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The Principal-Teacher Churn: Understanding the Relationship Between Leadership Turnover and Teacher Attrition

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Abstract

Purpose: Principals are critical to school improvement and play a vital role in creating inclusive and high-performing schools. Yet, approximately one in five principals leave their school each year, and turnover is higher in schools that serve low-income students of color. Relatedly, high rates of teacher turnover exacerbate challenges associated with unstable learning environments. Our study examines the extent to which principal turnover influences teacher turnover. We build on past work by exploring how the relationship between teacher and principal turnover differs in urban, high-poverty settings and by examining the effects of chronic principal turnover. **Research Methods/Approach:** We draw on a student- and employee-level statewide longitudinal dataset from Texas that includes all public K-12 schools from school years 1999–2000 to 2016–17. We estimate teacher-level models with school fixed effects, allowing us to compare

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teacher turnover in schools leading up to and immediately following a principal exit, to otherwise similar schools that do not experience principal turnover. **Findings:** Teacher turnover spikes in schools experiencing leadership turnover, and these effects are greater among high-poverty and urban schools, in schools with low average teacher experience, and in schools experiencing chronic principal turnover. **Implications:** Improving leadership stability, especially in urban schools experiencing chronic principal turnover may be an effective approach to reducing teacher turnover. Principal and teacher turnover and their relationship with each other requires further investigation. The field would benefit from qualitative research that can provide important insights into the individual decisions and organizational processes that contribute to principal turnover.

Keywords
principal, principal turnover, teacher turnover, school leadership, equity

Effective principal leadership plays a central role in improving schools and increasing student achievement (Eberts & Stone, 1988; Hallinger & Heck, 1996; Leithwood et al., 2004; Robinson et al., 2008; Sebastian & Allensworth, 2012). One of the most important jobs of the principal is related to recruiting, hiring, inducting, and retaining teachers that fit the school's culture and are committed to serving the school's student population (Grissom, 2011; Harris et al., 2010). Principals through their social interactions with teachers, also affect the working conditions in schools by including personnel in planning, decision-making, and culture shaping activities that lead to greater teacher job satisfaction, commitment, and collaboration (Cherkowski, 2016; Griffith, 2004; Marks & Printy, 2003). Principals can also work with teachers and families to create more inclusive schools and address longstanding inequities, especially for low-income students of color, students with disabilities, and English learner students (DeMatthews, 2018; DeMatthews & Mawhinney, 2014; Furman, 2012; Green, 2015; Khalifa et al., 2016; Watson & Bogotch, 2015). Thus, principal leadership is "second only to classroom instruction among school-related factors that affect student learning in school" (Wallace Foundation, 2013, p. 5) because principals significantly impact the conditions that support effective teachers.

High rates of principal turnover threaten school stability, school improvements that advance achievement and equity, and school working conditions that support effective teaching and meaningful relationships with communities and families. Among all U.S. public school principals in the 2015–16 school year, about 82% remained at the same school in the next year, 6% moved to

a different school, and 10% left the principalship (Goldring & Taie, 2018).[1] Principals in high-poverty schools, those with more than 75% of students qualifying for free and reduced meals (FARMs), were less likely to remain at their schools the following year (79%) compared to principals in schools with fewer than 35% of students qualifying for FARMs (85%) (Goldring & Taie, 2018). Of the principals that remained in 2016–17, only 43% planned to remain as a principal for as long as they were able to, while 11% planned to remain in their position until a more desirable job opportunity was available. Other studies have found higher rates of principal turnover in subsequent years and show that voluntary principal turnover (e.g., principals opting to retire, transfer to a different school or district, or accept a promotion) is at least partly driven by principals' desire to lead schools they view as more appealing (Gates et al., 2006; Loeb et al., 2010; Papa et al., 2002). Schools serving low-income students of color are at higher risk of principal turnover and may already have less experienced principals, which can contribute to organizational instability and poor working conditions that undermine continuous improvement efforts related to achievement and equity.

Given the importance of principal leadership and high rates of principal turnover, especially in schools that serve low-income students of color, we aim to better understand how principal turnover is related to teacher turnover. Our study is anchored by two guiding research questions: How does the probability a teacher leaves their school change when a new principal is hired? And to what extent are teacher, principal, and school characteristics related to the relationship between leadership turnover and teacher attrition? These questions are important because they provide insights for policymakers and district leaders responsible for principal and teacher retention. While prior studies address parts of these research questions, our analysis is the first of which we are aware that considered differences in the timing of principal turnover effects based on school contexts, principal turnover type, and the experience profile of the replacement principal. In the balance of this paper, we provide a review of extant literature that addresses these questions and explain how our study adds to current knowledge. We then describe our data and analytic approach, present findings, and conclude with discussion and recommendations for policy and practice.

Research on the Causes of Teacher Turnover and Effects of Principal Turnover

Principals are an important element of educational systems partly because they make key hiring decisions and foster the working conditions that enable effective and culturally responsive teaching. As such, principal

turnover may lead to increased rates of teacher turnover. Below we review research related to our research questions and describe how our work addresses an important gap in the literature. We begin with a review of research focused on causes of teacher turnover to highlight how school context, working conditions, and leadership affect teacher attrition, especially in schools serving low-income students of color and schools labeled as "hard-to-staff." Then, we review research on principal leadership and turnover to show how principals affect student achievement and working conditions including teacher retention and attrition.

