection was also Black or Hispanic.

Introduction

Women, Black, and Hispanic individuals are less likely to be promoted into the highest levels of leadership within organizations, or to face slower paces of advancement than white men (Crampton and Mishra 1999, Guthrie and Roth 1999, James 2000, Marini 1980). Social closure theory suggests a potential mechanism for the observed disparities in likelihood of advancement for these individuals. This model suggests that higher status individuals may limit access to networks and mentoring for employees of other groups, and that this reduced access may result in decreased opportunities for advancement that have been found among women, Black, and Hispanic employees (Ibarra 1995, Reskin 2002, Reskin and Roos 1990, Tomaskovic-Devey 1993a, 1993b).

Research on the composition of employment networks highlights more positive outcomes for individuals with connections to white-male dominant employment networks, including gaining higher-paying jobs and receiving more job offers (Elliot 1999, McDonald 2011, Smith 2000, Stainback 2008). Findings on whether benefits of membership in white male employment networks are conferred equally to job-seekers who are themselves not white males are mixed, with some evidence that gender congruent contacts are more likely to offer active referrals for prospective employees than are those who are gender incongruent (McDonald 2011).

Findings from education workforce research have confirmed some expectations from these theories as potential explanations for lower likelihood of hire into school leadership for Black, Hispanic, and female educators. Research on the principal pipeline has identified that employment networks and mentoring play a key role in whether teachers pursue leadership roles and are ultimately successful in doing so, and that these processes often benefit white men (Myung et al 2011, Young and McLeod 2001). These prior studies of mentoring have looked

only at principals already hired, with no systematic examination of how such networks may affect outcomes for principal candidates.

This study seeks to test expectations from social closure and answer remaining questions from the literature cited above as to whether shared employment networks with district superintendents increase the likelihood of hire for candidates overall, or for female, Black and Hispanic candidates specifically. Using discrete-time survival analysis to assess the likelihood of hire across candidate careers, this study finds evidence that Black and Hispanic candidates who shared a prior employment network with their superintendent were also more likely to be hired if the superintendent was of the same race.

Literature Review

Theoretical Framework for Differential Career Advancement

While overall racial and gender segregation across occupations has decreased over time, women, Black, and Hispanic individuals remain less likely to advance within their occupations. Research on career trajectories has demonstrated that while men and women enter the workforce in roles with roughly the same level of occupational status, men subsequently experience greater upward mobility in their careers, particularly into the highest levels of leadership (Crampton 1999, Marini 1980). The share of women in middle management positions has grown over the previous decades, with women now holding close to half of these positions. However, at the executive management level, women make up only 17% of employees, a number that has not increased substantially over time (Guthrie and Roth 1999). Black managers also reported slower rates of promotion and less support throughout their careers than did white managers at the same firms (James 2000). Similarly, a variety of studies of civil service employees consistently found higher rates of promotion for male and white employees, despite the relatively egalitarian reputation of such organizations (Daley 1996, Naff 1994).

Differential likelihood of career advancement has been attributed to the presence of social closure processes within organizations, through which individuals reserve the most valued resources for others who share their ascriptive characteristics (Tilly 1998). Kanter (1977) referred to a "shadow structure" within organizations whereby women, Black, and Hispanic workers are excluded from informal activities and social connections, which in turn reduces their access to opportunities for promotion. In practice, women are often excluded from desirable jobs by men through reduced opportunities for networking, mentorship, or on-the-job training (Reskin and Roos 1990, Tomaskovic-Devey 1993a, 1993b). Reskin (1993, 1998) identified workplace

inequality as arising in part from rank segregation, where the opportunities to pursue positions of authority are monopolized by men. These processes are particularly likely in workplace settings where there are not clear formal requirements for education and training or transparent hiring processes for promotion, such that the current leadership has greater discretion in selection and promotion decisions (Tomaskovic-Devey 1993b, Tomaskovic-Devey et al. 1996).Other work has looked at the specific likelihood of access to higher paying jobs for Black and Hispanic workers, demonstrating the role that racial segregation of networks plays in reducing opportunities for hiring into high-status jobs (Ibarra 1995, Reskin 2002).

The racial and gender composition of employment networks held by individuals has been shown to be differentially associated with employment outcomes. Specifically, individuals who access job referrals through network connections with white male contacts secure jobs with higher wages than do those who use connections with female or Black or Hispanic contacts (Elliot 1999, Smith 2000, Stainback 2008). In addition, white male-dominant employment networks tend to contain higher-status individuals than do other kinds of networks, and job seekers in these networks receive more job leads than do those in female, Black, or Hispanic-dominated employment networks (McDonald 2011). However, at one large firm made up primarily of entry-level jobs, Black, Hispanic, and Asian employees were more likely than white employees to produce referral applicants (Fernandez and Fernandez-Mateo 2006).

At the same time, the composition of employment networks varies systematically with the race and gender of individuals, with women and Black and Hispanic individuals reporting smaller networks that included fewer high status contacts than those of white men (Ibarra 1997, Marsden 1987, McGuire 2000, Smith 2000). Employment networks tend to be segregated by race and gender, likely due to existing residential and occupational segregation, as well as

individual homophily preferences for similar others (Collins 1989, Massey and Denton 1993, McPherson et al 2001).

Relatively little work has systematically examined the interactions of employment network composition with the race or gender of prospective employees to assess whether membership in white male employment networks confers benefits to all individuals, or if those benefits are reserved for other white males. McDonald (2011) used a nationally representative sample to explore variation in individuals' access to employment-based social capital conditional on the composition of their employment networks and found differences in the specific kinds of benefits conferred. Individuals in white male networks were equally likely to receive job information benefits, regardless of their race or gender. However, more intensive job finding assistance like personal referral were more frequent for gender-homophilous contacts, with no differences by race. Fernandez and Fernandez-Mateo (2006) also found that applicants who were referred for entry-level jobs by current employees at one large firm were most likely to have been referred by a racially or gender homophilous contact. In their study, whites were the most racially insular of any group, with nearly 80% of applicants referred by white employees also being white.

Principal Hiring and Superintendents

Studying the likelihood of hire into school leadership provides an opportunity to explore the mechanisms identified above that may contribute to differential rates of promotion by gender and race. Black, Hispanic, and female educators are all more likely than their white or male counterparts to seek school leadership certification and roles, with one study finding that Black and Hispanic teachers were twice as likely to seek such certification (DeAngelis and O'Connor 2012, Fuller et al 2007, Williams and Loeb 2012). However, a variety of longitudinal studies of

potential principal candidates have found that women, Black, and Hispanic individuals are less likely to be hired and face longer delays before first employment as a principal (Bailes and Guthery 2020, Crawford and Fuller 2017, Davis et al 2017).

Other prior work on principal hiring has focused explicitly on the role of networking and mentoring processes in the likelihood that educators pursue and are hired into principal roles. Weiner and Burton (2016) highlighted that women have less access to mentoring and occupational networks helpful in becoming principals, identifying this as one of several challenges women face in the process. Myung and colleagues (2011) found that many current principals in Miami-Dade County Public schools were tapped by their own former principals for leadership positions while they had been teachers, and that principals were more likely to identify male teachers and teachers of their own ethnicity for future leadership positions. Research on leadership outside of education has also found that access to existing leaders and influential networks is a key factor in success for candidates in leadership pipelines and that these connections are particularly important for women (Carli and Eagly 2016, Hewlett et al 2010).

Employment network connections with superintendents may make it more likely that administrative candidates are hired as principals. In Texas, the site of this study, superintendents have significant discretion in principal hiring, suggesting a key role for informal processes like mentorship by a current supervisor in the likelihood of an individual teacher subsequently becoming a principal, the conditions under which social closure processes are most likely to occur (Tomaskovic-Devey 1993b, Tomaskovic-Devey et al 1996). To date, no work has examined the role of superintendent race and gender, or of principal candidate network connections with superintendents, on hiring into school leadership positions.

Present Contribution

This study seeks to fill this gap in the literature, guided by the theoretical models described above and building on prior work modeling the odds of hire into school principal roles among individuals with administrative credentials in Texas. To do so, this study includes an indicator for shared employment networks between superintendents and candidates to explore whether potential network connections between superintendents and administrative candidates are associated with increased likelihood of hire overall. Additionally, this study examines whether employment network connections with superintendents are differentially associated with likelihood of hire for women, Black, and Hispanic candidates overall or when the superintendent is the same race or gender as the candidate.

The current research also makes a series of methodological improvements over prior work on the principal pipeline. Previous studies using discrete-time survival modeling do not include characteristics of the district context likely to influence candidate hiring, nor do they capture the entire pool of individuals likely to be hired into school leadership. Another drawback of prior work is that hazard models have not adequately modeled the relationship of key covariates with time, leading to potentially biased parameter estimates. Models estimated in this study specify relationships between race and gender hazards and time to address this. Additionally, this study's models include a variety of candidate experience and credential characteristics from prior work on principal hiring, as well as new measures of district context including the supply of and demand for principal jobs in local areas, superintendent race and sex, and a measure of network connections with superintendents.

Methods

Sample and Inclusion Criteria

To analyze principal hiring and employment patterns, employee person-year files were constructed from administrative records of the Texas Education Administration (TEA) for the years 1997 through 2019. These files include information on the demographic characteristics of employees, the role they held in each year, and the campus and district location of that role, if applicable. These were merged with records of individuals who earned the credential required to be hired as a principal at a regular public school between 1998 and 2016. This time frame was used to ensure the individual was not already employed as a principal prior to the observable employment period and that all individuals in the sample were observed for at least three years following when they earned the credential for possible employment as a principal. Without information about actual applications for principal positions, earning the credential required to become a principal serves as a proxy for status as a candidate for a principal role.

Control Variables

Principal hiring research has shown that level of experience, race, and gender of candidates are important factors in determining who is hired and where (Fuller et al 2016). Prior experience as an assistant principal was included in addition to measures of overall experience in education, based on findings from Roza and Swartz (2003) that superintendents identified prior leadership experience as the most important factor in principal selection. Academic credentials, including highest degree earned, are noted as predictive of hiring into administrative roles in a variety of studies cited by DeAngelis and O'Connor (2012). In addition to degrees earned, Grissom and colleagues (2019) include administrator credential test scores as a measure of

principal effectiveness, leading to its inclusion here as a potential indicator of future effectiveness likely to be considered in hiring. As in Crawford and Fuller (2017), candidate scores on the credential test were included as z-scores within each year to account for changes in the assessment over the time period. Davis and colleagues (2017) identify a variety of school and district setting factors that have been found to influence principal retention decisions and hypothesized these are likely important in initial hiring and selection processes as well. These include enrolled student characteristics, such as the proportion of students who are Black, Hispanic, or eligible for free- or reduced-price lunch, as well as the geographic setting of the district (urban, suburban, town, or rural).

Fuller and colleagues (2016) also include measures of the number of principal jobs in a given region in models of principal hiring to reflect the supply of such positions. This study enhances this by including a measure of demand for those jobs as well, calculating a ratio of administrative candidates to vacant principal jobs in each district and year to reflect the relative competition for principal jobs over time. The number of individuals with administrative credentials not currently employed as principals in each district and year was divided by the number of vacant principal roles in each district and year to create the ratio of candidates to principal roles. Vacant roles were identified by including both principal roles at schools that newly opened in each year, as well as principal roles held by a different individual in year *t* than in year *t-1*. There are limitations to this measure, given that candidates from outside the district or even outside the state could apply for a principal role; however, the majority of individuals hired as principals were employed in the same district in the prior year, suggesting that candidates in the district are a reasonable proxy for a measure of demand for jobs in a given district.

Candidate mobility across districts is another factor that may contribute to the likelihood of hire. The average candidate worked in more than one district over the observed time span, and willingness of candidates to move districts is likely to increase their opportunity to take on an administrative role. To examine whether transferring districts is associated with increased odds of hire, an indicator for whether the candidate had moved to a new district from the prior year was included.

Individual employment experience characteristics and number of principal roles were constructed from TEA employee files, and other contextual characteristics of the districts were constructed from the Common Core of Data (CCD) to capture geographic and student demographic characteristics. The geographic locale of each district from the CCD was collapsed into four categories – urban, suburban, town, and rural. The percentage of students of each racial group in each district was included for each year as well, with white, Hispanic, Black and race – other as the categories (the latter category including Asian, Pacific Islander, Native American, and two or more races).

Superintendent Characteristics and Network Connections

Superintendent characteristics were created using state employment files to construct the race and sex of the superintendent of each district in each year as well as the superintendent's campus employment history. To construct a potential shared employment network indicator, the campus history of each superintendent was compared to that of the administrative candidates to determine if they had previously worked at the same campus, described in more detail below. This comparison did not include a restriction on time of employment other than taking place prior to when the superintendent took on their current role and prior to the current year for the

administrative candidate, so it is possible that the superintendent and candidate worked at the same campus many years apart, which is a limitation.

Missing Data

Around two percent of all individuals who earned administrative credentials over the period were missing data on one or more characteristics, most frequently candidate certification test score and highest degree earned. These individuals were more experienced than were those with complete data, and slightly more likely to be Hispanic. The exclusion of this group may slightly underestimate associations of Hispanic candidates with likelihood of hire as principal, though the small relative size of the group likely did not significantly affect the overall results. Comparisons of complete observations to those missing at least one covariate are shown in the Appendix[7].

Hire as Principal

The outcome of interest was whether the individual candidate was first employed as a principal at a regular public school in year t[8].

Analytic Strategy

To examine the dynamics of time to hire as principal among candidates of various race-sex groups, discrete-time hazard and survival models were estimated, following Singer and Willett (2003). Within each race or sex group, the following hazard model was estimated using

[7] Imputation of missing data is less typical in studies using administrative data, particularly those with a small number of covariates that could be used for imputation. For this reason, as well as the relatively small incidence of missing data, imputation was not performed.

[8] Because charter schools in the state do not require that an individual hold an administrative credential to be hired as a principal, hire as principal at a charter school was excluded as an outcome. Survival models require the definition of a population at risk of the event, and earning an administrative credential is not as clear of an indication of "risk" of hire as a charter principal as at a regular public school; in fact, fewer than half of individuals employed as principals of charter schools in the state ever earned an administrative credential. Models including and excluding hire as charter principals had nearly identical results (see Appendix).

maximum likelihood to describe in each period the probability that individual *i* was hired in period *j*, conditional on not having been hired in any prior year period, where *T* is the number of years since the individual earned their administrative certification:

$$(1)\ h(t_{ij}) = Pr[T_i = j \mid T_i \geq j\ ]$$

To examine differences for race and sex groups, logit transformations of hazards of hire from the above model were calculated across each period and examined graphically. This transformation allows for comparison of distances between groups over time to inform the proper specification of time in subsequent modeling (Singer and Willet 2003). Together, these non-parametric estimates for each race and sex group are presented graphically below.

To understand the associations of the above characteristics, both those that remained constant in value across all periods as well as those that changed over time, discrete-time logit hazard models were estimated. These included time-invariant measures as well as variables measured in year *t* or *t -1*. Time was measured in whole years from the time the individual earned their administrative credential, with the year it was awarded as time 0. Whether an individual had worked as an assistant principal was measured in year *t-1* of that individual's employment history. A measure was included to account for change in the number of principal jobs in the district, a year-over-year measure of whether the number of principal roles in the district had increased from year *t-1* to year *t.* Additionally, the ratio of candidates to vacant principal jobs in each district in year *t* was included. Prior studies of principal candidate hiring have included the school or district context only in the year in which a candidate earned their credential, omitting district moves by candidates following that initial setting (Crawford and Fuller 2017, Bailes and Guthery 2020). On average, candidates worked in 1.7 districts across

their careers, and characteristics of the same district changed over the long period of study. Including measures of district context in each year improves the ability to observe associations of district characteristics with odds of hire.

Characteristics of each district superintendent were measured in each year, including their sex and race as well as the list of schools the superintendent had worked in previously. Hiring decisions for principals whose employment begins in school year *t* likely occurred in year *t-1* and were under the purview of the superintendent of the district in year *t-1*. To reflect this, measures of race and sex of superintendents reflect the superintendent who led the district in year *t-1*. Similarly, the indicator for potential network connections between candidates and superintendents are based on the entire employment history of the superintendent who led the district in year *t-1*. For example, a record for an individual administrative candidate employed in district A in 2003 would include the race and sex of the superintendent who led district A in 2002. Additionally, the record would include an indicator for whether that candidate had, up to that year, ever worked at any of the schools included in the employment history of the superintendent who led district A in 2002. Comparisons of school records for superintendents and candidates in each district and year were operationalized as an indicator set to one if a candidate shared a prior school in common with the superintendent of the district in which they were currently working and zero if not.

To account for the varying baseline logit hazard in each period, a series of indicators for periods 1 through 21 (the maximum number of years a subject was observed in the sample) was included in the model, per Singer and Willet (2003). Initial results from the above exploration of logit hazard models indicated that logit hazards for female candidates were not parallel to those for male candidates, with the magnitude of the difference in logit hazards decreasing over time

(graphically presented in the next section). Similar results were demonstrated for comparisons of logit hazard of hire for Hispanic relative to white candidates and Black relative to white candidates. To properly account for these decreasing logit hazard differentials, a linear term for time was interacted with each indicator for female, Hispanic, Black, and other race. Using models that assume proportional logit hazards to estimate the association of covariates with the outcome that are not, in fact, proportional over time can lead to biased estimates of these parameters, a drawback of prior literature (Davis et al 2017). This motivated the inclusion of linear time interactions with race and sex indicators.