Causes of Teacher Turnover

Teacher turnover has increased significantly over the past 30 years (Ingersoll et al., 2014). Relatively modest rates of teacher turnover can be good for a school, especially if departing teachers are ineffective, uncooperative, or lack evidenced-based and culturally responsive pedagogical expertise (Adnot et al., 2017). Turnover becomes problematic at higher levels because it exacts "instructional, financial, and organizational costs that destabilize learning communities and directly affects student learning" (Simon & Johnson, 2015, p. 6). The cost of teacher turnover is particularly evident and impactful in high-poverty schools serving higher concentrations of lower-performing students and students of color (Allensworth et al., 2009; Hanushek et al., 2004; Simon & Johnson, 2015). High rates of teacher turnover in what some scholars refer to as "hard-to-staff-schools" create a context where low-income students of color are continuously taught by new teachers who are often less experienced and effective (Clotfelter et al., 2007; Hanushek et al., 2004). As turnover persists, principals can struggle to find qualified teachers who are a good fit for their schools and can be forced into hiring teachers who are "mismatches" and more likely to be dissatisfied and exit quickly (Liu et al., 2008). Pressure to perform on high-stakes accountability tests can lead to narrowing of the curriculum, and with less experienced and less effective teachers, can contribute to teacher burnout and additional turnover (Clotfelter et al., 2004; Crocco & Costigan, 2007; Ryan et al., 2017). In turn, principals are tasked with continuously attracting and inducting new teachers rather than supporting working conditions for veteran faculty.

Some scholars have argued teachers leave "hard-to-staff-schools" in favor of higher-performing schools to avoid working with "challenging student populations" (Sass et al., 2012, p. 105) or with students that required greater effort to achieve results (Goldhaber et al., 2010; Hanushek et al., 2004; Scafidi et al., 2007). However, other studies find that most teachers

report entering the profession specifically to serve marginalized student groups (Sanger & Osguthorpe, 2011). The realities of being a teacher can impact retention, especially in challenging school contexts. As Cochran-Smith (2004) notes,

> Many enter teaching for idealistic reasons—they love children, they love learning, they imagine a world that is a better and more just place … But these reasons are not enough to sustain teachers' work over the long haul … in the face of the extraordinarily complex and multiple demands today's teachers face. (p. 391)

Teachers often report exiting lower-performing or "hard-to-staff" schools that could be because of working conditions that make it difficult to teach their students, not because of their students (Loeb et al., 2005; Simon & Johnson, 2015). Teacher turnover studies that combine survey data with administrative data are better able to parse out differences in teacher attrition related to working conditions, school culture, and leadership and student characteristics. For example, studies show administrative support is a stronger predictor of teacher retention than student demographics, but there is often less administrative support in high-poverty and lower-performing schools and schools with higher proportions of students of color (Boyd et al., 2011).

Effective, stable leadership that fosters a positive school culture contributes to teacher success (Grissom, 2012; Johnson et al., 2012) and supports teacher retention (Johnson & Birkeland, 2003). Teachers prefer working in schools with a strong professional work environment and at least adequate administrative support because it enables their success. Accordingly, principals impact teacher retention through recruiting and hiring teachers that fit their school-community context, but also because they are responsible for creating working conditions that promote teacher success. In "hard-to-staff" schools, the principal's job is more difficult because more teacher vacancies exist with a potentially smaller applicant pool. The job requires a greater investment of time to recruit new teachers and create the working conditions that lead to teacher success and retention. Thus, research on teacher turnover provides a strong empirical and theoretical basis for the importance of school leadership as well as the relevance of principal turnover to teacher turnover, though little prior work investigates this question empirically.

Effects of Principal Turnover

Principals indirectly affect student achievement and teacher success through establishing a school mission and vision, utilizing and distributing resources

strategically, evaluating teaching and curriculum, promoting a safe and orderly learning environment, and ensuring teachers engage in continuous learning and development (Marks & Printy, 2003; Robinson et al., 2008). Principals' abilities to understand school needs may also enable them to promote a shared set of values and distribute resources and opportunities in a way that is responsive to time and context (Day et al., 2016). Principals can further contribute to teacher success as they utilize their contextual knowledge to make important personnel decisions, including recruiting and retaining teachers that fit the school's culture and who are committed to the school's student populations. Relatedly, principals who lead for social justice foster a school culture and environment that addresses all forms of discrimination, segregation, and unequal outcomes (Khalifa et al., 2016; Rivera-McCutchen, 2019; Theoharis, 2007). In doing this work, principals can disrupt toxic teacher working environments, spur innovation among teachers, hire teachers committed to social justice, and connect teachers with supports they need. However, some teachers may be resistant to such changes and may opt to exit their school, contributing to some additional turnover.

Principals play an important role in supporting teachers, but their tenure at a given school is limited by retirement or exit from the profession, district principal rotation policies, voluntary or involuntary transfers within the district, moving to a school in another district, and promotion into a district leadership position (Boyce & Bowers, 2016; Cullen & Mazzeo, 2008; DeAngelis & White, 2011; Farley-Ripple et al., 2012; Papa, 2007). Principal turnover can be disruptive and is negatively related to achievement, teacher turnover, and a healthy and positive school climate (Snodgrass Rangel, 2018). However, not all principals are effective, equally capable of leading in a given context, and able to promote positive teacher working conditions, so principal turnover can be beneficial or harmful depending on many circumstances (Hallinger & Heck, 1996). For example, principal turnover can be beneficial if an ineffective principal is removed, if there is not a good fit between the principal and the school community, or if a change in leadership stimulates new ideas and innovation that improves working conditions and contributes to greater levels of teacher success. Miller (2013) finds that a school's test scores tends to fall in the years preceding a principal departure, but achievement returns to prior levels as the new principal gains tenure. Grissom and Bartanen (2019) find that less effective principals, as assessed through a multiple measure evaluation system, are more likely to be demoted, or exit the K-12 system, suggesting that some principal turnover may improve conditions within the school. However, turnover can also create organizational instability, undermine improvement efforts, and diminish working conditions.

Voluntary principal turnover is a common phenomenon (in comparison with principals being terminated for performance which is far less common in most districts). Like teachers, principals often choose to exit low-achieving schools and schools with high proportions of students of color for higher achieving schools that serve fewer low-income students of color (Gates et al., 2006; Loeb et al., 2010; Papa et al., 2002). Researchers have found that contextual factors and working conditions can impact principal retention (Tekleselassie & Choi, 2019). Principal turnover is also more pronounced in rural districts (Pendola & Fuller, 2018). Turnover in lower achieving schools and schools that serve high-proportions of students of color is especially problematic given the challenges these schools often confront (e.g., increased demands to increase student achievement, racial and economic neighborhood segregation, historic budget shortfalls, higher rates of teacher turnover) and the added accountability pressure from federal, state, and local education agencies. Thus, principals may opt to exit certain school contexts at higher rates in a phenomenon described as principals using lower-performing schools as "stepping stones" to more desirable and higher-performing schools (Béteille et al., 2012).

Principal turnover likely has an influence on teacher turnover, especially considering that principals may have valuable relationships with the teachers they hire. A new principal may trigger veteran teachers hired by a previous principal to leave, while a more veteran, highly effective principal can have a positive impact on teacher retention, especially in schools that serve high-proportions of low-income students of color (Grissom, 2011). At least three prior studies quantify the effect of principal turnover on teacher turnover. Béteille and colleagues (2012) used longitudinal administrative data from Miami-Dade County Public Schools and find that frequent principal turnover results in lower teacher retention and student achievement, and that the effects of principal turnover are particularly harmful in high poverty, low-achieving schools, and in schools with the least experienced teachers. Related studies reach similar conclusions based on statewide data from North Carolina (Miller, 2013) and Tennessee and Missouri (Bartanen et al., 2019). Bartanen et al. (2019) study applies a difference-in-difference framework to school-level data to measure changes in teacher turnover in the years leading up to and following a principal turnover. The authors find teacher turnover increases during the first year of a principal transition, but effects are significantly smaller if the principal was promoted, as opposed to demoted, transferred, or exited the K-12 system. The authors suggest the type of principal turnover – exit, demotion, transfer, or promotion – is likely a proxy for elements of the school context. Principal promotions may suggest perceived positive leadership, while demotions may suggest

ineffective leadership. Consistent with Bartanen et al.'s work, principal turnover in our context may have more modest effects on teacher turnover with promotions (or demotions), since district leaders may have additional warning time or might even have initiated the move. Transfers and exits might be less expected, as principals may not notify their district of their intentions until after their future employment is secured. Bartanen et al. (2019) find that replacing an existing principal with a more experienced principal can reduce the negative impacts on achievement, but the authors do not example different types of experience profiles, such as, prior experience as an assistant principal, the most common route to the principalship.

Other studies based on survey data show teachers working in schools that experience rapid principal turnover are more likely to report poor working conditions, including a school culture with a lack of purpose, staff cynicism about principal commitments, and the inability focus on continuous improvement (Fink & Brayman, 2006). Even highly-effective teachers committed to their students and the school's mission can be more likely to transfer or leave under such conditions. In addition, teacher turnover, including turnover of less effective teachers, can negatively impact student achievement because of what has been called "collective teacher efficacy" or the "perceptions of teachers in a school that the efforts of the faculty as a whole will have a positive effect on students" (Goddard et al., 2000, p. 480). Related research has shown that high-functioning professional learning communities (PLCs) predict higher levels of collective teacher efficacy which in turn can contribute to improved student achievement (Voelkel & Chrispeels, 2017), teacher success, and teacher retention. In other words, teacher turnover can disrupt teacher teams, teacher learning, and important social networks that support organizational learning and healthy relationships, even when less effective teachers exit schools.

Teacher turnover, including the turnover of less effective teachers, interrupts important teacher-to-teacher relationships, a sense of trust among co-workers, and organizational learning processes that support effective teaching. Not surprisingly, Mascall and Leithwood (2010) found that principal turnover is moderately and negatively correlated with teacher perceptions of school culture.[2] Positive working conditions for teachers have been found to reduce turnover (Loeb et al., 2005). In sum, principals can improve or sustain working conditions over time, especially as they recruit and retain teachers that are well-matched for their school-community context and as they engage in leadership activities that contribute to teacher success, such as providing quality professional development, high-levels of family engagement, and targeted supports and resources aligned to teacher requests and needs. When principals leave their schools, such efforts can be disrupted and destabilize the organizational conditions that support teacher success.

The literature cited above leaves unanswered several important questions for policymaking. How does the magnitude and timing of effects of principal turnover vary across different types of principal departures (exit, promotion, transfer, or demotion)? Are effects larger in certain types of schools? What role does the experience profile of the replacement principal play for tempering the negative effects of principal turnover? Our work builds on three studies in particular, Béteille et al. (2012), Miller (2013), and Bartanen et al. (2019), in several important ways. First, we estimate teacher level models consistent with Béteille et al. (2012) (but in contrast to Bartanen et al., 2019 and Miller, 2013), which allows us to test teacher fixed effects models and explore more deeply overlapping heterogeneous effects of principal turnover on teacher turnover. We build on Bartanen et al.'s work specifically by further unpacking different types of principal turnover, exploring the role of the replacement principal's experience profile, and examining heterogeneous effects across school types. Bartanen et al. (2019) report that 60% of new-to-school principals in Missouri and Tennessee have no prior experience as a principal, and similar to Béteille et al. (2012), they find that additional prior years of experience as a principal for the replacement principal tempers the negative effects of principal turnover. But many schools do not receive principal applicants with prior principal experience (Whitaker, 2003). We find that within our sampling window in Texas, 59% of new-to-school principals have no prior experience as a principal, but 48% have experience as an assistant principal (while 11% have no prior administrative position experience).[3] Examining the role of prior experience as an assistant principal may be valuable given limited applicants with principal experience, especially in high-poverty schools. We further build on past work by exploring how the effect of each type of principal turnover varies by the replacement principal's experience profile, comparing the effects of principal turnover across different schools types, and examining effects in a set of specific large urban districts.