To estimate the logit hazard of hire as principal for individual *i* in period *j*, the following discrete-time model was estimated using maximum likelihood:

(3) $$logit\ h(t_{ij}) = [\alpha_1 D_{1ij} + \alpha_2 D_{2ij} \ldots + \alpha_{21} D_{21ij}] + \beta_1 Female_i + \beta_2 Female_i * Time_j + \beta_3 Black_i + \beta_4 Black_i * Time_j + \beta_5 Hispanic_i + \beta_6 Hispanic_i * Time_j + \beta_7 OtherRace_i + \beta_8 OtherRace_i * Time_j + \beta_9 ExperienceVars_i + \beta_{10} CredentialVars_i + \beta_{11} DistrictVars_{ij} + \beta_{12} SuperintendentCharacteristics_{ij-1} + \beta_{13} SuperintendentSharedPriorEmployment_{ij-1} + \varepsilon_{ij}$$

Descriptive Statistics

Across the period, around 49,000 individuals earned administrative credentials, resulting in a total of 374,000 person-year observations. Of that group, just under a quarter (24%, n = 11,947) were hired as a principal before 2019. Within race-sex groups among administrative candidates, men of all races were more likely than women of all races to be hired as assistant principals at some point in the period, with Black and Hispanic men more likely than white men to hold this role (see Figure 1). However, white men were the group most likely to be hired as principal. Most individuals hired as principals had prior experience as an assistant principal in the state, with only about 1 in 10 individuals in most race-sex groups being hired directly as principals without first working in an assistant principal role. Among white men with administrative credentials, however, about 1 in 5 were hired as principals without any prior assistant principal experience (see Figure 2). Prior studies of promotion into the principalship have used the pool of assistant principals as the sample at risk, which may lead to an underestimation of the differential rate of hire experienced by men, since one in five male principals in the state was hired as a principal without prior assistant principal experience (Bailes and Guthery 2020). Full sample characteristics within race and sex groups are listed below in Table 1. Every individual who earned an administrative credential was observed in the sample for between 1 and 21 years, until they either were hired as a principal or left employment by the Texas Education Agency.

Over the period studied, the number of individuals earning administrative credentials each year more than doubled, from around 1,600 in 1998 to nearly 3,700 in 2016. The distribution of race and sex among individuals earning administrative credentials changed as well, with white men making up a smaller share in 2016 than in 1998, and Hispanic women,

Black women, and Black men making up a larger share at the end of the period (see Table 2). As in prior research, Black and Hispanic educators were slightly more likely than white educators to earn an administrative credential. Among all teachers with at least five years of experience over the period of study, around 12% of Black teachers and 9% of Hispanic educators earned an administrative credential, relative to about 7% of white educators. A larger share of Black women than men earned credentials, but Hispanic men and white men were more likely than Hispanic women and white women, respectively, to earn administrative credentials.

The absolute number of candidates within each race-sex group increased over the time period, with the count more than doubling for each group except white men. The number of principals also increased across the period of study, though not by nearly the magnitude of the increase in administrative candidates (see Table 3). In 1998, just over 6,500 individuals were employed as principals in Texas, and by 2016, this number had grown to just under 8,400, an increase of 28%, or 1,851 additional principal roles. The share of Hispanic women and Black women principals grew the most from 1998 to 2016, while the share of white men among principals fell substantially. The absolute number of principals in each race-sex group grew over the period, except for among white men, whose numbers decreased by nearly 500.

The average ratio of candidates to vacant principal jobs within districts increased substantially over the period as well, though it varied across districts. In 1998, the average district had a ratio of 1 candidates for each principal job, with a standard deviation of 2.2. Ten years later, the average district had a ratio of 4.2 candidates per vacant principal job, with a standard deviation of 7.9. By the end of the period, the average district had more than 5 administrative candidates per vacant principal job, with a standard deviation of 11.6. This motivates the inclusion of district-year ratios within the models to follow.

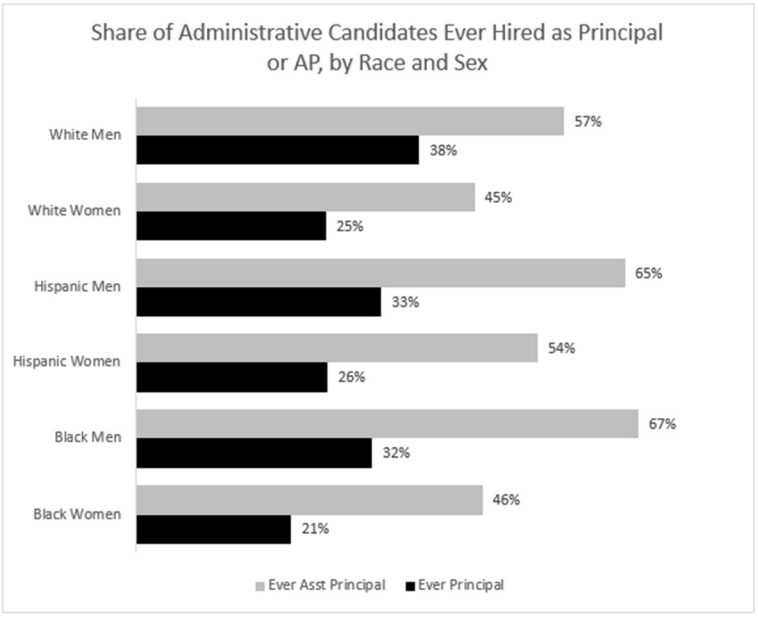


Figure 1. Share of Administrative Candidates Ever Hired as Assistant Principal or Principal

Note: This figure includes 48,906 unique individuals who earned administrative credentials in Texas between 1998 and 2016. Percentages indicate share ever employed as Assistant Principal or Principal of a regular public school in the state by 2019.

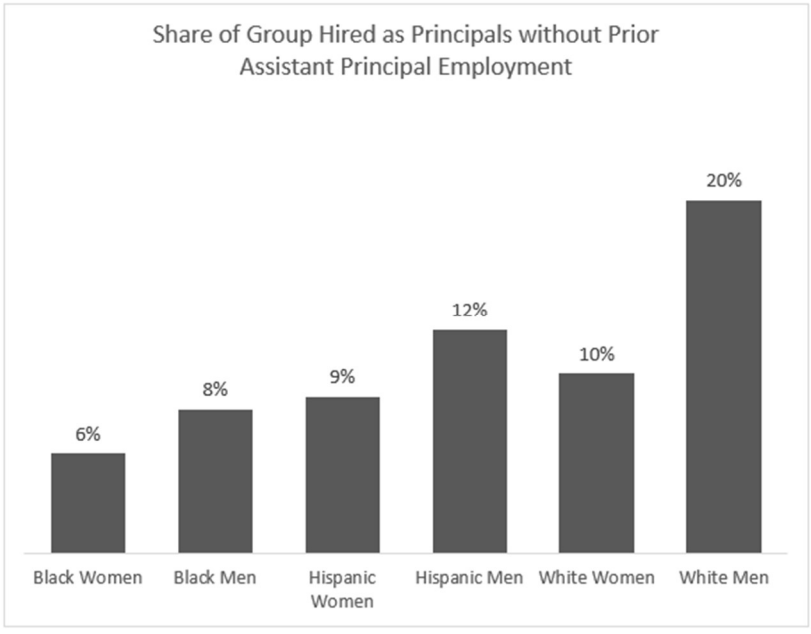


Figure 2. Share of Principals Hired Without Prior Assistant Principal Experience

Note: This figure includes 11,947 unique individuals who were hired as a principal of a regular public school in Texas between 1998 and 2019. Percentages indicate share of that group who were hired without prior employment as an Assistant Principal.

Table 1. Descriptive Statistics: Unique Candidates

	Black Female	Black Male	Hispanic Female	Hispanic Male	White Female	White Male
Unique Candidates	*n = 5,632*	*n = 1,736*	*n = 7,456*	*n = 3,244*	*n = 20,377*	*n = 9,200*
Pct of Total	*11.5*	*3.5*	*15.2*	*6.6*	*41.7*	*18.8*
	%	%	%	%	%	%
Experience Characteristics						
Experience - Less than 6 years	28.8	43.3	25.5	34.0	22.8	31.3
6 to 10 years	39.5	34.7	37.8	39.2	32.8	35.6
11 to 15 years	17.8	14.2	20.0	16.2	22.4	18.3
Greater than 16 years	13.9	7.8	16.7	10.6	21.9	14.8
Credential Characteristics						
Masters degree	62.5	54.1	57.7	48.4	49.3	41.9
PhD	1.1	1.4	0.7	0.6	0.8	0.9
Earned credential pre-2000	5.6	7.0	6.3	6.9	6.9	8.6
2000 – 2004	14.2	15.3	15.5	17.4	17.6	19.8
2005 – 2009	28.7	27.7	27.9	28.4	28.4	28.8
2010 – 2014	36.2	33.3	34.8	32.4	33.3	30.5
2015 and later	15.3	16.7	15.5	15.0	13.8	12.3
	M / SD	*M / SD*	*M / SD*	*M / SD*	*M / SD*	*M / SD*
Mean years of experience at time of earning credential	9.2	7.5	9.8	8.3	10.8	9.2
	(5.9)	(5.1)	(5.8)	(5.3)	(6.4)	(6.0)
Mean credential test z-score	-0.22	-0.49	-0.17	-0.26	0.41	0.20
	(0.89)	(0.93)	(0.89)	(0.91)	(0.82)	(0.84)

Total n = 48,906 unique candidates

Table 2. Descriptive Statistics: Person-Year Observations

Person-year observations	Black Female *n = 45,359*	Black Male *n = 13,045*	Hispanic Female *n = 58,496*	Hispanic Male *n = 24,285*	White Female *n = 157,665*	White Male *n = 66,776*
	%	%	%	%	%	%
Assistant Principal Employment						
Worked as asst. principal year t-1	24.6	40.5	27.6	36.6	24.4	33.5
District Movement						
Changed districts year t-1 to t	8.0	10.3	6.4	8.5	7.3	9.3
District Characteristics						
Urban locale	57.6	53.3	57.4	56.9	34.2	32.2
Suburban locale	36.0	38.4	28.4	26.3	37.3	35.1
Town locale	2.7	3.3	7.9	9.8	11.3	12.7
Rural locale	3.7	5.1	6.3	7.0	17.2	20
Increased num. principals	41.2	41.5	36.3	35.9	34.6	32.6
Superintendent Characteristics						
Black female superintendent	1.8	2.1	1.4	1.5	1.0	0.9
Black male superintendent	14.9	14.4	4.0	3.7	5.0	4.6
Hispanic female superintendent	0.2	0.4	6.2	6.2	0.7	0.7
Hispanic male superintendent	17.3	15.3	39.2	37.4	8.7	8.5
White female superintendent	15.7	15.8	8.0	8.3	13.5	13.0
White male superintendent	45.9	48.2	39.0	41.1	69.2	70.7
Network Characteristics						
Shared school with supe.	5.0	4.1	8.8	8.9	8.9	9.4
	M / SD	*M / SD*	*M / SD*	*M / SD*	*M / SD*	*M / SD*
Mean total student enrollment	750.8	699.5	444.3	472.1	337.0	314.8
	(659.3)	(643.2)	(439.0)	(498.0)	(380.0)	(388.7)
Mean percent white students	18.4	20.3	15.7	15.9	40.3	42.2
	(16.1)	(17.2)	(17.7)	(17.4)	(22.9)	(23.9)
Mean percent Black students	25.9	24.7	8.2	9.1	12.9	12.5
	(14.3)	(15.0)	(10.1)	(10.6)	(10.9)	(11.0)
Mean percent Hispanic students	49.1	48.8	72.5	71.5	40.5	39.4
	(19.1)	(19.9)	(25.0)	(24.5)	(22.1)	(22.4)
Mean percent other race students	10.2	9.3	5.3	5.2	9.2	8.6
	(11.3)	(10.4)	(7.7)	(7.5)	(10.3)	(10.3)
Mean candidate to principal job opening ratio	26.6	25.9	24.0	22.8	24.2	21.9
	(29.2)	(29.7)	(26.3)	(25.7)	(33.3)	(30.9)

Total n = 374,880 person-year observations, n = 48,906 unique candidates

Table 3. Race and Sex Composition of Administrative Candidates, Beginning and End of Period

	Credentials Earned - 1998		Credentials Earned - 2016		Chg in Group Share
Group	n	%	n	%	%
White Women	698	43.4	1,529	41.4	-4.5
White Men	379	23.5	617	16.7	-29.0
Black Women	143	8.9	424	11.5	29.3
Black Men	52	3.2	150	4.1	25.8
Hispanic Women	203	12.6	605	16.4	30.0
Hispanic Men	108	6.7	250	6.8	0.9
Total Individuals	*1,583*		*3,575*		

Table 4. Race and Sex Composition of School Principals, Beginning and End of Period

	School Principals - 1998		School Principals - 2016		Chg in Group Share
Group	n	%	n	%	%
White Women	2,267	34.7	3,186	38.0	9.5
White Men	2,522	38.6	2,076	24.7	-35.8
Black Women	367	5.6	695	8.3	47.6
Black Men	247	3.8	335	4.0	5.7
Hispanic Women	584	8.9	1,293	15.4	72.6
Hispanic Men	509	7.8	672	8.0	2.9
Total Individuals	*6,496*		*8,257*		

Results

Time to Hire

To assess the relationship between the time that an educator earned their administrative credential, when an individual becomes eligible to be hired as a principal (the beginning of their "at risk" status in this setting), and eventual hire as a principal, if at all, discrete-time survival methods were used. As per Singer and Willett (2003), initial graphical exploration of estimated logit hazard of hire within key groupings conveys important dynamics of how log odds of the event hazard vary with time. As shown in Figure 3, logit hazard of hire climbs steadily for each group for the first five or six years after certification before peaking and declining. Small sample sizes remain by year 15, leading to a significant spike in logit hazard when a few of those remaining are hired after that point. Among those hired, white candidates were hired on average 4.8 years after earning their credential, while Hispanic candidates were hired 5.6 years and Black candidates 5.9 years after earning their credentials.

The top panel of Figure 3 below shows sample logit hazards for men and women in the sample, with clear differences in the two groups. The shapes are similar, with both groups experiencing a steep increase in logit hazard over the first two years, although the magnitude is higher for men. The difference between the groups decreases steadily through about 14 years, when the logit hazards begin to overlap. This decreasing difference suggests that the logit hazards by sex group are not proportional across the period, and that models should account for the specific decline in logit hazard differences over time. Similarly, the bottom panel shows logit hazards for individuals by race, and here again the magnitude of difference in logit hazard between Black and white and Hispanic and white individuals decreases in magnitude over time – although more quickly for Hispanic than for Black individuals.

Candidates who are not hired as principals could remain employed in another role and thus still at risk of hire, or they could exit educational employment altogether. To explore both hire and exit from employment as competing risks relative to remaining in another role, cumulative incidence functions for hire and exit from educational employment were constructed (see Appendix). Cumulative incidence of hire as principal takes on a curvilinear form, with change in incidence higher initially and then decreasing steadily, while cumulative incidence of exit is linear over time. The linear increase in cumulative incidence of exit suggests that the population at risk of hire declines steadily across the period of study after certification.