We hypothesize that, as in past studies, principal turnover is most detrimental when the replacement principal has no experience as a principal, but we suspect that prior experience as an assistant principal may reduce some of the effects on teacher turnover. We further hypothesize that the timing of effects of principal turnover on teacher turnover may vary by type of principal turnover (exit, promotion, transfer, or demotion). Principals who transfer to other schools or districts (or exit the state K-12 system) may notify teachers ahead of time, increasing teacher turnover during the last year before the principal's departure. In contrast, principal demotions and promotions may have larger "first year of new principal" effects, if teachers find out about principal demotions and promotions later

in the year and wait to see who the replacement principal will be before making any career path decisions. As a result, we suspect principal transfers and exits may have more prior-year effects, while promotions and demotions might have larger year t effects, and the effects of promotions and demotions may be more sensitive to characteristics of the replacement principal. In addition, given that teachers in urban schools have more alternate job opportunities both within and outside teaching, we further hypothesize that principal turnover may have a stronger influence on teacher turnover in urban schools. We also hypothesize that high-poverty schools, which often struggle to retain both principal and teachers, may experience greater teacher turnover following a change in school leadership. Finally, we suspect that school serving a high percent of novice teachers may experience greater increase in teacher turnover following principal turnover since early career teachers may be more willing to change places of work in response to changes in working conditions. Our results provide greater insights into how district leaders might curb the effects of principal turnover on teacher turnover and where regional and state leaders may need to focus efforts to address high educator attrition.

Data and Analytic Approach

Data

We draw on a student- and employee-level statewide longitudinal dataset from Texas that includes all public K-12 schools from school years 1999–2000 to 2016–17 (henceforth we refer to academic years by the spring year in some cases). Staffing data include information about employees' roles, such as whether they are a teacher or principal, total experience as an educator, and school assignment. Student data include information about students' eligibility for free or reduced-price meals, race/ethnicity and gender, and scores on statewide standardized exams. Employees' school assignment data allow us to track career pathway movements into and out of schools and out of the public K-12 Texas educator workforce. The dataset does not include information about principal experience, so we count the number of years an employee is listed with the principal role. We use the first 5 years of our dataset to measure principal experience and omit these years from our analytic dataset. This results in a principal experience variable that take the values of 0, 1, 2, 3, 4, 5, or more than 5 years of experience.

The final analytic dataset includes 93,872 principal observations, 3.8 million teacher observations, and over 57 million student observations, covering all public schools in Texas from 2004–05 to 2015–16. We use data from

2016–17 to determine teacher and principal mobility outcomes for the 2015–16 school year. Summary statistics for our analytic dataset are included in Table 1. The average principal has 21 years of experience as an educator, and about half of all principals in a given year have 5 or more years of experience. Approximately 60% of all principals are female, two-thirds identify as White, and 19% and 11% identify as Latinx and Black, respectively. Principals who are more likely to be in their first year in their current school have less experience as an educator, and are slightly more likely to be male and identify as a person of color. Panel B of Table 1 shows teacher characteristics. The average teacher has 11.4 years of experience, with slightly more experienced teacher in schools with more stable leadership. Teachers in schools with a new principal have 11.3 years of experience compared to 11.7 for those in schools where the principal is in their fifth or greater year at the school. As with principal gender and race/ethnicity, schools with new principals are more likely to have more novice teachers, more male teachers, and more teachers of color. Finally, consistent with prior research, lower-achieving students and low-income students are more likely to attend schools with principals in their first few years in that school (shown in the final two rows of Table 1).

Analytic Approach

Identifying the causal effect of principal turnover on teacher turnover is challenging because unobserved school factors that lead to principal turnover may also cause teacher turnover. Principal turnover is not randomly distributed across schools. Past research demonstrates that schools that are more likely to see turnover among principals are also more likely to experience teacher turnover (e.g., Edwards et al., 2018; Fuller et al., 2007; Fuller & Young, 2009). On the one hand, the replacement of a principal may cause teachers to leave their school in search of more stable leadership environments, consistent with the finding that supportive administrative leadership is a strong predictor of teacher retention (Boyd et al., 2011). On the other hand, other factors such as negative school climate, may contribute to both principal and teacher turnover. In short, principal turnover could be endogenous to the likelihood a teacher leaves their school if a third factor contributes to both teacher and principal turnover. Moreover, the relationship could exhibit reverse causality, where teacher turnover leads to principal turnover.

We control for these two threats to validity by including school fixed effects and using indicator variables to control for the timing of principal turnover. School fixed effects allow us to compare the likelihood of teacher turnover during school years when there is principal turnover to teacher turnover

Table 1. Summary Statistics by Number of Years Principal is Employed in Current School, 2005–2017.

		Year at current school				
	Total	First	Second	Third	Fourth	Fifth or greater
Panel A. Principal characteristics						
Num. of principal-obs.	93,872	18,023	15,371	12,289	9,643	38,546
Total experience	20.5	16.2	17.7	18.8	19.9	24.2
Principal experience	4.8	2.0	2.9	3.7	4.4	7.3
Percent female	59%	57%	58%	59%	60%	61%
Principal race/ethnicity						
Asian	1%	1%	1%	1%	1%	1%
Black/Af. Am.	11%	13%	12%	12%	11%	10%
Latinx/Hisp.	19%	21%	20%	20%	20%	17%
White	64%	60%	61%	62%	63%	67%
Other	5%	6%	6%	5%	5%	5%
Panel B. Teacher and student characteristics						
Num. of teacher-obs.	3,858,189	730,887	634,970	517,921	407,389	1,567,022
Total experience	11.4	11.3	11.2	11.3	11.4	11.7
Percent novice	13%	14%	14%	13%	13%	12%
Percent female	77%	75%	75%	76%	76%	78%
Percent exiting school	20%	22%	21%	20%	20%	18%
Teacher race/ethnicity						
Asian	1%	1%	1%	1%	1%	1%