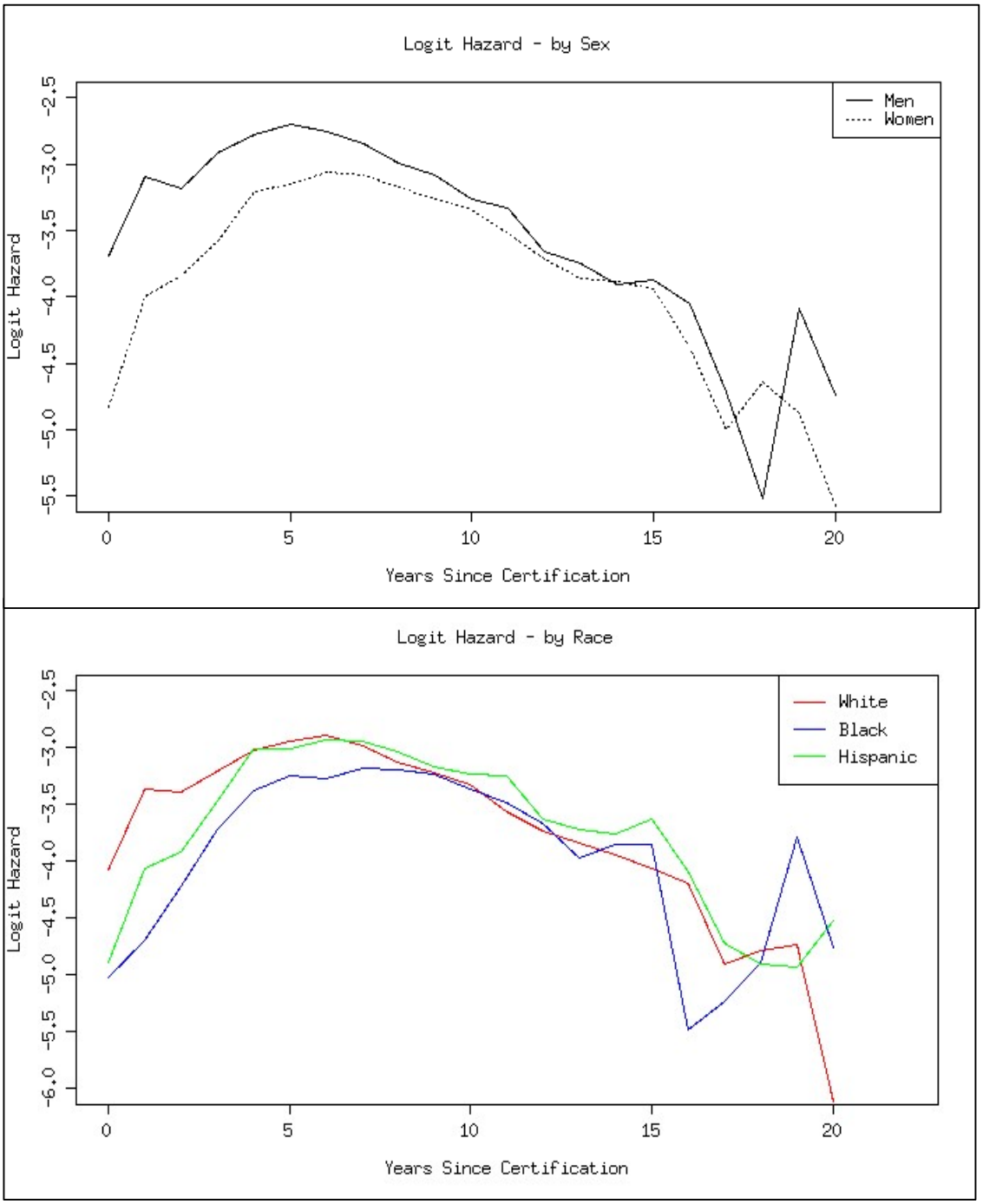


Figure 4. Sample Logit Hazard of Hire as Principal by Sex and Race of Candidates

Note: This figure includes 48,906 unique individuals who earned administrative credentials in Texas between 1998 and 2016. Year 0 indicates the academic year in which each individual earned their administrative credential. Event is hire as principal of a regular public school in Texas.

Hire Logit Hazard Models

To assess the potential association of employment network connections between superintendents and candidates on the odds of hire as a principal among individuals with administrative certification, discrete-time hazard models were estimated as shown in Table 5 below. In the initial specification, only race and sex were included (along with interactions with time periods to account for the observed decreases in differences between groups over time – see the Appendix for full model results). In this specification, shown in the first column, odds of hire were much lower for female, Black, and Hispanic individuals relative to male or white candidates. In Model 2, experience and credential characteristics were added, and the odds ratios for each demographic group increased, though all were still significantly below 1. Prior experience working as an assistant principal was associated with significantly increased odds of hire, consistent with the prior literature. The addition of district characteristics again increased the estimated odds ratios for female, Black and Hispanic candidates, suggesting that a large share of the observed reduced odds of hire for these groups can be attributed to differences in district context. The changes in odds ratios for Black and Hispanic candidates after the addition of district context were particularly large. Among district characteristics, higher candidate to vacant principal job ratios were associated with decreased odds of hire. Candidate credential test scores were also associated with increased odds of hire once district characteristics were included in Model 3.

Superintendent Characteristics

Superintendent race and sex indicators were added in Model 4, and the changes in odds ratios for female, Black and Hispanic candidates were much smaller than the changes observed

between Models 2 and 3. Odds ratios for the superintendent characteristics indicate that candidates in districts led by female superintendents were slightly less likely to be hired relative to those in districts led by male superintendents, and that candidates in districts led by Black and other race superintendents were more likely to be hired than those in districts led by white superintendents. As expected, candidates moving to a new district from the year prior was associated with increased odds of hire, which may reflect moving to accept a job offer.

Network Connections with Superintendents

The indicator for whether a candidate had previously worked at the same school as the district superintendent was added in Model 5 (shown in Table 5 below), with almost no resulting change in the odds ratios of hire for female, Black or Hispanic candidates. The results suggest that overall, individual candidates who shared a school in common in their employment history with the superintendent were less likely to be hired as a principal. To assess whether the association of this shared school indicator with odds of hire varied conditional on candidate race or sex, the indicator was interacted with candidate sex and race indicators, with results in Table 6 below (full model results in Appendix). The interaction with female was not significant, but for both Black and Hispanic candidates, the interaction with the indicator of shared prior school with the superintendent was significant and associated with increased odds of hire. The total effects of a shared prior employment network with the superintendent remained below one for each group.

To examine whether the association of shared prior employment network differed when the superintendent was also of the same race as the candidate, three-way interactions between candidate race and sex, superintendent race and sex, and shared prior school networks were included (full model results in the Appendix). Total effects of these interactions indicated that an

employment network connection to the superintendent was associated with increased odds of hire for Black candidates when the superintendent was also Black, as well as for Hispanic candidates when the superintendent was also Hispanic; effects for female candidates remained below one (see Figure 4).

Table 5. Odds Ratios of Hire as Principal Model Results

	Model 1 (OR / SE)	Model 2 (OR / SE)	Model 3 (OR / SE)	Model 4 (OR / SE)	Model 5 (OR / SE)
Demographic Characteristics					
Female	0.037***	0.284***	0.496***	0.498***	0.495***
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Black	0.075***	0.305***	0.825***	0.796***	0.794***
	(0.00)	(0.01)	(0.04)	(0.04)	(0.04)
Hispanic	0.080***	0.369***	0.899**	0.883**	0.882**
	(0.00)	(0.01)	(0.04)	(0.04)	(0.04)
Experience Characteristics					
AP in prior year		4.245***	6.653***	6.749***	6.735***
		(0.08)	(0.13)	(0.14)	(0.14)
Credential Characteristics					
Credential test score (z-score)		1.005	1.135***	1.134***	1.134***
		(0.01)	(0.01)	(0.01)	(0.01)
District Characteristics					
Candidate - principal job vacancy ratio			0.973***	0.974***	0.973***
			(0.00)	(0.00)	(0.00)
Superintendent Characteristics					
Female superintendent in year t-1				0.919**	0.927**
				(0.03)	(0.03)
Black superintendent in year t-1				1.124*	1.125*
				(0.05)	(0.05)
Hispanic superintendent in year t-1				1.018	1.021
				(0.03)	(0.03)
Other race superintendent in year t-1				1.161*	1.152*
				(0.08)	(0.08)
District Movement					
Changed districts year t-1 to t				2.032***	2.043***
				(0.05)	(0.05)
Network Characteristics					
Prior shared school with supe.					0.844***
					(0.03)
	n = 374,880	*n = 374,880*	*n = 374,880*	*n = 374,880*	*n = 374,880*

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model 1 includes only demographic characteristics of candidates; Model 2 includes controls for candidate experience and credential characteristics; Model 3 includes district contextual characteristics; Model 4 includes superintendent characteristics; Model 5 includes indicator for shared prior employment network with superintendent. Full model results in the Appendix.

** p < 0.10, ** p <0.05, *** p<0.01*

Table 6. Odds Ratios of Hire as Principal – Candidate Race and Sex and Network Connection

	Model A (OR / SE)
Network Characteristics	
Prior shared schoool with superintendent	0.672***
	(0.05)
Female * Prior shared schoool with superintendent	1.127
	(0.08)
Black * Prior shared schoool with superintendent	1.258*
	(0.09)
Hispanic * Prior shared schoool with superintendent	1.344***
	(0.11)
	n = 374,880

Note: Each observation is a person-year. Odds ratios are reported for each variable The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Includes controls for all characteristics noted in Model 5 above. Full model results in the Appendix.

** p < 0.10, ** p <0.05, *** p<0.01*

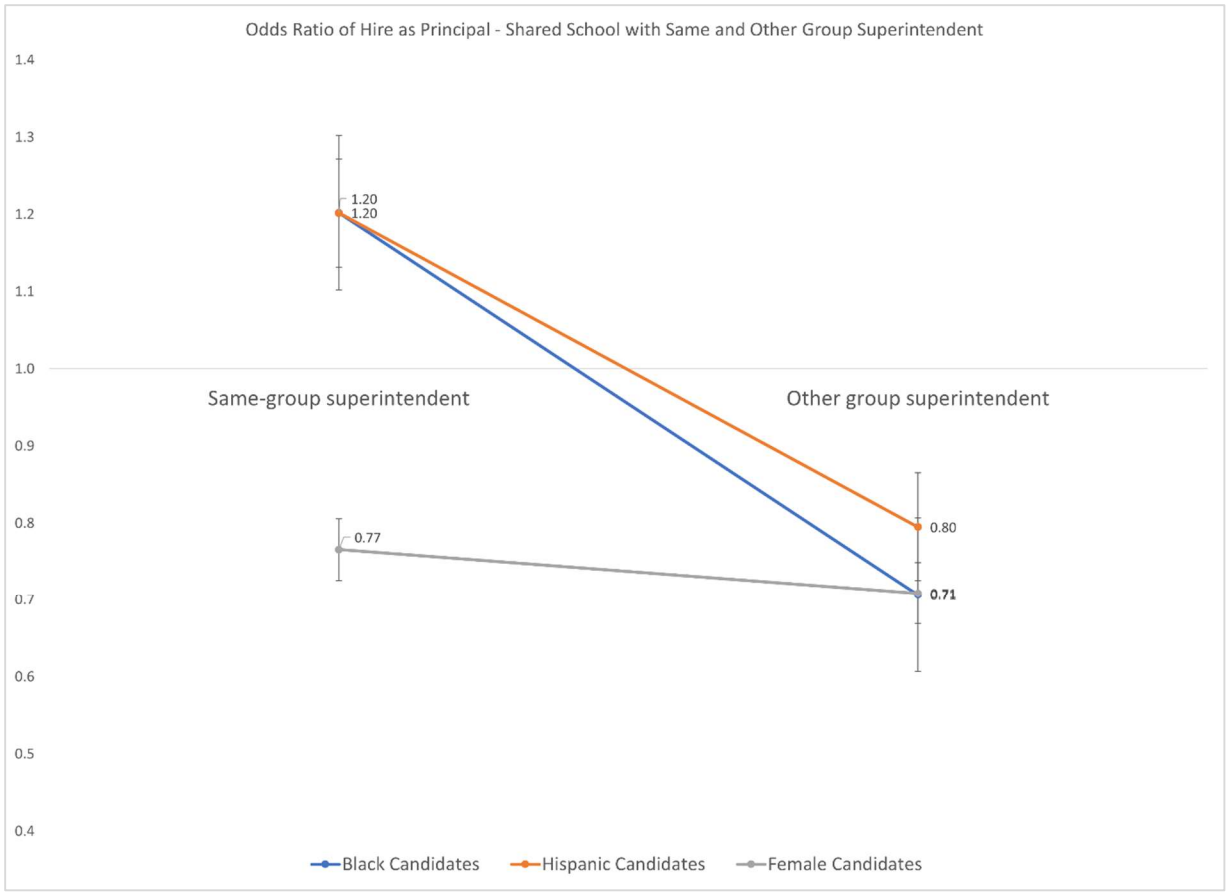


Figure 4. Hire as Principal, Odds Ratios of Network Connection with Same and Different-Group Superintendent by Race and Sex of Candidates

Note: Odds ratios of total effects for three-way interactions between candidate race or sex, superintendent race or sex, and indicator for shared prior employment network. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Includes controls for all characteristics noted in Model 5 above. Full model results in the Appendix.

** p < 0.10, ** p <0.05, *** p<0.01*

Discussion

Prior work has demonstrated lower rates of hire as school principals among female, Black, and Hispanic educators relative to their male and white peers, consistent with findings from broader studies of occupational trajectories suggesting reduced likelihood of advancement among these groups (Bailes and Guthery 2020, Crawford and Fuller 2017, Daley 1996, Davis et al 2017, Marini 1980, Naff 1994). Social closure processes that result in reduced access to mentoring or employment networks for female, Black, and Hispanic candidates may partially explain lower likelihood of hire (Myung et al 2011, Tomaskovic-Devey 1993b, Tomaskovic-Devey et al. 1996, Young and McLeod 2001).

To test expectations from this framework, this study examined the association of an indicator of shared employment networks between candidates and superintendents of their districts with the odds of hire as a principal. After establishing baseline differences in log odds of hazards of hire as principal between male and female and white, Black, and Hispanic candidates using graphical representation of logit hazard curves, discrete time survival models demonstrated that these reduced odds of hire persisted for each group after the inclusion of sets of individual, district, and superintendent characteristics. Prior work that only included individuals already employed as assistant principals found significantly lower odds of hire as principal just for Black candidates (Bailes and Guthery 2020). The inclusion of all administrative candidates as the population at risk in this study revealed significantly reduced odds of hire for Black, Hispanic, and female candidates. As expected, including only assistant principals underestimates the advantage in principal hiring for white men, given that one in five white male principals was hired without prior assistant principal experience as shown above.

The odds of hire increased somewhat for female, Black, and Hispanic candidates after the addition of experience and credential characteristics, and the odds ratios for these groups changed substantially after the inclusion of district characteristics, including a measure of potential crowding out of jobs in each district. This suggests that the distribution of candidates across districts plays a key role in the observed overall likelihood of hire. However, in the final model including all characteristics, female, Black, and Hispanic candidates all had odds ratios of hire below 1.

The exploration of potential shared network effects on the odds of hire as principal did not demonstrate a positive association of shared prior school between candidates and superintendents on the overall pool of candidates; in fact, the odds ratio of hire was reduced for this indicator. Candidates who shared a prior school with superintendents were disproportionately likely to work in smaller districts, where the odds of sharing a common school history with superintendents are higher. While controls were included for geographic locale of districts, as well as for ratios of candidates to available jobs, it is possible that other unmeasured characteristics of smaller districts made hire less likely for candidates in these places who were also more likely to share an employment network with superintendents. This may also be a weak measure of connection between individuals, as there were no constraints on the time period in which the superintendent and candidate worked at the same school. In that case, however, association with odds of hire would be expected to be null rather than negative.

When the indicator for network connection was interacted with candidate gender and race, however, odds of hire as principal did increase for Black and Hispanic candidates relative to those for white candidates with such connections. However, the total association was still associated with odds of hire below one. Three-way interactions of candidate race and sex,

superintendent race and sex, and the indicator for a shared prior school indicated that for Black and Hispanic candidates, overall odds of hire increased when they shared a prior employment network with a superintendent who was also Black or Hispanic. The difference in odds of hire for a shared connection with a same- versus different-group superintendent were particularly large for Black candidates. This aligns with prior work finding that mentorship and encouragement from former colleagues influencing educators to pursue and obtain school leadership roles were most likely to be offered to educators of the same race, as well as from research on network connections more broadly demonstrating larger benefits from homophilous connections, consistent with expectations from social closure theory (McDonald 2011, Myung et al 2011, Reskin and Roos 1990, Tomaskovic-Devey 1993a, 1993b).

Conclusion

Taken together, these findings demonstrate that female, Black, and Hispanic candidates are less likely to be hired as principals than are male and white candidates, even when individual and district characteristics are held constant. Shared prior employment networks with superintendents were associated with decreased odds of hire overall, counter to expectations. These connections did appear to benefit Black and Hispanic candidates in odds of hire when the superintendent with whom they were connected was of the same group. Other methods of identifying potentially advantageous network connections for educators aspiring to become school leaders should be explored to better understand the role such connections may play in principal hiring. In addition to confirming expectations regarding social closure, this study highlights the continued obstacles to creating a diverse school leader workforce.

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Appendix

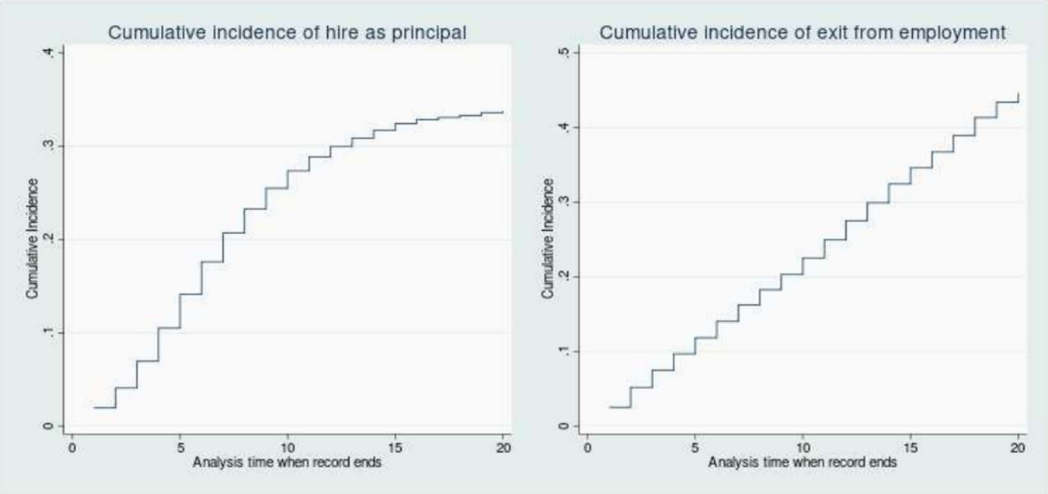


Figure A1. Cumulative Incidence of Candidate Hire and Exit from Employment as Competing Risks

Note: This figure includes 48,906 unique individuals who earned administrative credentials in Texas between 1998 and 2016. Year 0 indicates the academic year in which each individual earned their administrative credential. Events are hire as principal of a regular public school in Texas or exit from employment in the Texas Education Agency.