(continued)

Table 1. (continued)

		Year at current school				
	Total	First	Second	Third	Fourth	Fifth or greater
Black/Af. Am.	10%	11%	10%	10%	10%	9%
Latinx/Hisp.	20%	21%	21%	21%	21%	19%
White	62%	61%	61%	61%	62%	63%
Other	7%	6%	6%	6%	7%	7%
Num. of student-obs.	57,070,766	10,744,840	9,330,364	7,627,859	6,026,263	23,341,440
Avg. achievement	−0.021	−0.098	−0.087	−0.052	−0.016	0.054
Percent low-income	50%	51%	51%	50%	50%	48%

Note. "Person-obs." (e.g., "principal-obs.") refers to the number of person-year observations.

within the same school that occur during years of stable school leadership in years with and without a principal turnover for teachers *in the same school over several years*. School fixed effects and the indicators for the number of years leading up to treatment allow us to track teacher attrition in the same school over time leading up to and immediately following a change in school leadership. This analytic approach allows us to control for time-invariant school factors such as persistent negative school culture or persistent lack of professional working environment, as well as trends in teacher turnover leading up to a principal turnover. In all models, we also control for time-varying school factors such as average achievement and student poverty rate, which further address concerns about reverse causality or selection bias. As an additional specification check, we find our results are robust to models with teacher fixed effects.

Our approach approximates an event study analysis in that we include dummy variables capturing "lead up effects," or the likelihood a teacher leaves their school in the years leading up to a principal turnover, year t effects, the effect of having a new principal in the current year on the likelihood a teacher leaves at the end of the current year, and "later year effects," or the effects on teacher turnover during a new principal's second, third, and fourth year at the school (year $t+1$, year $t+2$, and year $t+3$ effects). Lead up effects include year $t-2$ effects, which we expect to be zero, and "year-of-departure" or $t-1$ effects, which based on Miller (2013), we expect to be positive. In each case, the reference group is years at that same school in which the principal has been employed for 5 or more years (and there will not be a turnover event in the next one or two years). We estimate the following non-parametric difference-in-differences linear probability model indexing for teacher j in school s in year t:

$$Y_{jst} = \alpha_1 New\_Principal_j + \sum_{k=-2}^{3} Year_k \lambda_k + \sum_{k=-2}^{3} (Year_k * New\_Principal_j)\beta_k + \gamma X_{jst} + \sigma_s + \delta_t + \varepsilon_{jst}, \quad (1)$$

where Y_{jst} is an indicator for whether the teacher leaves their school at the end of the current year, $New\_Principal_j$ is an indicator for whether a school currently has a new principal, X_{jst} includes teacher, principal, and school covariates, and k refers to the number of years relative to a principal transition. The variables σ_{s} and δ_{t} represent school and year fixed effects, which control for unobserved time-invariant school factors such as persistently poor working conditions (school fixed effects), and factors idiosyncratic to a specific year (in the case of year effects). The coefficients in β_k provides an estimate of the relationship

between the presence of a new principal in a teacher's school and the likelihood that teacher leaves their school. The reference group for each time trend indicator is school years in which the school has had the same principal for 5 or more years (excluding those years in which there will be a principal transition within 1 or 2 years). At the school level, we control for average student achievement and the percent of low-income students. Principal characteristics include total experience as an educator, gender, and race/ethnicity and teacher characteristics include experience (specified as individual dummies), certification area, educational attainment, gender, and race/ethnicity. We cluster standard errors at the school level. The analytic approach provides strong evidence of a causal relationship, but we do not rule out the possibility that external factors contribute to some portion of our estimates effects. Time-varying school factors, such as deteriorating work environment, could lead to both principal and teacher turnover. For our estimates to be causal, we assume that our time-varying school covariates (mean achievement and the percent of students from low-income households) control for any changing school factors that influence both teacher and principal attrition.

Our approach is similar to that of Bartanen et al. (2019), except we estimate a teacher-level model and do not use a matched sample. We also examine heterogeneous effects by running separate models on specific samples, including school types (low teacher experience, high poverty, urban, suburban, rural), principal turnover types (exit, demotion, transfer, and promotion), experience profiles of the replacement principal (no leadership experience, experience as an assistant principal, experience as a principal), and combinations of these. As shown in Table 2, our sample includes at least 185 school-year observations in each cell of principal turnover type and prior experience profile.

We confront a similar challenge of multiple events as in previous principal turnover studies (i.e., Bartanen et al., 2019 and Miller, 2013), where in a given year, for example in 2012, a teacher may be in a school that both experienced a principal turnover in 2009, 3 years prior to the current year ($t+3$ effects) and will experience a principal turnover in 2 years, in 2014 ($t-2$ effects). Following Bartanen et al. (2019), we use two approaches suggested in prior literature. Miller (2013) stacks the data so that if a school changes principals in 2009 and again in 2014, both effects are included by adding the second turnover event as an additional record in the dataset. Sandler and Sandler (2014) suggest simply allowing multiple timing indicators to turn on for the same observation, allowing, for example, a school-year observation to contribute to both $t-2$ effects and $t+3$ effects. We reach similar results across both methods and use Sandler and Sandler (2014) approach as our preferred method.

Table 2. Number of Schools-Year Observations with various Principal Turnover Outcomes, 2005–2017.

	Prior principal turnover type				
New principal has …	Exit	Demotion	Transfer	Promotion	Total
No prior leadership experience	592	502	466	185	1,745
Prior experience as an asst. principal	2,500	2,021	2,549	471	7,541
Prior experience as a principal	1,906	1,811	2,222	463	6,402
Total	4,998	4,334	5,237	1,119	15,688

Note. Table shows, for example, that the analytic sample includes 592 school observations in which a school has a newly hired principal with no prior leadership experience.