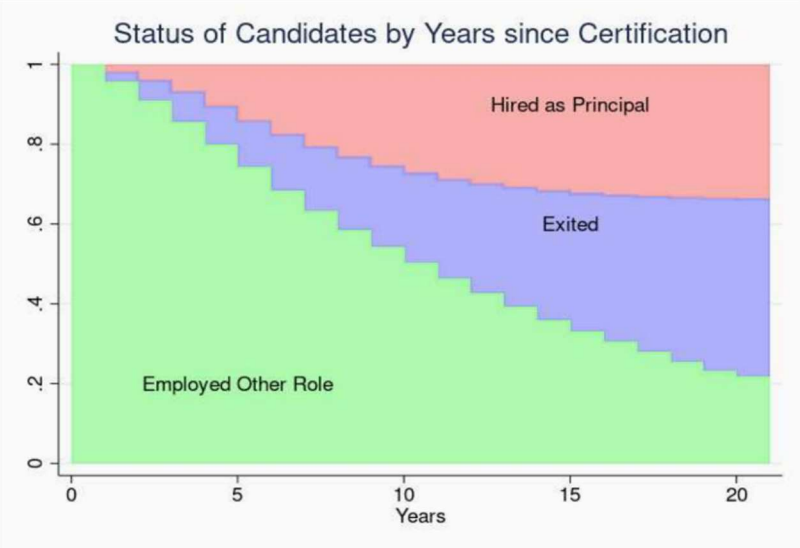


Figure A2. Cumulative Incidence of Candidate Hire and Exit from Employment as Competing Risks

Note: This figure includes 48,906 unique individuals who earned administrative credentials in Texas between 1998 and 2016. Year 0 indicates the academic year in which each individual earned their administrative credential. The share of all candidates who are hired as principal of a regular public school in Texas, exit from employment in the Texas Education Agency, or remain at risk or hire as principal are shown over time.

Table A1. Odds Ratios of Hire as Principal Full Model Results

	Model 1 (OR / SE)	Model 2 (OR / SE)	Model 3 (OR / SE)	Model 4 (OR / SE)	Model 5 (OR / SE)
Demographic Characteristics					
Female	0.037***	0.284***	0.496***	0.498***	0.495***
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Female*Time	1.044***	1.070***	1.070***	1.071***	1.072***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Black	0.075***	0.305***	0.825***	0.796***	0.794***
	(0.00)	(0.01)	(0.04)	(0.04)	(0.04)
Black*Time	1.073***	1.070***	1.054***	1.056***	1.056***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Hispanic	0.080***	0.369***	0.899**	0.883**	0.882**
	(0.00)	(0.01)	(0.04)	(0.04)	(0.04)
Hispanic*Time	1.053***	1.057***	1.042***	1.043***	1.043***
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Other Race	0.073***	0.331***	0.743***	0.720**	0.717**
	(0.01)	(0.04)	(0.08)	(0.08)	(0.08)
Other Race*Time	1.028	1.043**	1.035*	1.036*	1.036*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Experience Characteristics					
AP in prior year		4.245***	6.653***	6.749***	6.735***
		(0.08)	(0.13)	(0.14)	(0.14)
6 to 10 years experience		0.407***	0.653***	0.648***	0.652***
		(0.01)	(0.02)	(0.01)	(0.01)
11 to 15 years experience		0.417***	0.615***	0.618***	0.624***
		(0.01)	(0.02)	(0.02)	(0.02)
More than 16 years experience		0.425***	0.584***	0.595***	0.602***
		(0.01)	(0.02)	(0.02)	(0.02)
Credential Characteristics					
Masters degree		0.511***	0.755***	0.744***	0.744***
		(0.01)	(0.02)	(0.02)	(0.02)
PhD		0.351***	0.758*	0.753*	0.753*
		(0.06)	(0.12)	(0.11)	(0.11)
Earned credential pre-2000		1.663***	1.001	1.001	1.001
		(0.10)	(0.10)	(0.10)	(0.10)
2000 – 2004		1.579***	1.003	1.002	1.002
		(0.09)	(0.10)	(0.11)	(0.11)
2005 – 2009		1.323***	1.003	1.003	1.003
		(0.07)	(0.10)	(0.10)	(0.10)
2010 – 2014		1.142**	1.011	1.013	1.013
		(0.06)	(0.10)	(0.10)	(0.10)
Credential test score (z-score)		1.005	1.135***	1.134***	1.134***
		(0.01)	(0.01)	(0.01)	(0.01)

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model 1 includes only demographic characteristics of candidates; Model 2 includes controls for candidate experience and credential characteristics; Model 3 includes district contextual characteristics; Model 4 includes superintendent characteristics; Model 5 includes indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A1. Odds Ratios of Hire as Principal Full Model Results - Continued

	Model 1 (OR / SE)	Model 2 (OR / SE)	Model 3 (OR / SE)	Model 4 (OR / SE)	Model 5 (OR / SE)
District Characteristics					
District total enrollment			1.000	1.000	1.000
			(0.00)	(0.00)	(0.00)
Pct Black students			0.986***	0.985***	0.985***
			(0.00)	(0.00)	(0.00)
Pct Hispanic students			0.983***	0.982***	0.982***
			(0.00)	(0.00)	(0.00)
Pct Other Race students			0.951***	0.949***	0.949***
			(0.00)	(0.00)	(0.00)
Urban locale			0.532***	0.544***	0.534***
			(0.02)	(0.02)	(0.02)
Suburban locale			0.535***	0.550***	0.542***
			(0.02)	(0.02)	(0.02)
Town locale			0.604***	0.610***	0.607***
			(0.02)	(0.02)	(0.02)
Number of principal jobs in district increased t-1 to t			1.043	1.031	1.028
			(0.03)	(0.03)	(0.03)
Candidate - principal job vacancy ratio			0.973***	0.974***	0.973***
			(0.00)	(0.00)	(0.00)
Superintendent Characteristics					
Female superintendent in year t-1				0.856***	0.867***
				(0.02)	(0.02)
Black superintendent in year t-1				1.123*	1.127*
				(0.05)	(0.05)
Hispanic superintendent in year t-1				1.126***	1.129***
				(0.04)	(0.04)
Other race superintendent in year t-1				0.810**	0.803**
				(0.06)	(0.06)
District Movement					
Changed districts year t-1 to t				2.032***	2.043***
				(0.05)	(0.05)
Network Characteristics					
Prior shared school with supe.					0.772***
					(0.02)
	n = 374,880	*n = 374,880*	*n = 374,880*	*n = 374,880*	*n = 374,880*

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model 1 includes only demographic characteristics of candidates; Model 2 includes controls for candidate experience and credential characteristics; Model 3 includes district contextual characteristics; Model 4 includes superintendent characteristics; Model 5 includes indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A2. Odds Ratios of Hire as Principal Full Model Results – Including Charter Principal

	Model 5 - Charter (OR / SE)
Demographic Characteristics	
Female	0.495***
	(0.01)
Female*Time	1.072***
	(0.00)
Black	0.788***
	(0.04)
Black*Time	1.060***
	(0.01)
Hispanic	0.881**
	(0.04)
Hispanic*Time	1.043***
	(0.01)
Other Race	0.715**
	(0.08)
Other Race*Time	1.039*
	(0.02)
Experience Characteristics	
AP in prior year	6.569***
	(0.13)
6 to 10 years experience	0.646***
	(0.01)
11 to 15 years experience	0.618***
	(0.02)
More than 16 years experience	0.589***
	(0.02)
Credential Characteristics	
Masters degree	0.748***
	(0.02)
PhD	0.742*
	(0.11)
Earned credential pre-2000	1.001
	(0.10)
2000 – 2004	1.002
	(0.11)
2005 – 2009	1.003
	(0.10)
2010 – 2014	1.013
	(0.10)
Credential test score (z-score)	1.136***
	(0.01)

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t, including hires into charter schools. Model includes controls for candidate experience and credential characteristics, district contextual characteristics, superintendent characteristics, and indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A2. Odds Ratios of Hire as Principal Full Model Results – Including Charter Principal Hires - Continued

	Model 5 - Charter (OR / SE)
District Characteristics	
District total enrollment	1.000
	(0.00)
Pct Black students	0.987***
	(0.00)
Pct Hispanic students	0.984***
	(0.00)
Pct Other Race students	0.952***
	(0.00)
Urban locale	0.577***
	(0.02)
Suburban locale	0.542***
	(0.02)
Town locale	0.584***
	(0.02)
Number of principal jobs in district increased t-1 to t	1.063**
	(0.03)
Candidate - principal job vacancy ratio	0.971***
	(0.00)
Superintendent Characteristics	
Female superintendent in year t-1	0.878***
	(0.02)
Black superintendent in year t-1	1.117*
	(0.05)
Hispanic superintendent in year t-1	1.112***
	(0.04)
Other race superintendent in year t-1	0.814**
	(0.06)
District Movement	
Changed districts year t-1 to t	2.157***
	(0.05)
Network Characteristics	
Prior shared school with supe.	0.772***
	(0.03)
	n = 374,880

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t, including hires into charter schools. Model includes controls for candidate experience and credential characteristics, district contextual characteristics, superintendent characteristics, and indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A3. Odds Ratios of Hire as Principal – Candidate Race and Sex and Network Connection Interactions Full Model Results

	Model A (OR / SE)
Demographic Characteristics	
Female	0.492***
	(0.01)
Female*Time	1.072***
	(0.00)
Black	0.786***
	(0.04)
Black*Time	1.055***
	(0.01)
Hispanic	0.892**
	(0.04)
Hispanic*Time	1.042***
	(0.01)
Other Race	0.668***
	(0.08)
Other Race*Time	1.036*
	(0.01)
Experience Characteristics	
AP in prior year	6.752***
	(0.14)
6 to 10 years experience	0.653***
	(0.02)
11 to 15 years experience	0.626***
	(0.02)
More than 16 years experience	0.604***
	(0.02)
Credential Characteristics	
Masters degree	0.746***
	(0.02)
PhD	0.760
	(0.12)
Earned credential pre-2000	1.001
	(0.10)
2000 – 2004	1.001
	(0.10)
2005 – 2009	1.000
	(0.10)
2010 – 2014	1.011
	(0.10)
Credential test score (z-score)	1.134***
	(0.01)

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model includes controls for candidate experience and credential characteristics, district contextual characteristics, superintendent characteristics, and indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A3. Odds Ratios of Hire as Principal – Candidate Race and Sex and Network Connection Interactions Full Model Results - Continued

	Model A (OR / SE)
District Characteristics	
District total enrollment	1.000
	(0.00)
Pct Black students	0.985***
	(0.00)
Pct Hispanic students	0.982***
	(0.00)
Pct Other Race students	0.952***
	(0.00)
Urban locale	0.534***
	(0.02)
Suburban locale	0.541***
	(0.02)
Town locale	0.606***
	(0.02)
Number of principal jobs in district increased t-1 to t	1.026
	(0.03)
Candidate - principal job vacancy ratio	0.973***
	(0.01)
Superintendent Characteristics	
Female superintendent in year t-1	0.867***
	(0.02)
Black superintendent in year t-1	1.126*
	(0.05)
Hispanic superintendent in year t-1	1.126***
	(0.04)
Other race superintendent in year t-1	0.806**
	(0.06)
District Movement	
Changed districts year t-1 to t	2.048***
	(0.05)
Network Characteristics	
Prior shared school with supe.	0.672***
	(0.04)
Prior shared school * Female	1.127
	(0.08)
Prior shared school * Black	1.258
	(0.16)
Prior shared school * Hispanic	1.344***
	(0.11)
	n = 374,880

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model includes controls for candidate experience and credential characteristics, district contextual characteristics, superintendent characteristics, and indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A4. Odds Ratios of Hire as Principal – Candidate Race and Sex, Superintendent Race and Sex and Network Connection Interactions Full Model Results

	Model B (OR / SE)
Demographic Characteristics	
Female	0.460***
	(0.01)
Female*Time	1.071***
	(0.00)
Black	0.778***
	(0.04)
Black*Time	1.054***
	(0.01)
Hispanic	0.903*
	(0.04)
Hispanic*Time	1.040***
	(0.01)
Other Race	0.725**
	(0.08)
Other Race*Time	1.036*
	(0.01)
Experience Characteristics	
AP in prior year	6.786***
	(0.14)
6 to 10 years experience	0.658***
	(0.02)
11 to 15 years experience	0.630***
	(0.02)
More than 16 years experience	0.609***
	(0.02)
Credential Characteristics	
Masters degree	0.749***
	(0.02)
PhD	0.761
	(0.12)
Earned credential pre-2000	1.001
	(0.10)
2000 – 2004	1.001
	(0.10)
2005 – 2009	1.000
	(0.10)
2010 – 2014	1.011
	(0.10)
Credential test score (z-score)	1.137***
	(0.01)

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model includes controls for candidate experience and credential characteristics, district contextual characteristics, superintendent characteristics, and indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A4. Odds Ratios of Hire as Principal – Candidate Race and Sex, Superintendent Race and Sex and Network Connection Interactions Full Model Results - Continued

	Model B (OR / SE)
District Characteristics	
District total enrollment	1.000
	(0.00)
Pct Black students	0.985***
	(0.00)
Pct Hispanic students	0.983***
	(0.00)
Pct Other Race students	0.951***
	(0.00)
Urban locale	0.537***
	(0.02)
Suburban locale	0.539***
	(0.02)
Town locale	0.609***
	(0.02)
Number of principal jobs in district increased t-1 to t	1.025
	(0.03)
Candidate - principal job ratio	0.973***
	(0.01)
Superintendent Characteristics	
Female superintendent in year t-1	0.608***
	(0.03)
Female * Female superintendent	1.739***
	(0.10)
Black superintendent in year t-1	1.029
	(0.06)
Black * Black superintendent	1.254**
	(0.12)
Hispanic superintendent in year t-1	1.004
	(0.04)
Hispanic * Hispanic superintendent	1.214**
	(0.07)
Other race superintendent in year t-1	0.805**
	(0.06)
District Movement	
Changed districts year t-1 to t	2.066***
	(0.05)

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model includes controls for candidate experience and credential characteristics, district contextual characteristics, superintendent characteristics, and indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A4. Odds Ratios of Hire as Principal – Candidate Race and Sex, Superintendent Race and Sex and Network Connection Interactions Full Model Results - Continued

	Model B (OR / SE)
Network Characteristics	
Prior shared school with supe.	0.643***
	(0.04)
Superintendent Characteristics and Network Interactions	
Prior shared school * Female supe	1.30
	(0.18)
Female * Prior shared school	1.103
	(0.09)
Female * Prior shared school * Female supe	0.787
	(0.14)
Prior shared school * Black supe	1.203
	(0.25)
Black * Prior shared school	1.100
	(0.17)
Black * Prior shared school * Black supe	1.096
	(0.37)
Prior shared school * Hispanic supe	1.607***
	(0.22)
Hispanic * Prior shared school	1.24
	(0.14)
Hispanic * Prior shared school * Hispanic supe	0.772
	(0.16)
	n = 374,880

Note: Each observation is a person-year. Odds ratios are reported for each variable. The dependent variable is an indicator for whether the individual was first hired as a principal in year t. Model includes controls for candidate experience and credential characteristics, district contextual characteristics, superintendent characteristics, and indicator for shared prior employment network with superintendent.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A5. Sample Characteristics for Complete Observations and Observations Missing Data

	Complete Observations	Missing Covariate(s)
Percent of total person-year observations	93.7 (n = 374,880)	6.3 (n = 25,164)
Characteristic	%	%
Demographic Characteristics		
White	59.9	49.9
Black	15.6	18.2
Hispanic	22.1	30.0
Other Race	2.5	1.9
Women	71.5	68.9
Men	28.5	31.1
Experience Characteristics		
Worked as assistant principal	27.9	22.6
Experience - Less than 5 years	26.9	21.8
6 to 10 years	35.9	31.1
11 to 15 years	20.1	21.7
Greater than 16 years	17.1	25.4
Credential Characteristics		
Masters degree	52.1	62.4
PhD	0.7	0.9
Earned credential pre-2000	9.5	26.8
2000 – 2004	21.7	25.5
2005 – 2009	32.5	27.1
2010 – 2014	28.7	17.3
2015 and later	7.6	3.3
Network Characteristics		
Shared school with supe.	8.3	11.7
Female superintendent	15.7	16.7
Male superintendent	84.3	83.3
White superintendent	71.8	60.4
Black superintendent	7.5	7.9
Hispanic superintendent	18.5	29.9
Other Race superintendent	2.2	1.8
District Characteristics		
Urban locale	42.8	52.0
Suburban locale	24.7	23.2
Town locale	9.4	7.3
Rural locale	23.1	17.5
	M	*M*
Mean years of experience	9.5	11.4
Mean total enrollment	42,593.9	42,514.3
Mean percent white students	35.1	28.9
Mean percent Black students	13.9	13.2
Mean percent Hispanic students	48.8	56.1
Mean percent other race students	2.2	1.8

Chapter 3: Effects of Superintendent and Principal Demographic Congruence on Principal Hiring and Retention

Organizational theories of relational demography and similarity attraction suggest that racial congruence between superintendents and principals may increase the share of Black and Hispanic principals in districts; these theories also predict that gender congruence may not increase hiring of female principals by female superintendents holding such a male-dominated role. Prior work on teacher hiring and retention has demonstrated positive effects of racial congruence with principals, but the interactions of race and gender, as well as effects of superintendent and principal demographic congruence on principal hiring and retention, remain unexplored. This study uses administrative data in Texas and controls for district and year fixed effects to estimate the causal effect of superintendent racial and gender congruence with principals on the share of new principal hires who are Black and Hispanic males and females, as well as on the likelihood of principal retention. The study finds that Black superintendents hire more Black male and female principals after replacing a white superintendent in the same district, but that superintendent gender does not affect the share of hires of any group. Racial congruence with superintendents also affected likelihood of turnover among Black principals, although the effects varied by principal sex. No effects of racial congruence were evident between Hispanic superintendents and principals.

Introduction

Theories of relational demography offer potential explanations for observed disparities in rates of hire as principals among Black, Hispanic, and female candidates, as well as insights into remaining questions of how to ensure a racially and gender diverse principal workforce (Fuller et al 2007, Williams and Loeb 2012). Broader research on managerial dyads uses theoretical frameworks within relational demography, such as similarity attraction, to understand how and when shared characteristics between supervisors and subordinates influence employment outcomes like selection, job satisfaction, and retention (Goldberg 2005, Graves and Powell 1995, Tsui et al 2002). Within studies of the educational workforce, this research has focused on congruence between teachers and principals, with no work to date examining the dynamics of principals and superintendents. Using representative bureaucracy frameworks, studies of teachers and principals have found that congruence along racial and gender dimensions increase teacher satisfaction and retention, with teachers less likely to leave schools when they share race or gender characteristics with their principals (Fairchild et al 2012, Grissom et al 2012, Viano and Hunter 2017). Recent work by Bartanen and Grissom (2021) used school fixed effects to identify a positive causal effect of principal and teacher racial congruence on teacher hiring and retention among Black and white teachers.

The prior literature does not address whether the race or gender of superintendents impacts the hiring or retention of racially or gender congruent school leaders, a question this study seeks to answer. Similarity in patterns of principal and teacher placement across schools suggests that principal hiring processes may operate in ways like teacher hiring, but it is less certain that principal retention will be as sensitive to superintendent influences as teacher retention is to principals (Grissom et al 2019). There is greater distance between principals and

superintendents working in separate buildings, and distance theory in organizations more generally suggests this may reduce superintendent influence on principal job satisfaction and retention (Napier and Ferris 1993). In addition, while relational demography frameworks predict that racial congruence in these districts would lead to higher shares of Black or Hispanic principals among new hires, predictions regarding gender congruence are more complex. Women leaders in highly male-dominated roles may, in fact, perceive more similarity between themselves and male candidates, a hypothesis that has found some support from broad studies of recruiters and job interview assessments (Goldberg 2005, Graves and Powell 1995).

This study seeks to test both whether findings on racial congruence between teachers and principals for hiring and retention extend to the dynamics of principals and superintendents, as well as whether gender congruence impacts the likelihood that female superintendents will hire more female principals, despite their holding a male-dominated role. Using administrative data for all public schools and districts in Texas between 1998 and 2019, this study finds that Black superintendents hire a larger share of Black principals in the same district relative to when that district is led by a white superintendent, but there are no such effects between Hispanic superintendents and principals, nor does superintendent gender affect the likelihood of hire for any group of principals. In addition, Black female principals are less likely to leave their roles when working in districts led by Black superintendents, regardless of the superintendent's gender. Black male principals, however, are more likely to leave their roles when their district is led by a Black woman relative to a Black man.

Literature Review

Principal Hiring and Relational Demography

Scholars have raised concerns about disparities in the representation of Black, Hispanic, and female principals relative to the overall teacher workforce or student population (Perrone 2022, Fuller et al 2018). These disproportionalities are particularly stark among Hispanic individuals, who made up 24% of Texas principals in 2018 but 53% of students in the state that year. Representation of women in principalships lags in particular at the secondary school level, where women make up around a third of all principalships relative to 61% of elementary school principalships (Fuller et al 2018, Bjork et al 2005). Black, Hispanic, and female educators are all more likely than their white or male counterparts to seek school leadership certification and roles, with one study finding that Black and Hispanic teachers were twice as likely to seek such certification (DeAngelis and O'Connor 2012, Fuller et al 2007, Williams and Loeb 2012). A variety of longitudinal studies of potential principal candidates have found women, Black, and Hispanic individuals less likely to be hired, and in some cases facing longer delays before first employment as a principal (Bailes and Guthery 2020, Crawford and Fuller 2017, Davis et al 2017)[9].

Superintendents are important in principal hiring processes, with a key aspect of their roles that of human resource managers for school districts, particularly for highly visible positions like school principals (Bjork et al 2005). Theories of relational demography in organizational research more broadly provide a useful framework for understanding how

[9] These studies have largely looked at race or sex of candidates separately, and those that do consider race and sex together are descriptive in nature. Additionally, no study of principal workforce diversity to date has sought to identify causal effects on principal hiring, as this study does.

superintendent race and gender may influence their hiring of principals. As noted in Chapter 1 above, within relational demography, similarity attraction suggests that a hiring manager will assume shared values and positive attributes with job applicants who are similar in observable characteristics (Riordan et al 2005). Indeed, research in education demonstrates that Black principals hire significantly greater shares of Black teachers after controlling for a variety of observable and unobservable school characteristics (Bartanen and Grissom 2021). However, ideas of similarity attraction are complicated somewhat when female managers are in male-dominated roles. In some studies, female recruiters perceived male applicants as more attitudinally similar and sought to identify with these higher-status applicants, consistent with social identity theory (Graves and Powell 1995). Others have found that female managers hold stronger preferences for male-typed job attributes than do students, suggesting the influence of holding traditionally male jobs on attitudes among women (Konrad et al 2000). These results, as well as the desire for individuals to identify with high-status others, suggest that there may be less evidence of similarity attraction benefits between female managers and female applicants when those managers work in male-dominated or traditionally male roles.

The superintendency is indeed a male-dominated role, one that scholars note has been constructed and reinforced as men's work (Blount 1998, Grogan 1999, Skrla 1999). In fact, school superintendent was determined by the US Census to be the "most male-dominated of any profession in the United States" (Bjork et al 2005, p. 32). It is also an overwhelmingly white profession, with recent estimates that 8% of superintendents were people of color in 2020 (Grogan and Nash 2021). A study using superintendent first names to estimate gender found that around one quarter of superintendents nationally were women (White 2021). In Texas, just over 76% of superintendents in 2019 were male, and 80% were white.

Principal Retention

Black, Hispanic, and female principals also face distinct challenges once hired. The average employment duration for female principals is shorter than that for men, and studies of job satisfaction among school administrators reveal that women in these roles are less likely to perceive opportunities for advancement or support (Conrad and Rosser 2007). Principal turnover overall is estimated at around 20% each year, with significant negative impacts on students and school quality following such departures (Beteille et al 2012, Bartanen et al 2019, Fuller 2009). Studies of attrition among Black and Hispanic principals have shown mixed results in exit rates relative to white principals, while to date, no estimates exist for principal turnover by race and gender intersections (Snodgrass Rangel 2018, Gates et al 2006). Studies of principal turnover identify characteristics of school context as predictive of principal exit, as well as perceptions of support within their school buildings, districts, and communities (Gates et al 2006, Grissom et al 2019, Loeb et al 2010, Sun and Ni 2016, Boyce and Bowers 2016).

One key departure from the teacher attrition literature, where principal effectiveness is among the top reasons teachers cite for leaving their schools, is the relative infrequency of principal manager effectiveness or relationships with superintendents as a factor in principal attrition. Indeed, no studies of principal turnover focus on superintendents as being predictive of school leader attrition outside of enactment of school accountability policies that involve removal of school leaders or staff (Boyce and Bowers 2016). Principals are also much more proximate to the teachers they manage, working in the same buildings, while superintendents typically work in a separate location. Theories of distance in organizations more generally predict that this greater distance may reduce the influence, positive or negative, that superintendents may have on principal satisfaction and retention (Napier and Ferris 1993).

As noted in Chapter 1 above, studies of teacher retention have placed findings of positive impacts of racial and gender congruence with principals within a representative bureaucracy framework, in which managers who are demographically congruent with their subordinates are more likely to enact policies that support those subordinates, particularly when they are members of a group that has historically faced discrimination (Grissom et al 2012, Selden 1997). Ideas proposed by Tsui and colleagues regarding negative impacts of demographic dissimilarity when the manager holds a lower-status identity than does the subordinate may be particularly salient in principal and superintendent management when a male principal is managed by a female superintendent (Tsui and O'Reilly 1989, Tsui et al 2002). Given the strong characterization of the superintendency as a male role, women holding these roles may be viewed as significant outliers by the men they manage. The extent to which superintendents, their management practices, and their relationships with principals impact the likelihood of principal retention remains unstudied. With the high cost to districts and schools, both financial and otherwise, of principal turnover, greater insight into the role that superintendent characteristics play in retaining principals is potentially of great value.

Specific attention to differences in racial congruence effects between Black principals and superintendents relative to the effects between Hispanic principals and superintendents is merited, based on findings from teacher and student racial congruence showing distinct effects for each pairing. As noted above, positive impacts on student achievement outcomes of racial congruence have been found most consistently for Black students with Black teachers, with mostly null or negative results for Hispanic students with Hispanic teachers (Egalite et al 2015, Redding 2019). In one such study, the authors noted the significant diversity of national origin among the Hispanic population studied, suggesting that the broad definition of Hispanic may not

signify cultural similarity of experience and background (Egalite et al 2015). Recent work has attempted to identify matches of students and teachers along native language dimensions in addition to identification as Hispanic, with evidence that students who share both language status and Hispanic identification with teachers are more positively evaluated by their teachers than are students matching on only one of those domains (Seah 2021). Effects of racial congruence on hiring and retention among Hispanic educators have not been studied to date, although the results above for student and teacher congruence suggest that effects among Hispanic principals and superintendents may be different than those among Black racially congruent principals and superintendents.

Present Contribution

This study seeks to apply ideas of relational demography to superintendent hiring of school principals, interacting race and gender of principals and superintendents to identify potentially distinct impacts of racial and gender congruence, as well as differential effects within race and sex groups. In addition, this study attempts to explore the role of superintendent race and gender in the likelihood of principal turnover. These findings will help illuminate the potential impacts that a more racially and gender diverse superintendent workforce may have on school principals, as well as on how an overwhelmingly white and male superintendent workforce may hinder other policy efforts to diversify school leaders.

Methods

To analyze principal and superintendent hiring and employment patterns, principal person-year files were constructed from administrative records of the Texas Education Administration (TEA) for the years 1998 through 2019. These files include information on the demographic characteristics of employees, their years of experience overall and in their current campus or district, highest degrees earned, the role they held in each year, and the campus and district location of that role, if applicable. Building on prior education workforce hiring research, controls for individual characteristics of superintendents beyond their race and sex were included (total years of experience, years as superintendent in the district, highest degree earned), as well as a variety of characteristics of school district context shown to be associated with principal placement (student enrollment demographics and geographic locale as in Davis et al 2017 and Fuller et al 2018). Similarly, models of principal attrition included principal level of experience and degree attainment based on prior principal turnover research (Grissom et al 2019). Characteristics of superintendents in each district and year were constructed from the TEA administrative records and linked to the principal records. Other contextual characteristics of the districts were constructed from the Common Core of Data (CCD) to capture geographic and student demographic characteristics. The geographic locale of each district from the CCD was collapsed into four categories, urban, suburban, town and rural. The percentage of students of each racial group in each district was included for each year as well, with white, Hispanic, Black and race – other as the categories (the latter category including Asian, Pacific Islander, Native American, and two or more races).

To estimate relationships between change in superintendent race or sex and teacher hiring and retention, each principal-year observation required that a unique superintendent be assigned

to their district in that year. Of the total of just over 155,000 principal-year observations, around 6,000 did not have a superintendent associated with the education agency to which their campus was assigned. In most cases, this was due to working at a charter organization without a traditional district structure. These cases did not meet inclusion criteria necessary for the study and were dropped, resulting in just under 150,000 principal-year observations prior to analysis. The outcomes of interest were the race and sex of principals newly hired in each district in each year, as well as whether a given principal returned to their role in the same district the following year.

Analytic Strategy

A key contribution of this project is the specification of models to estimate causal effects of superintendent race and sex on outcomes using district and year fixed effects, as well as controls for district-specific trends. Prior work demonstrates, as do descriptive statistics for this sample described below, that districts led by Black, Hispanic or female superintendents often differ systematically from those led by white or male superintendents. It is likely that unobserved characteristics of a district that make it more likely to hire a Black male superintendent, for example, are also associated with employing more Black male principals. This may reflect local labor markets or a willingness of the community to support Black male leaders. The inclusion of district fixed effects can remove the effects of time-invariant unobservable characteristics of districts, which might otherwise inflate estimates of the effect of superintendent racial or gender congruence on the composition of new principal hires. Additionally, the share of female principals increased substantially in Texas across the period of study, so including year fixed effects and controlling for district-specific trends over time in the share of new female, Black, or

Hispanic principals can isolate effects of superintendent race and sex from secular trends experienced in the state or in each district. Fixed effects models used over long periods of time have several drawbacks, given the likelihood that unobserved characteristics related to outcomes of interest change over time. Controlling for district-specific trends also helps isolate effects from a change in superintendent sex or race from other district-specific changes over the long time period. Despite the drawbacks and limitations of fixed effects in this setting, evidence using this strategy removes much of the concerns present in other specifications.

To analyze principal hiring, models were estimated following Bartanen and Grissom (2021) and Giuliano and colleagues (2009), with the additional interaction of sex with race of principals and superintendents. For estimates of the effect of superintendent race and sex on principal hiring, linear probability models were estimated of the following form for principals new to each district in each of the following race-sex groups (Black Female, Black Male, Hispanic Female, Hispanic Male):

3) $$\Pr(NewPrincipalBlackFemale_{ijt} = 1) = \beta_1 FemaleSuperintendent_{jt} + \beta_2 BlackSuperintendent_{jt} + \beta_3 FemaleSuperintendent_{jt} * BlackSuperintendent_{jt} + \beta_4 HispanicSuperintendent_{jt} + \beta_5 HispanicSuperintendent_{jt} * FemaleSuperintendent_{jt} + \beta_6 OtherRaceSuperintendent_{jt} + \beta_7 FemaleSuperintendent_{jt} * OtherRaceSuperintendent_{jt} + S_{jt} + D_{jt} + \alpha_j + \gamma_t + \varepsilon_{ijt}$$

That is, the probability that a newly hired principal *i* in district *j* in year *t* is a Black female conditional on whether the superintendent in district *j* in year *t* is Black female, Black male, Hispanic female, Hispanic male, other race female or other race male[10]. Each model was then

[10] An alternative approach in hiring choice models would be to use a multinomial logit with each race-sex group as an outcome (as in Giuliano et al 2009). However, to estimate these models using district fixed effects requires that only districts with at least one hire in each group across the period be included. Across the entire sample, only 9% of districts met this criterion, and they were systematically different from the distribution of districts as a whole. In reality, superintendents are likely choosing from an applicant pool that does not include members of each race-sex group. Additionally, fixed effects probit models could be used by including a dummy variable for each district; however, estimates from such models are only consistent if a sufficient number of new principal hires are observed within each district. The average district observed in the

repeated for the probability that a newly hired principal is Black male, Hispanic female, and Hispanic male. Additionally, *S* is a vector of characteristics of the superintendent of district *j* in year *t*, and D includes characteristics of district *j* in year *t*. District fixed effects are included in α_j and year effects in γ_t. District-specific trends were also included as controls. Standard errors are clustered at the district level due to the nested nature of the data. As in Bartanen and Grissom (2021), linear probability models are used to estimate binary choice marginal effects, following assumptions set forth in Angrist and Pischke (2008).

To examine whether principal exit varies systematically with superintendent race and sex, the following model was estimated within each of the four race-sex groups:

4) $$\Pr(PrincipalExit_{ijt} = 1) = \beta_1 FemaleSuperintendent + \beta_2 BlackSuperintendent_{jt} + \beta_3 FemaleSuperintendent_{jt} * BlackSuperintendent_{jt} + \beta_4 HispanicSuperintendent_{jt} + \beta_4 HispanicSuperintendent_{jt} * FemaleSuperintendent_{jt} + \beta_6 OtherRaceSuperintendent_{jt} + \beta_7 FemaleSuperintendent_{jt} * OtherRaceSuperintendent_{jt} + P_{ijt} + S_{jt} + D_{jt} + \alpha_j + \gamma_t + \varepsilon_{ijt}$$

This estimates the probability that principal *i* in district *j* in year *t* exits the district in the following year, conditional on the race and sex of the superintendent in district *j* in year *t*. In addition to vectors *S* and *D* described above, vector *P* of characteristics of principal *i* in district *j* in year *t* are also added, including the principal's total years of experience, number of years in that district, and highest degree earned. District fixed effects are again included in α_j and year effects in γ_t. Standard errors are again clustered at the district level.

period hired around 2 new principals each year, insufficient for unbiased estimates from probit models of this type. Therefore, linear probability models were used, following Bartanen and Grissom (2021).