Data Issues and Specification Checks. Our dataset includes schools with multiple employees listed as principals, principals linked to multiple schools, schools with no principals listed and new schools (which by definition, have new principals). Our preferred model includes dummy variables for whether a school has multiple principals listed in the current year and, in alternate models (those without school fixed effects), whether a school ever had multiple principals. We code schools with multiple principals listed as having a new principal when none of the principals from the prior year return the following year. In specification checks, we drop all schools with multiple principals and all principals listed at multiple schools. Given the rarity of these cases, the consistency of our results across these various specifications is not surprising. Finally, we recognize that new schools differ in important ways from other schools and we therefore limit our sample to only schools in their fifth or greater year of existence. The dataset also includes teachers located at multiple schools. We link teachers to the schools in which they are assigned a greater level of full-time equivalency (FTE, a separate variable in our dataset), and keep only teachers with FTE greater than 0.40.

Findings

Results are displayed in Figures 1 to 3 and Tables 3 and 4. Column 1 of Table 3 shows results for our baseline model. The first row shows, not surprisingly, that schools that will have a new principal in 2 years from the current year (but haven't had one in at least 5 years) on average have the

same teacher turnover as the years when they have stable leadership (5 or more years with the same principal). But in the last year of a principal's tenure (year $t-1$, row 2), teacher turnover increases by 2.3 percentage points, or about 11.5% based on the statewide average teacher turnover rate of 20%. The next 4 years are characterized by elevated teacher turnover, where the turnover rate is 2.1 percentage points (10.4%) greater than stable-leadership years in the first year of the new principal, and 1.1, 0.9, and 0.6 percentage points greater during that principal's subsequent second, third, and fourth year at the school. To put that in perspective, the typical elementary school with 40 teachers loses about eight teachers per year on average, but these findings imply that a principal turnover event will mean they will

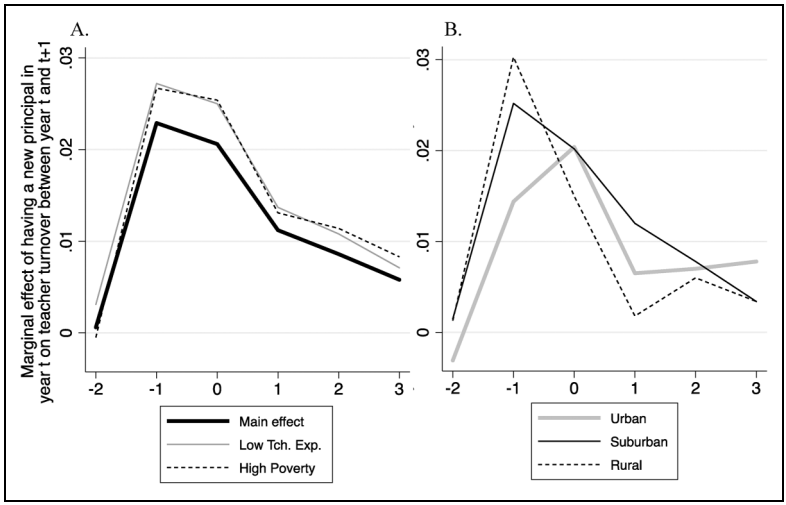

Figure 1. Marginal effect of having a new principal in the current year on the likelihood a teacher exits their school at the end of the current year, relative to years at the same school in which the principal is in their fifth or greater year at that school, by school type

Note. This figure displays the results shown in Table 3. The figure shows, for example, that teachers in high-poverty schools are 2.7 percentage points more likely to leave their school if there will be a new principal next year (year $t-1$ effects), 2.5 percentage points more likely to leave if there is currently a new principal hired (year t effects), and 1.3 percentage points more likely to leave if their principal was newly hired the prior year (year $t+1$ effects), relative to years at the same school in which the principal has served for 5 or more years. Low Tch. Exp. refers to schools in the bottom quintile of average teacher experience statewide and high poverty refers to schools in the highest quintile of percent of student eligible for free/reduced price lunch.

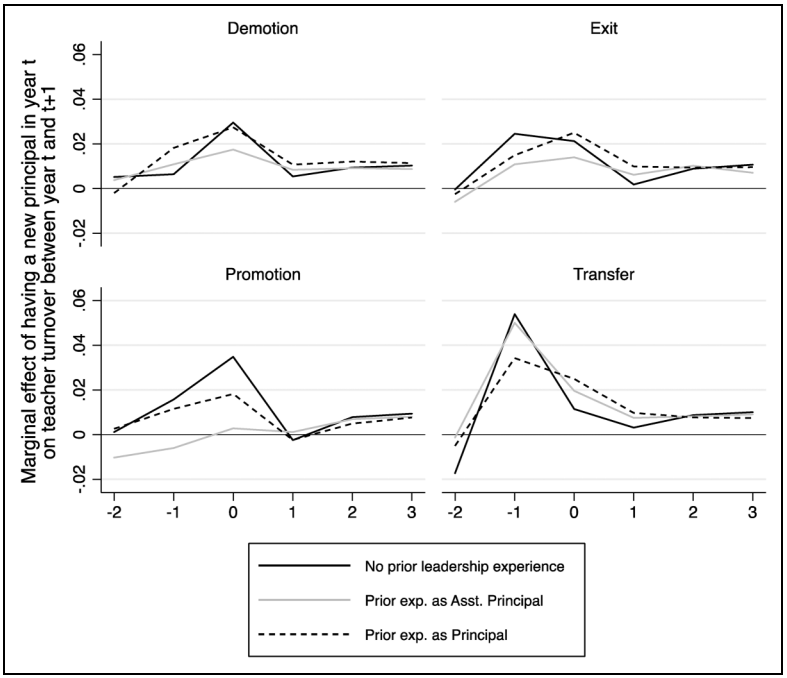

Figure 3. Marginal effect of having a new principal in the current year on the likelihood a teacher exits their school at the end of the current year, by principal turnover type and new principal's prior experience profile