Descriptive Statistics

Across the period, 27,155 unique principals were observed for a total of 148,260 person-year observations. In models estimating the effects of superintendent race and sex on the composition of new principal hires, only those principals who were newly hired to their district in year *t* were included, resulting in an analytic sample for hiring models of 20,119 unique principals observed for a total of 23,802 principal-years. Principals were included in every year that they were new to a district, regardless of whether they had been a principal in another district previously. For example, if a principal were hired at two different districts throughout the study period, they would contribute an observation in their first year at each of the two districts. Characteristics of these principals in those years are shown in Table 2 below. White female principals made up nearly 40% of the sample, with white male principals the next largest group at 28%. Just over 60% of newly hired principals in the sample worked in districts led by white male superintendents across the period, with 14% of principals working in districts led by Hispanic male superintendents and 13% led by white female superintendents. Newly hired principals worked in districts that served an average of 44% Hispanic students, 14% Black students, and with 48% of students eligible for free or reduced-price lunch. Just over a third of newly hired principals worked in urban districts, with 26% of newly hired principals working in rural districts across the period (see Table 1).

Models estimating the effects of superintendent race and sex on the likelihood of principal exit included observations for all principals in all years to determine if they exited their roles between years *t* and *t+1*. These models included 148,260 person-year observations for 27,155 unique principals. Sample characteristics of these principals within race and sex groups are shown below in Table 2. Average annual rates of exit for each race and sex group of

principals are shown in Table 3, with exit defined as a principal not working in the same role in the same district in year $t+1$ as in year t. This could include principals who were hired as principals in another district, principals who took on a new role within the Texas Education Agency, or principals who left educational employment entirely. Exit was defined at the district level because of the analytic focus on the superintendent. White male principals were the most likely to leave, with just over 18 percent of these principals exiting their roles in their districts each year.

The race and sex composition of principals within each district differed systematically by the race and sex of the superintendents of their districts, as shown in Table 4. Black and Hispanic male and female principals made up much larger shares of principals in districts led by same-race-sex superintendents than of principals overall; for example, Black female principals represented just under 5% of principals overall but just over 50% of principals in districts led by Black female superintendents. Districts led by superintendents of each race-sex group differed on other characteristics as well (see Table 5). Student populations in districts led by Hispanic male and female superintendents were on average 82% Hispanic, while districts led by Black superintendents had the highest share of students eligible for free- or reduced-price lunch. Districts led by Black female superintendents were much more likely to be in urban areas than those led by any other group. The concentrations of racially congruent students and principals in districts motivates the inclusion of district fixed effects to isolate the effects on the composition of new principal hires of superintendent turnover resulting in a change in the race of the superintendent leading a district.

To illustrate mean trends in principal hiring following a change in superintendent race or sex prior to modeling formally, as well as to identify evidence of possible pre-existing trends in

principal hiring prior to superintendent changes, Figures 1 and 2 below show the share of new hires by sex and race within campuses in the three years prior to and three years following a superintendent transition. The number of new Black principal hires in districts with some types of superintendent transitions were too small to be displayed under privacy constraints of the data agreement, so Figure 2 includes only Hispanic principals[11]. Figure 1 shows the share of newly hired female principals in districts before and after superintendent transitions; Figure 2 shows the share of newly hired Hispanic principals in districts where each type of superintendent transition occurred. In these figures, the sample was restricted to transitions where the outgoing and incoming superintendents each worked at the district for at least three years. In each case, the black dashed line indicates a change from male (white) to female (Hispanic) superintendent.

The share of female principals increased in the year following all types of superintendent transitions, although the absolute level was higher in districts where both the outgoing and incoming superintendents were female. This apparent trend of increased female principal share motivates the inclusion of district trend controls noted above to remove the effect of general increases over time. There is no evidence of differential patterns of female principal hiring across transition types. Among Hispanic principals, there appears to be an immediate increase in the share of Hispanic principals hired when a Hispanic superintendent replaces an outgoing white superintendent, although this is followed by a slight decline in the subsequent year. The share of Hispanic principals increased slightly as well in districts where a Hispanic superintendent was replaced by a white superintendent (grey solid line), but the share then drops after about two years. One striking feature to note is the significant difference in share of Hispanic principals at

[11] Group Ns within race-sex groupings by year within these schools were too small to be shared due to data privacy guidelines, so race and sex are examined separately here. Additionally, the number of new Black principal hires within groups of superintendent transitions were too small to be displayed in a number of years so are not shared.

districts led by Hispanic superintendents who are then replaced by another Hispanic superintendent relative to the share at districts with white outgoing and incoming superintendents.

Missing Data

Of the 150,000 principal-year observations that met the inclusion criteria noted above, 1,400 (0.97%) were missing data on the share of students in the district eligible for free or reduced-price lunch. These individuals missing data on this characteristic were slightly less experienced than were those with complete data, and slightly more likely to be Hispanic women; however, as these cases represented fewer than one percent of all eligible cases, overall model results were likely not biased by their exclusion. Comparisons of complete observations to those missing at least one covariate are shown in the Appendix[12].

[12] Imputation of missing data is less typical in studies using administrative data, particularly those with a small number of covariates that could be used for imputation. For this reason, as well as the relatively small incidence of missing data, imputation was not performed.

Table 1. Descriptive Statistics: Newly Hired Principals

	Newly Hired Principals	
	Sample Characteristics	
Characteristic	Mean	SD
Principal Characteristics		
White Female	0.37	
White Male	0.28	
Black Female	0.08	
Black Male	0.04	
Hispanic Female	0.13	
Hispanic Male	0.08	
Other Race Female	0.01	
Other Race Male	0.01	
n = 20,119 unique principals		
	Sample Characteristics	
Characteristic	Mean	SD
Years of experience	15.2	8.1
0 prior years at campus	1.00	
1 to 4 prior years at campus	0.00	
5 or more prior years at campus	0.00	
Highest degree MA	0.82	
Highest degree doctorate	0.05	
Superintendent Characteristics		
White Female	0.13	
White Male	0.62	
Black Female	0.01	
Black Male	0.05	
Hispanic Female	0.02	
Hispanic Male	0.14	
Other Race Female	0.004	
Other Race Male	0.02	
Years of experience as superintendent	5.8	4.3
0 prior years at campus	0.22	
1 to 4 prior years at campus	0.55	
5 or more prior years at campus	0.23	
Highest degree MA	0.47	
Highest degree doctorate	0.48	
District Characteristics		
Proportion Black	0.14	0.14
Proportion Hispanic	0.44	0.28
Proportion FRPL	0.48	0.20
Enrollment (100s)	272.4	449.3
Urban	0.35	
Suburban	0.25	
Town	0.14	
Rural	0.26	
n = 23,802 principal-year observations		

Note: Sample characteristics shown above for all principals in their first year at each district when they were a new hire. The above group represents all principals included in models estimating effects of superintendent race and sex on composition of new principal hires. Includes 20,119 unique principals observed for a total of 23,802 principal-years.

Table 2. Descriptive Statistics: All Principals by Race and Sex

	Black Female	Black Male	Hispanic Female	Hispanic Male	White Female	White Male
Unique Principals	2,051	1,058	3,408	2,056	9,542	7,462
Pct of Total	0.08	0.04	0.13	0.08	0.35	0.27
Person-year Observations	10,930	5,486	19,396	11,083	56,741	42,699
Characteristic	Mean / SD	Mean / SD	Mean / SD	Mean / SD	Mean / SD	Mean / SD
Years of experience	20.8	19.4	21.1	19.5	21.4	20.3
	(9.1)	(9.5)	(8.2)	(8.8)	(7.9)	(8.8)
0 prior years at campus	0.24	0.26	0.22	0.25	0.2	0.21
1 to 4 prior years at campus	0.48	0.48	0.49	0.49	0.47	0.46
5 or more prior years at campus	0.28	0.27	0.28	0.26	0.33	0.32
Highest degree MA	0.85	0.84	0.90	0.88	0.88	0.86
Highest degree doctorate	0.08	0.07	0.04	0.04	0.05	0.05
Superintendent Characteristics						
White Female	0.15	0.14	0.08	0.08	0.14	0.12
White Male	0.43	0.5	0.35	0.37	0.71	0.77
Black Female	0.04	0.03	0.01	0.01	0.01	0.01
Black Male	0.16	0.14	0.04	0.03	0.04	0.03
Hispanic Female	0.01	0.01	0.08	0.06	0.01	0.005
Hispanic Male	0.19	0.16	0.43	0.43	0.08	0.06
Other Race Female	0.01	0.003	0.00	0.003	0.001	0.002
Other Race Male	0.02	0.02	0.01	0.01	0.01	0.01
0 prior years at campus	0.21	0.21	0.21	0.22	0.17	0.17
1 to 4 prior years at campus	0.55	0.55	0.55	0.56	0.54	0.56
5 or more prior years at campus	0.24	0.23	0.24	0.22	0.29	0.27
Highest degree MA	0.26	0.29	0.40	0.44	0.4	0.56
Highest degree doctorate	0.65	0.62	0.55	0.51	0.56	0.41
District Characteristics						
Proportion Black	0.29	0.28	0.09	0.09	0.13	0.11
	(0.17)	(0.17)	(0.11)	(0.11)	(0.11)	(0.11)
Proportion Hispanic	0.47	0.44	0.75	0.74	0.38	0.33
	(0.20)	(0.22)	(0.23)	(0.24)	(0.23)	(0.23)
Proportion FRPL	0.57	0.57	0.49	0.52	0.44	0.45
	(0.20)	(0.19)	(0.24)	(0.23)	(0.19)	(0.18)
Enrollment (100s)	741.4	617.4	470.7	407.8	283.2	176.1
	(718.1)	(696.1)	(539.6)	(532.8)	(375.8)	(328.3)
Urban	0.65	0.62	0.60	0.55	0.34	0.22
Suburban	0.25	0.23	0.23	0.19	0.32	0.24
Town	0.05	0.07	0.10	0.14	0.12	0.17
Rural	0.05	0.09	0.07	0.12	0.22	0.36

Note: Sample characteristics shown above for 27,155 unique principals observed for a total of 148,260 principal-year observations. The above group represents all principals included in models estimating effects of superintendent race and sex on probability of principal exit.

Table 3. Average Rate of Principal Exit by Principal Race and Sex

	Black Female Principals	Black Male Principals	Hispanic Female Principals	Hispanic Male Principals	White Female Principals	White Male Principals
Avg Rate Principal Exit %	14.4	17.9	12.6	16.7	13.8	18.3
	n = 10,930	*n = 5,486*	*n = 19,396*	*n = 11,083*	*n = 56,741*	*n = 42,699*

Note: Average annual rate of exit for principals within each race and sex group. Exit defined as principal not holding a principal role in the same district in the subsequent year.

Table 4. Average Racial and Sex Composition of Principals by District Superintendent Race and Sex: All Principals and Newly-Hired Principals

	All Superintendents	Black Female Superintendents	Black Male Superintendents	Hispanic Female Superintendents	Hispanic Male Superintendents	White Female Superintendents	White Male Superintendents
All Principals							
% Black Female	4.5	50.1	32.4	1.9	2.7	3.6	1.9
% Black Male	2.8	15.0	17.7	2.1	1.0	2.4	1.7
% Hispanic Female	6.8	2.3	5.0	40.4	36.5	5.2	3.1
% Hispanic Male	6.8	2.3	5.0	40.4	36.5	5.2	3.1
% White Female	34.5	14.2	21.5	17.1	17.2	43.2	37.5
% White Male	44.5	11.4	19.0	8.6	14.0	40.0	51.7
Newly Hired Principals							
% Black Female	5.1	42.8	30.7	2.0	3.0	4.6	2.7
% Black Male	3.3	19.2	17.1	2.7	1.5	3.0	2.2
% Hispanic Female	8.5	3.3	6.3	42.6	36.2	6.0	4.1
% Hispanic Male	7.3	2.9	4.2	29.9	29.0	5.5	4.2
% White Female	34.3	17.4	21.1	13.0	17.1	43.5	37.8
% White Male	40.4	11.9	18.9	8.7	12.5	36.3	47.8
District-years	*n = 24,835*	*n = 343*	*n = 577*	*n = 399*	*n = 1,691*	*n = 2,831*	*n = 16,234*
Unique districts	*n = 2,034*	*n = 76*	*n = 101*	*n = 89*	*n = 212*	*n = 508*	*n = 1,048*

Note: Above table shows race and sex composition of all principals observed across all years within districts led by superintendents of each group listed in column headers.

Table 5. Average Student Demographic Composition and District Geographic Locale by Superintendent Race and Sex

Characteristic	Black Female Superintendents Mean	Black Male Superintendents Mean	Hispanic Female Superintendents Mean	Hispanic Male Superintendents Mean	White Female Superintendents Mean	White Male Superintendents Mean
District Characteristics						
Proportion White	0.30	0.34	0.56	0.47	0.69	0.71
Proportion Black	0.54	0.46	0.04	0.04	0.11	0.09
Proportion Hispanic	0.30	0.32	0.82	0.82	0.35	0.29
Proportion FRPL	0.67	0.63	0.54	0.54	0.49	0.46
Enrollment	3678.6	10177.5	5590.0	10536.5	4296.9	3849.9
Urban	0.55	0.40	0.26	0.31	0.15	0.08
Suburban	0.28	0.32	0.23	0.18	0.17	0.13
Town	0.03	0.10	0.22	0.23	0.2	0.19
Rural	0.14	0.18	0.29	0.29	0.48	0.59
District years	*n = 343*	*n = 577*	*n = 399*	*n = 1,691*	*n = 2,831*	*n = 16,234*
Unique districts	*n = 76*	*n = 101*	*n = 89*	*n = 212*	*n = 508*	*n = 1,048*

Note: Above table shows characteristics of districts led by superintendents of each group listed in column headers across all years.

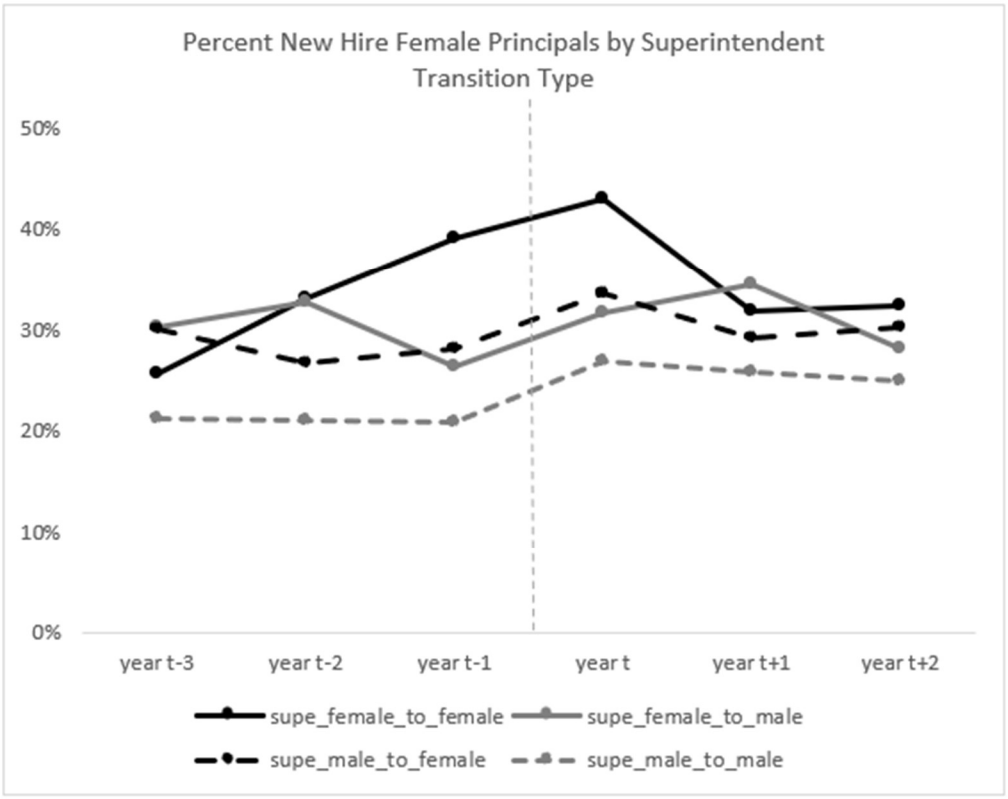


Figure 1. Percentage of Female Principal Hires Before and After Superintendent Transition

Note: This figure plots event studies (six-year window) of the share of a district's newly hired principals that are female in each year. Transitions are limited to cases where each superintendent stayed at least three years in the district. Note that in some years, the total number of new principals across districts with female-to-female superintendent transitions was as low as 40.

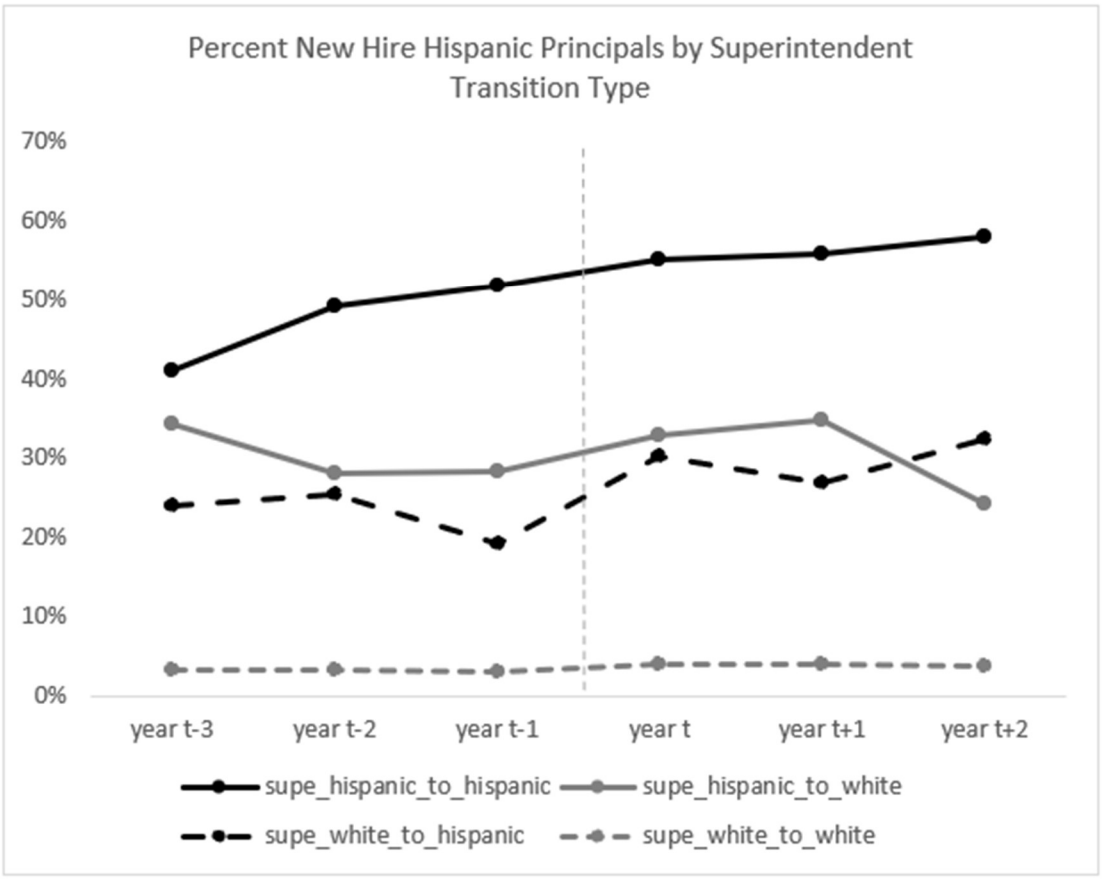


Figure 2. Percentage of Hispanic Principal Hires Before and After Superintendent Transition

Note: This figure plots event studies (six-year window) of the share of a district's newly hired principals that are Hispanic in each year. Transitions are limited to cases where each superintendent stayed at least three years in the district. Number of new hires of Black principals in some years were too small to be displayed due to data suppression policies.

Results

To determine the effects of superintendent race and sex on the hiring of Black and Hispanic male and female principals, linear probability models were estimated of the likelihood that a newly hired principal was a Black female, Black male, Hispanic female, or Hispanic male. Results of these models are shown in Table 6 below. Black male and female principals made up larger shares of new principal hires after a Black superintendent replaced a white superintendent in the same district, with estimated increases of 4.1 percentage points in the share of Black females and 2.7 percentage points in the share of Black males. There were no significant effects of Hispanic superintendents replacing white superintendents on the share of Hispanic male or female principals hired, as shown in the third and fourth columns. Superintendent turnover resulting in a female superintendent replacing a male superintendent did not affect the share of new hires of any group. As a nullification test, these models were replicated with the addition of indicators for superintendent race and sex in the subsequent year, which should not affect hiring in year *t.* None of the year *t+1* indicators was significant (see Appendix). Full model results are also in the Appendix.

To assess whether change in superintendent race and sex affect the likelihood of principal exit, linear probability models of exit were estimated for principals of each race-sex group. For example, the left column of Table 7 below displays estimates of the effects of superintendent race and sex on the likelihood that Black female principals exit their roles. Black female principals were 5.8 percentage points less likely to exit their roles when working in a district led by a Black superintendent who had replaced a white superintendent in the same district. Black male principals, in contrast, were more likely to leave their roles when working in districts led by Black female superintendents relative to when those districts were led by Black male

superintendents (second column). Models of turnover among Hispanic male and female principals did not show any significant effects of superintendent race or gender.

Table 6. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Black Female, Black Male, Hispanic Female, or Hispanic Male

	New Principal Black Female	New Principal Black Male	New Principal Hispanic Female	New Principal Hispanic Male
Female superintendent	-0.008	0.001	-0.004	0.002
	(0.01)	(0.01)	(0.01)	(0.01)
Same race superintendent	**0.041*** **	**0.027***	-0.007	0.015
	(0.01)	**(0.01)**	(0.02)	(0.01)
Same race superintendent * Female superintendent	0.02	-0.019	-0.003	-0.008
	(0.04)	(0.03)	(0.04)	(0.01)
Observations	23,727	23,727	23,727	23,727
R^2	0.207	0.115	0.285	0.184

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends. Models also control for other superintendent characteristics (years of experience, prior years as superintendent at the district, highest degree earned – MA or PhD indicators) and district characteristics (total enrollment, proportion Black students, proportion Hispanic students, proportion students eligible for free- or reduced-price lunch, geographic locale). Full model results in the Appendix.

Table 7. Estimates of the Effect of Superintendent Race and Sex on the Probability of Principal Turnover

	Principal Exit - Black Female	Principal Exit - Black Male	Principal Exit - Hispanic Female	Principal Exit - Hispanic Male
Superintendent Characteristics				
Female superintendent	0.001	-0.016	-0.02	0.02
	(0.01)	(0.03)	(0.02)	(0.01)
Same race superintendent	**-0.058****	**-0.076****	0.005	-0.005
	(0.011)	**(0.03)**	(0.01)	(0.01)
Same race superintendent * Female superintendent	0.05	**0.16****	0.049	-0.024
	(0.06)	**(0.07)**	(0.04)	(0.04)
Observations	10,930	5,486	19,396	11,083
R^2	0.138	0.195	0.112	0.166

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects and control for other principal characteristics (years of experience, years at current campus, highest degree earned – MA or PhD indictors), other superintendent characteristics (years of experience, prior years as superintendent in the district, highest degree earned – MA or PhD indicators) and district characteristics (total enrollment, proportion Black students, proportion Hispanic students, proportion students eligible for free- or reduced-price lunch, geographic locale). Full model results in the Appendix.

** p < 0.10, ** p <0.05, *** p<0.01*

Discussion

This study contributes to understanding relational demography in principal hiring and retention by estimating causal effects of superintendent race and gender on the hiring and retention of Black and Hispanic male and female principals across a large sample of districts and years with significant shares of Black and Hispanic educators and students. A key finding is that superintendent race – but not gender – affects the share of Black male and female principals hired in districts, with Black superintendents hiring 4.1 percentage points more Black female principals and 2.7 percentage points more Black male principals after replacing a white superintendent in the same district. The finding that racial congruence affects principal hiring while gender congruence does not aligns with expectations from theories of similarity attraction and social identity. Specifically, women who hold roles that are male-dominated, such as the superintendency, may be more likely to align with male candidates in an effort to identify with higher-status individuals. This may explain why female superintendents are not differentially likely to hire female principals across any models.

The findings that racial congruence between Black superintendents and principals affected the likelihood of Black male and female principals exiting their roles was unexpected, given the lack of prior research that superintendents impact principal turnover. Decreased likelihood of exit for Black female principals when working for a Black superintendent may suggest evidence of greater satisfaction in their roles, consistent with ideas of representative bureaucracy (Grissom et al 2012). The finding that Black male principals are more likely to exit when working for a Black female superintendent but less likely to do so when working for a Black male superintendent may reflect evidence of dissatisfaction stemming from gender incongruence within dyads that does not align with relational norms (Tsui and O'Reilly 1989,

Tsui et al 2002). This finding also aligns with those from teacher satisfaction and attrition research noting that male teachers are more likely to report dissatisfaction and exit their roles when working for a female principal (Grissom et al 2012).

The null effects of racial congruence between Hispanic superintendents and principals on principal hiring and retention are consistent with findings from student and teacher congruence research that show less consistent effects of racial congruence on student outcomes between Hispanic students and teachers than between Black students and teachers. Explanations for this difference offered in prior studies regarding the diversity of national origin within Hispanic populations may not apply to Texas, where the Hispanic population is much more homogenous in national origin, with over 80% of Hispanics in the state of Mexican origin (Egalite et al 2015, Texas Demographic Center 2021). Local labor markets may be a larger factor, with significant concentrations of Hispanic individuals in districts with Hispanic superintendents. Indeed, as shown in Table 3 above, more than 80% of students are Hispanic in districts led by Hispanic superintendents; by comparison, around 50% of students are Black in districts led by Black superintendents. As reasonable proxies for demographics of local communities, the concentration of Hispanic students in districts led by Hispanic superintendents suggest that these districts are in areas where local labor markets are likely also largely made up of Hispanic individuals. This may limit the potential pool of principals such that the effect of a Hispanic superintendent on the likelihood that a newly hired principal is Hispanic may be minimal.

Conclusion

These findings identify the potential effects that greater racial diversity among superintendents may have on increasing the diversity of the principal workforce, particularly among Black superintendents and principals, which in turn will impact teachers and students. These results confirm that findings of Bartanen and Grissom (2021) regarding principal and teacher racial congruence in hiring extend to superintendents and principals, at least among Black educators. In addition, much of the evidence presented here confirms expectations from theory on similarity attraction, specifically that gender congruence does not increase likelihood of hire for female applicants when hiring managers hold male-dominated roles. There is also evidence consistent with ideas of representative bureaucracy that Black female principals are less likely to exit their positions when working for a Black superintendent, potentially suggesting greater satisfaction in their roles. Further study is merited regarding how to increase the share of Hispanic principals in schools, as well as how superintendents can best support them. Understanding the potential system-wide impacts of increasing the racial and gender diversity of district superintendents will aid in crafting and reinforcing policies designed to ensure greater representation of Black, Hispanic, and female school leaders, whose greater numbers will convey benefits to millions of students.

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Appendix

Table A1. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Black Female

New Black Female Principal	Main Model	Main Model - with *t+1* superintendent characteristics
Female superintendent	-0.008	-0.017
	(0.01)	(0.01)
Black superintendent	**0.041*** **	**0.048*** **
	(0.01)	**(0.03)**
Black superintendent * Female superintendent	0.02	0.01
	(0.04)	(0.05)
Hispanic superintendent	-0.015	-0.03
	(0.01)	(0.02)
Hispanic superintendent * Female superintendent	0.026	**0.05***
	(0.02)	**(0.03)**
Other race superintendent	-0.012	-0.02
	(0.01)	(0.02)
Other race superintendent * Female superintendent	**0.11***	0.125
	(0.06)	(0.09)
Superintendent Characteristics - following year		
Female superintendent (next year)		0.015
		(0.01)
Black superintendent (next year)		0.029
		(0.03)
Black superintendent (next year) *		
Female superintendent (next year)		-0.035
		(0.07)
Hispanic superintendent (next year)		-0.01
		(0.01)
Hispanic superintendent (next year) *		
Female superintendent (next year)		-0.02
		(0.02)
Other race superintendent (next year)		0.06
		(0.07)
Other race superintendent (next year) *		
Female superintendent (next year)		0.039
		(0.04)
Other Superintendent Characteristics		
Superintendent years of experience	0.001	0.001
	(0.001)	(0.001)
Superintendent 0 prior years in district	-0.000	-0.000
	(0.01)	(0.01)
Superintendent 1 to 4 prior years in district	0.002	0.001
	(0.01)	(0.01)
Superintendent highest degree Masters	0.009	0.008
	(0.02)	(0.02)
Superintendent highest degree PhD	0.015	**0.028***
	(0.02)	**(0.02)**

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A1. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Black Female - Continued

New Black Female Principal	Main Model	Main Model - with *t+1* superintendent characteristics
District Characteristics		
Proportion Black students	-0.23	0.048
	(0.17)	(0.17)
Proportion Hispanic students	-0.13	-0.002
	(0.10)	(0.10)
Proportion students eligible for FRPL	-0.02	-0.03
	(0.02)	(0.02)
Total student enrollment (100s)	0.000	0.000
	(0.001)	(0.001)
Observations	23,727	23,727
R^2	0.207	0.203

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A2. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Black Male

New Black Male Principal	Main Model	Main Model - with *t+1* superintendent characteristics
Female superintendent	0.001	0.006
	(0.01)	(0.01)
Black superintendent	**0.027***	**0.027***
	(0.01)	**(0.01)**
Black superintendent * Female superintendent	-0.019	-0.005
	(0.03)	(0.05)
Hispanic superintendent	0.002	0.004
	(0.005)	(0.008)
Hispanic superintendent * Female superintendent	-0.005	-0.004
	(0.01)	(0.02)
Other race superintendent	0.002	0.004
	(0.01)	(0.03)
Other race superintendent * Female superintendent	0.01	-0.016
	(0.05)	(0.08)
Other Superintendent Characteristics		
Superintendent years of experience	0.000	0.000
	(0.001)	(0.001)
Superintendent 0 prior years in district	0.004	0.002
	(0.005)	(0.006)
Superintendent 1 to 4 prior years in district	0.005	0.005
	(0.01)	(0.005)
Superintendent highest degree Masters	**-0.019***	**-0.026****
	(0.01)	**(0.01)**
Superintendent highest degree PhD	-0.015	**-0.026****
	(0.01)	**(0.01)**
Superintendent Characteristics - following year		
Female superintendent (next year)		-0.001
		(0.01)
Black superintendent (next year)		0.016
		(0.04)
Black superintendent (next year) *		
Female superintendent (next year)		0.016
		(0.04)
Hispanic superintendent (next year)		0.004
		(0.01)
Hispanic superintendent (next year) *		
Female superintendent (next year)		-0.01
		(0.02)
Other race superintendent (next year)		-0.015
		(0.02)
Other race superintendent (next year) *		
Female superintendent (next year)		0.002
		(0.05)

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A2. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Black Male - Continued

New Black Male Principal	Main Model	Main Model - with *t+1* superintendent characteristics
District Characteristics		
Proportion Black students	0.19	0.11
	(0.15)	(0.20)
Proportion Hispanic students	0.01	-0.03
	(0.07)	(0.11)
Proportion students eligible for FRPL	0.01	-0.01
	(0.02)	(0.02)
Total student enrollment (100s)	0.000	0.000
	(0.001)	(0.001)
Observations	23,727	23,727
R^2	0.115	0.111

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A3. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Hispanic Female

New Hispanic Female Principal	Main Model	Main Model - with *t+1* superintendent characteristics
Female superintendent	-0.004	0.009
	(0.01)	(0.01)
Black superintendent	-0.000	0.004
	(0.01)	(0.02)
Black superintendent * Female superintendent	-0.03	**-0.05***
	(0.02)	**(0.03)**
Hispanic superintendent	-0.007	0.011
	(0.02)	(0.02)
Hispanic superintendent * Female superintendent	-0.003	-0.029
	(0.04)	(0.05)
Other race superintendent	0.003	-0.003
	(0.01)	(0.02)
Other race superintendent * Female superintendent	0.03	0.15
	(0.10)	(0.17)
Other Superintendent Characteristics		
Superintendent years of experience	-0.002	-0.001
	(0.001)	(0.001)
Superintendent 0 prior years in district	0.001	0.001
	(0.008)	(0.008)
Superintendent 1 to 4 prior years in district	-0.005	-0.003
	(0.01)	(0.01)
Superintendent highest degree Masters	**-0.02***	-0.02
	(0.01)	(0.01)
Superintendent highest degree PhD	**-0.03***	-0.02
	(0.01)	(0.02)
Superintendent Characteristics - following year		
Female superintendent (next year)		-0.003
		(0.01)
Black superintendent (next year)		0.013
		(0.02)
Black superintendent (next year) * Female superintendent (next year)		-0.02
		(0.04)
Hispanic superintendent (next year)		-0.02
		(0.02)
Hispanic superintendent (next year) * Female superintendent (next year)		0.05
		(0.04)
Other race superintendent (next year)		0.007
		(0.03)
Other race superintendent (next year) * Female superintendent (next year)		-0.07
		(0.14)

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A3. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Hispanic Female - Continued

New Hispanic Female Principal	Main Model	Main Model - with *t+1* superintendent characteristics
District Characteristics		
Proportion Black students	0.10	0.08
	(0.12)	(0.12)
Proportion Hispanic students	-0.09	-0.16
	(0.10)	(0.10)
Proportion students eligible for FRPL	-0.012	-0.012
	(0.02)	(0.02)
Total student enrollment (100s)	0.000	0.000
	(0.001)	(0.001)
Observations	23,727	23,727
R^2	0.285	0.291

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A4. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Hispanic Male

New Hispanic Male Principal	Main Model	Main Model - with *t+1* superintendent characteristics
Female superintendent	0.002	0.016
	(0.01)	(0.01)
Black superintendent	0.015	0.013
	(0.01)	(0.02)
Black superintendent * Female superintendent	-0.03	0.008
	(0.03)	(0.04)
Hispanic superintendent	0.015	0.014
	(0.01)	(0.02)
Hispanic superintendent * Female superintendent	-0.008	-0.007
	(0.01)	(0.04)
Other race superintendent	-0.012	-0.006
	(0.02)	(0.02)
Other race superintendent * Female superintendent	0.06	-0.04
	(0.05)	(0.04)
Other Superintendent Characteristics		
Superintendent years of experience	0.000	0.000
	(0.001)	(0.001)
Superintendent 0 prior years in district	-0.01	-0.01
	(0.008)	(0.009)
Superintendent 1 to 4 prior years in district	-0.005	-0.004
	(0.01)	(0.01)
Superintendent highest degree Masters	0.008	0.01
	(0.01)	(0.01)
Superintendent highest degree PhD	**0.016***	0.016
	(0.01)	(0.01)
Superintendent Characteristics - following year		
Female superintendent (next year)		-0.02
		(0.03)
Black superintendent (next year)		0.03
		(0.02)
Black superintendent (next year) * Female superintendent (next year)		-0.001
		(0.03)
Hispanic superintendent (next year)		-0.01
		(0.01)
Hispanic superintendent (next year) * Female superintendent (next year)		0.01
		(0.04)
Other race superintendent (next year)		-0.02
		(0.02)
Other race superintendent (next year) * Female superintendent (next year)		0.13
		(0.07)

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.