Note. Figure shows, for example, that teachers in schools where the principal was demoted in the prior year and then replaced in the current year by a new principal who has no prior leadership experience are about 3 percentage points more likely to leave their school at the end of the current year, relative to teachers in that same school during years in which the principal is in their fifth or greater year at that school (black line in upper left graph). Teacher turnover increases by less when the new principal has experience as an assistant principal (gray line).

lose approximately nine teachers 2 years in a row, and perhaps another teacher in the third or fourth year.[4]

These baseline estimates are larger in some circumstances. The second and third columns of Table 3 show larger effects for schools that fall in the highest quintile of percent of novice teachers and students classified as low-income.[5] In high poverty schools, for example, principal turnover increases teacher turnover by 2.7 percentage points during the last year of the principal's tenure and by 2.5, 1.3, 1.1, and 0.8 percentage points in the first, second, third, and fourth years of the new principal. The last three columns show that "year of departure" effects are largest in rural

Table 3. Regression Coefficients Showing the Likelihood a Teacher Leaves Their School Leading up to and Following a Principal Turnover, 2004–05 to 2016–17.

	Main	Low Tch. experience	High poverty	Urban	Suburban	Rural
$t-2$	0.0006	0.0031*	−0.0005	−0.0031	0.0015	0.0013
	(0.0014)	(0.0018)	(0.0024)	(0.0031)	(0.0027)	(0.0046)
$t-1$	0.0229***	0.0272***	0.0267***	0.0144***	0.0252***	0.0303***
	(0.0015)	(0.0019)	(0.0028)	(0.0032)	(0.0026)	(0.0048)
t	0.0206***	0.0250***	0.0254***	0.0204***	0.0202***	0.0150***
	(0.0015)	(0.0019)	(0.0028)	(0.0032)	(0.0026)	(0.0049)
$t+1$	0.0112***	0.0137***	0.0131***	0.0065*	0.0120***	0.0018
	(0.0015)	(0.0018)	(0.0028)	(0.0033)	(0.0025)	(0.0049)
$t+2$	0.0086***	0.0108***	0.0114***	0.0070**	0.0078***	0.0060
	(0.0015)	(0.0018)	(0.0027)	(0.0033)	(0.0024)	(0.0048)
$t+3$	0.0058***	0.0071***	0.0083***	0.0078**	0.0034	0.0034
	(0.0016)	(0.0018)	(0.0027)	(0.0035)	(0.0024)	(0.0054)
Observations	2,888,845	1,899,429	974,135	551,877	927,342	145,830
R^2	0.0452	0.0458	0.0553	0.0366	0.0311	0.0734

Note. All models include school fixed effects and the same set of principal, teacher, and school covariates. Robust standard errors are in parenthesis (clustered at the school level).
* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4. Regression Coefficients Showing the Probability of a Teacher Leaving Their School Following a Principal Turnover, by Principal Turnover Type and by new Principal's Prior Experience, 2004–05 to 2016–17.

	Principal turnover type				New principal's prior experience		
	Exit	Demotion	Transfer	Promotion	None	AP	Prin.
$t-2$	−0.0038*	0.0009	−0.0032	−0.0029	0.0028	0.0016	0.0012
	(0.0020)	(0.0027)	(0.0025)	(0.0044)	(0.0053)	(0.0020)	(0.0022)
$t-1$	0.0130***	0.0154***	0.0438***	0.0059	0.0295***	0.0222***	0.0234***
	(0.0021)	(0.0028)	(0.0032)	(0.0047)	(0.0051)	(0.0020)	(0.0024)
t	0.0189***	0.0241***	0.0231***	0.0123***	0.0234***	0.0149***	0.0251***
	(0.0024)	(0.0029)	(0.0025)	(0.0044)	(0.0050)	(0.0020)	(0.0022)
$t+1$	0.0094***	0.0132***	0.0118***	0.0023	0.0078*	0.0081***	0.0120***
	(0.0024)	(0.0028)	(0.0025)	(0.0043)	(0.0044)	(0.0019)	(0.0022)
$t+2$	0.0107***	0.0113***	0.0082***	0.0070*	0.0114***	0.0084***	0.0081***
	(0.0023)	(0.0028)	(0.0024)	(0.0037)	(0.0037)	(0.0019)	(0.0021)
$t+3$	0.0073***	0.0101***	0.0087***	0.0075**	0.0113***	0.0060***	0.0074***
	(0.0025)	(0.0028)	(0.0025)	(0.0035)	(0.0036)	(0.0020)	(0.0023)
Obs.	1,643,808	1,482,892	1,609,686	1,207,721	1,188,645	1,994,693	1,802,732
R^2	0.0484	0.0533	0.0494	0.0526	0.0571	0.0460	0.0498

Note. All models include school fixed effects and the same set of principal, teacher, and school covariates. None refers to a new principal with no prior leadership experience, AP = prior experience as an assistant principal, Prin. = prior experience as a principal. Robust standard errors are in parenthesis (clustered at the school level).

* $p < .05$, ** $p < .01$, *** $p < .001$.

schools, but effects are smaller for rural schools during the first year of the new principal. Overall, the magnitude of the effect of principal turnover on teacher turnover is slightly smaller in urban schools compared to suburban and rural schools. Figure 1 plots these coefficients for the main effects and for various school types shown in Table 3. In Appendix Table A1, we show that results for urban schools are not necessarily uniform. Principal turnover has the largest effects on teacher turnover in Houston, where effects are essentially double the average of all urban districts. Dallas Independent School District also has larger than average effects, while effects in Austin and Fort Worth are lower than the average for urban districts.