** p < 0.10, ** p <0.05, *** p<0.01*

Table A4. Estimates of the Effect of Superintendent Race and Sex on the Probability that a Newly Hired Principal is a Hispanic Male - Continued

New Hispanic Male Principal	Main Model	Main Model - with *t+1* superintendent characteristics
District Characteristics		
Proportion Black students	0.0358	-0.11
	(0.13)	(0.15)
Proportion Hispanic students	0.16	**0.26****
	(0.10)	**(0.13)**
Proportion students eligible for FRPL	0.027	0.01
	(0.03)	(0.03)
Total student enrollment (100s)	0.000	0.000
	(0.001)	(0.001)
Observations	23,727	23,727
R^2	0.184	0.187

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year when that principal was newly hired in a district, representing the total pool of new hires at districts in each year. Of the 23,802 principal-year observations of newly hired principals, 75 were singleton observations within their district and thus excluded from the analysis, resulting in an n = 23,727. The dependent variable is an indicator for whether the newly hired principal is a member of the group listed in the header. Models are linear probability models estimated via OLS. Models include district and year fixed effects, as well as district-specific trends.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A5. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Black Female Principals

Black Female Principals	All Exits
Superintendent Characteristics	
Female superintendent	0.001
	(0.01)
Black superintendent	**-0.058****
	(0.011)
Black superintendent * Female superintendent	0.05
	(0.06)
Hispanic superintendent	-0.009
	(0.01)
Hispanic superintendent * Female superintendent	-0.004
	(0.06)
Other race superintendent	-0.008
	(0.03)
Other race superintendent * Female superintendent	-0.30*
	(0.18)
Principal Characteristics	
Years of experience	0.01***
	(0.001)
Principal 0 prior years at campus	0.004
	(0.01)
Principal 1 to 4 prior years at campus	0.02**
	(0.01)
Principal highest degree Masters	0.025
	(0.02)
Principal highest degree PhD	0.04*
	(0.03)
Other Superintendent Characteristics	
Superintendent years of experience	-0.001
	(0.001)
Superintendent 0 prior years in district	0.025
	(0.02)
Superintendent 1 to 4 prior years in district	-0.002
	(0.01)
Superintendent highest degree Masters	-0.01
	(0.02)
Superintendent highest degree PhD	0.000
	(0.02)

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A5. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Black Female Principals - Continued

Black Female Principals	All Exits
District Characteristics	
Proportion Black students	-0.37
	(0.44)
Proportion Hispanic students	-0.62**
	(0.28)
Proportion students eligible for FRPL	-0.11**
	(0.06)
Total student enrollment (100s)	0.000
	(0.001)
Observations	10,930
R^2	0.138

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A6. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Black Male Principals

Black Male Principals	All Exits
Superintendent Characteristics	
Female superintendent	-0.016
	(0.03)
Black superintendent	**-0.076****
	(0.03)
Black superintendent * Female superintendent	**0.16****
	(0.07)
Hispanic superintendent	0.002
	(0.03)
Hispanic superintendent * Female superintendent	0.006
	(0.08)
Other race superintendent	0.07*
	(0.04)
Other race superintendent * Female superintendent	-0.25*
	(0.12)
Principal Characteristics	
Years of experience	0.01***
	(0.002)
Principal 0 prior years at campus	-0.059**
	(0.02)
Principal 1 to 4 prior years at campus	-0.01
	(0.02)
Principal highest degree Masters	0.040
	(0.02)
Principal highest degree PhD	0.11**
	(0.05)
Other Superintendent Characteristics	
Superintendent years of experience	0.002
	(0.002)
Superintendent 0 prior years in district	0.057**
	(0.02)
Superintendent 1 to 4 prior years in district	0.037**
	(0.02)
Superintendent highest degree Masters	0.006
	(0.03)
Superintendent highest degree PhD	0.017
	(0.03)

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A6. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Black Male Principals - Continued

Black Male Principals	All Exits
District Characteristics	
Proportion Black students	0.50
	(0.68)
Proportion Hispanic students	0.31
	(0.46)
Proportion students eligible for FRPL	-0.14
	(0.10)
Total student enrollment (100s)	0.000
	(0.001)
Observations	5,486
R^2	0.195

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A7. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Hispanic Female Principals

Hispanic Female Principals	All Exits
Superintendent Characteristics	
Female superintendent	-0.02
	(0.02)
Black superintendent	-0.018
	(0.02)
Black superintendent * Female superintendent	0.020
	(0.03)
Hispanic superintendent	0.005
	(0.01)
Hispanic superintendent * Female superintendent	0.049
	(0.04)
Other race superintendent	0.05
	(0.03)
Other race superintendent * Female superintendent	0.06
	(0.06)
Principal Characteristics	
Years of experience	0.01***
	(0.001)
Principal 0 prior years at campus	-0.016
	(0.01)
Principal 1 to 4 prior years at campus	0.01
	(0.01)
Principal highest degree Masters	0.007
	(0.01)
Principal highest degree PhD	0.08***
	(0.02)
Other Superintendent Characteristics	
Superintendent years of experience	-0.001
	(0.001)
Superintendent 0 prior years in district	0.001
	(0.01)
Superintendent 1 to 4 prior years in district	0.01
	(0.01)
Superintendent highest degree Masters	-0.004
	(0.01)
Superintendent highest degree PhD	0.003
	(0.02)

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A7. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Hispanic Female Principals - Continued

Hispanic Female Principals	All Exits
District Characteristics	
Proportion Black students	0.26*
	(0.14)
Proportion Hispanic students	0.039
	(0.14)
Proportion students eligible for FRPL	-0.005
	(0.03)
Total student enrollment (100s)	0.000
	(0.001)
Observations	19,396
R^2	0.112

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A8. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Hispanic Male Principals

Hispanic Male Principals	All Exits
Superintendent Characteristics	
Female superintendent	0.02
	(0.01)
Black superintendent	-0.03
	(0.02)
Black superintendent * Female superintendent	0.18
	(0.05)
Hispanic superintendent	-0.005
	(0.01)
Hispanic superintendent * Female superintendent	-0.024
	(0.04)
Other race superintendent	0.06**
	(0.03)
Other race superintendent * Female superintendent	-0.15*
	(0.08)
Principal Characteristics	
Years of experience	0.006***
	(0.001)
Principal 0 prior years at campus	-0.06***
	(0.02)
Principal 1 to 4 prior years at campus	0.003
	(0.01)
Principal highest degree Masters	0.01
	(0.02)
Principal highest degree PhD	0.09***
	(0.03)
Other Superintendent Characteristics	
Superintendent years of experience	-0.000
	(0.001)
Superintendent 0 prior years in district	0.037**
	(0.02)
Superintendent 1 to 4 prior years in district	0.034***
	(0.01)
Superintendent highest degree Masters	-0.018
	(0.03)
Superintendent highest degree PhD	-0.01
	(0.03)

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A8. Estimates of the Effect of Superintendent Race and Sex on the of Principal Turnover Among Hispanic Male Principals - Continued

Hispanic Male Principals	All Exits
District Characteristics	
Proportion Black students	0.640
	(0.68)
Proportion Hispanic students	0.17
	(0.18)
Proportion students eligible for FRPL	-0.07*
	(0.04)
Total student enrollment (100s)	0.000
	(0.001)
Observations	11,083
R^2	0.166

Note: District-level clustered standard errors in parentheses. Each observation is a principal-year, representing the total pool of principals in districts in each year. In each column the dependent variable is an indicator for whether the principal in the group listed in the header exited their role in the district between years *t* and *t+1*. Models are linear probability models estimated via OLS. Models include district and year fixed effects.
** p < 0.10, ** p <0.05, *** p<0.01*

Table A9. Sample Characteristics for Complete Observations and Observations Missing Data

	Complete Observations	Missing Covariate(s)
Percent of total principal-year observations	99.0	0.97
	(n = 148,260)	(n = 1,468)
Characteristic	Mean	Mean
Principal Characteristics		
White Female	0.36	0.31
White Male	0.29	0.28
Black Female	0.08	0.09
Black Male	0.04	0.04
Hispanic Female	0.13	0.10
Hispanic Male	0.08	0.08
Other Race Female	0.01	0.01
Other Race Male	0.01	0.01
Years of experience	20.8	19.7
0 prior years at campus	0.22	0.31
1 to 4 prior years at campus	0.47	0.48
5 or more prior years at campus	0.31	21.20
Highest degree MA	0.87	0.85
Highest degree doctorate	0.05	0.08
Superintendent Characteristics		
White Female	0.12	0.18
White Male	0.63	0.32
Black Female	0.01	0.03
Black Male	0.05	0.12
Hispanic Female	0.02	0.10
Hispanic Male	0.16	0.24
Other Race Female	0.002	0.002
Other Race Male	0.01	0.01
Years of experience as superintendent	6.2	5.1
0 prior years at campus	0.18	0.25
1 to 4 prior years at campus	0.55	0.59
5 or more prior years at campus	0.27	0.27
Highest degree MA	0.43	0.46
Highest degree doctorate	0.52	0.50
District Characteristics		
Proportion Black	0.14	0.10
Proportion Hispanic	0.45	0.65
Proportion FRPL	0.47	0.62
Enrollment (100s)	334.2	88.0
Charter District	0.02	0.02
Urban	0.39	0.48
Suburban	0.21	0.28
Town	0.26	0.06
Rural	0.13	0.19

Conclusion

The results of these studies suggest that efforts to recruit, hire, and retain Black and Hispanic men and women as teachers and school leaders must take into consideration the demographic composition of school and district leaders who manage them. These findings suggest that increased numbers of Black superintendents, for example, will likely increase the share of Black principals leading schools, which will in turn increase the share of Black teachers. Along the same lines, greater numbers of Hispanic principals will likely lead to increased numbers of Hispanic teachers in the schools they manage. One mechanism through which these congruence effects appear to operate is through the benefits of same-race network connections with superintendents that made it more likely that Black and Hispanic candidates were hired as principals.

Investigating racial and gender congruence simultaneously revealed important differences in hiring effects across school and district leadership levels previously unexplored in the literature. Black and Hispanic female principals hired greater shares of Black and Hispanic female teachers than they did of racially congruent male teachers, suggesting that gender congruence conferred additional benefits to Black and Hispanic female applicants than did racial congruence alone. This was not the case in hiring of principals by female superintendents, in which there was no evidence of gender congruence affecting hiring. This difference is consistent with theories and applied work outside of education suggesting that women who hold male-dominated roles may not align as strongly with female applicants as do women who hold other kinds of roles (Graves and Powell 1995, Konrad et al 2000). Indeed, the superintendency is a role still largely held by men in Texas, while the share of women in school leadership roles has

grown significantly over the period of study, with women now making up a majority of principals in the state.

This study also represents the first systematic exploration of superintendent and principal racial and gender congruence effects on principal hiring or retention. Placed alongside prior work on teacher and principal demographic congruence, the results of Chapter 3 suggest that racial congruence between Black superintendents and principals increases the rate of hire among Black female and male principals, consistent with findings of Bartanen and Grissom (2021) among principals and teachers. Superintendent racial and gender congruence with principals also affected the likelihood of principal exit among Black principals, an unexpected result given the lack of prior work identifying superintendents as a driver of principal retention or turnover. The finding that Black male principals were less likely to exit their roles when a Black male superintendent replaced a white superintendent, but more likely to exit if the new superintendent was a Black female is consistent with research on principal and teacher gender congruence. Specifically, male teachers are less satisfied and more likely to exit when a male principal is replaced by a female principal, with no such negative effects noted for female teachers led by male principals (Grissom et al 2012).

The results in Chapter 2 regarding likelihood of hire into school principal roles confirm and expand findings from prior work that female, Black, and Hispanic educators with administrative certification are less likely to be hired than are white males, with some of these observed differences explained by the distribution of candidates across district contexts. Most notably, this study suggests that employment network connections to superintendents are only associated with increased likelihood of hire for Black and Hispanic candidates when the superintendent with whom they are connected is of the same race. This finding adds to prior

work on the intersection of applicant race and gender with the demographic composition of the applicant's employment network, providing evidence that employment network connection with a high-status, racially homophilous contact was associated with greater odds of hire for Black and Hispanic candidates. Prior work by McDonald (2011) found that the most intensive job-seeking support provided by contacts in employment networks was reserved for same-gender applicants and did not find differences by racial homophily. That study examined a variety of job-seeking supports rather than actual employment outcomes, however, and did not isolate the status level of employment network contacts, while in this study, the employment network connections measured were all to individuals holding the same, high-status role.

There are several limitations to these studies. As noted in the Introduction, Texas is distinct from other states in key ways that may affect these results. The high pace of growth in number of schools is unusual, likely resulting in greater opportunities for Black, Hispanic, and female educators to become principals over the period of time under study with a larger number of open roles. In addition, Texas has many districts with student enrollments that are almost entirely made up of Hispanic students, and Hispanic educators are also clustered into a small share of districts across the state. While the significant shares of Hispanic students and educators provides an ideal setting for studying the careers of these educators, these findings may not apply to many other states. However, as noted in the Introduction, the share of Hispanic students is growing in other states, suggesting that evidence from Texas may be increasingly relevant to educators and policymakers in a variety of settings.

Finally, the measure of employment network connections between administrative candidates and superintendents has a number of weaknesses, as noted in Chapter 2. The indicator for shared employment networks did not restrict the time period in which superintendents had

worked at a school that was also part of the candidate's employment history, so they may have worked there many years apart. In addition, in some smaller districts, there may only be a few schools, such that nearly everyone who had worked in schools in that district would likely share a campus employment history.

Future research into teacher and principal hiring that observes selection processes at a more granular level may reveal greater insights into the ways in which racial and gender congruence between school and district leaders and teacher and principal candidates operate. The first and third studies relied on observations only of those who were hired into roles, while the second study used the completion of an administrative credential as a proxy for seeking a principalship. Future work that observes actual applicant pools and how applicants move through stages of selection could reveal mechanisms through which racial congruence influences candidates to consider jobs as well as influences hiring managers to offer them.

Future studies of employment network connections and how they influence principal hiring could better identify connections through additional methods, such as surveys or interviews with educators to directly map their networks and to identify the strength of various ties. These mixed-methods approaches could also identify specific mechanisms through which support is offered by contacts within employment networks and assess their efficacy in hiring and promotion for educators.

In addition, the first and third studies revealed differences in racial congruence effects on hiring for Black relative to Hispanic teachers and principals in a pattern consistent with those from research on teacher and student matching, with effects of racial congruence stronger among Black educators than those observed among Hispanic educators. Further research that employs mixed-methods approaches to understanding the career trajectories and experiences of Hispanic

educators could shed light on how they understand their opportunities to advance, the salience of their identities in building school and district networks, and the resources they employ to pursue advancement.

Policy efforts that focus solely on the production of greater numbers of Black and Hispanic men and women as candidates for teacher or principal roles may not meet with much success while the hiring manager workforces for these roles remain largely white and male. At a time when school and district leader turnover is historically high, there are opportunities to substantially increase the representation of Black and Hispanic men and women in superintendent and principal positions across Texas and the country. These studies suggest that the results of doing so will have effects far beyond the leaders themselves, giving more Black and Hispanic students the opportunity to learn from a teacher who mirrors them.

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