Table 4 shows similar results disaggregated by principal turnover type and by the new principal's prior experience profile and these results are plotted in Figure 2. Consistent with Bartanen et al. (2019), we find effects are smallest when the principal is promoted and largest when the principal transfers schools. The timing of effects also varies significantly across principal turnover types. Relative to stable-leadership years, the likelihood a teacher leaves their school at the end of the year increases by 4.4 percentage points when a principal will transfer to a new principalship in another school or district at the end of the current year (compared to 1.3, 1.5, and 0.6 percentage points for exits, demotions, and promotions, respectively). This may happen if teachers have greater warning about an upcoming principal transfer than they do about an upcoming principal exit, demotion, or promotion. Or there may be other circumstances associated with principal transfers. We find that the proportion of principal departures classified as exit, demotion, transfer or promotion are similar between high and low poverty and teacher experience schools, but that the experience profile of the replacement principal varies by prior principal turnover type (a topic we discuss below). For principal transfers, the increase in teacher turnover is greater in the last year before that principal leaves, but the increase in turnover is not as high when the new principal takes over. In contrast, for exits, demotions, and promotions, teacher turnover increases during the last year of the departing principal (relative to stable-leadership years) but increases by even more after the new principal finishes their first year. This finding is consistent with the idea that teachers may not be notified of a principal exit, demotion, or promotion with enough time to make career path decisions and instead leave their school after the new principal take over. By the third and fourth year of the new principal's tenure, teacher turnover is elevated by approximately one percentage point over stable-leadership years, regardless of prior principal turnover type. Overall, principal transfers have the largest effects, followed by demotions

and then exits, while promotions have positive but generally smaller effects on teacher turnover.

The right panel of Table 4 and Panel B of Figure 2 show effects disaggregated by the new principal's prior experience. First, we find that the "year of departure" effects (year $t-1$ effects, where teachers leave at the same time as the principal leaves) vary by the experience profile of the new principal. Year of departure effects are greatest when the replacement principal will have no administrative experience. This may happen if teachers have some information about who the new principal will be, or if other factors are associated with the likelihood the replacement principal has no administrative experience. A new-to-school principal is most likely to lack any prior administrative experience when they replace a principal who was promoted, and least likely when they replace a principal who transferred (Table 2). We thus rule out the possibility that greater "year of departure" effects for replacement principals with no administrative experience stem from these principals entering schools where the prior principal transferred. After the first year of the new principal, teacher turnover remains elevated regardless of the experience profile of the replacement principal, but the increase is lowest when the new principal has some experience as an assistant principal. By the third and fourth year of the new principal, teacher turnover remains just over one percentage point higher than stable-leadership years if the new principal has no prior administrative experience, but just under one percentage point if the new principal has prior experience as either an assistant principal or principal.

Results from Figures 1 and 2 suggest that heterogeneous effects on teacher turnover tend to converge toward the main effects over time when effects are disaggregated by prior principal turnover type, but not when effects are disaggregated by school type or new principal characteristics. This finding makes conceptual sense because the circumstances of the prior principal's departure will lose salience over time, while school contexts and characteristics of the new principal will not.

Our final set of results is shown in Figure 3, with numeric results reported in Appendix Table A2. Before exploring these results, we refer the reader back to Table 2, which shows among other things that overall, 11% of new-to-school principals have no prior experience as an assistant principal or principal (185 out of 1745), but that number climbs to 17% when the departing principal was promoted. When the departing principal transfers (the turnover type associated with the largest effect on teacher turnover), the district is slightly more likely to replace that principal with one who has prior experience either as an assistant principal or principal (only 9% of replacements following a transfer have no administrative

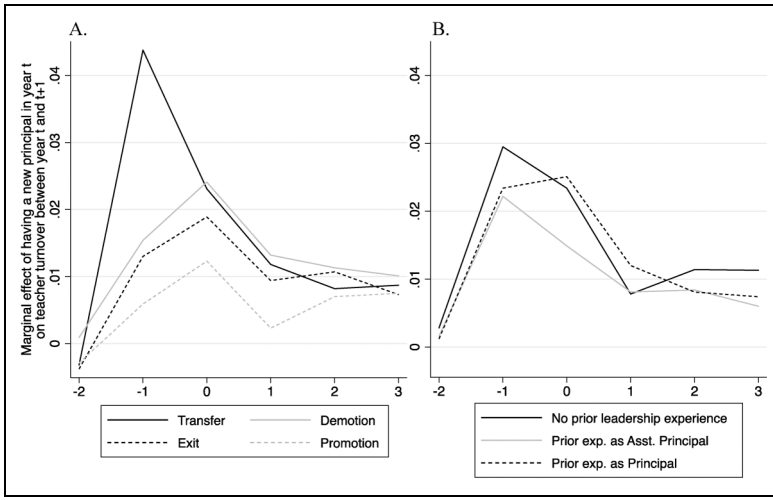

Figure 2. Marginal effect of having a new principal in the current year on the likelihood a teacher exits their school at the end of the current year, by principal turnover type (A) and by new principal's prior experience profile (B)
Note. This figure displays the results shown in Table 4. The figure shows, for example, that the percent of teachers who leave the school at the end of the year increases by 4.4 percentage points when the principal transfers to a new principalship in another school or district at the end of that same year. Teach turnover remains elevated in the first through fourth year of the new principal's tenure.

experience). As shown in Figure 3, replacing a departing principal with someone who has prior experience as an assistant principal can reduce the effects on teacher turnover across all principal turnover types, except in the case of transfers. When principals transfer, new principals with prior experience as a principal have smaller year-of-departure ($t-1$) effects on teacher turnover, while prior experience as an assistant principal has the same effects as having no administrative experience. In the first year of the new principal (year t effects) following a principal transfer, those entering with prior administrative experiences actually have larger effects on teacher turnover, but collectively, new principals have lower effects on teacher turnover. In sum, replacing a departing principal with someone who has any prior administrative experience will temper the negative effects on teacher turnover, unless the prior principal transferred, in which case only new principals with prior principal experience will reduce the negative effects on teacher turnover.

Discussion

Our results show that, consistent with past studies, teacher turnover spikes in schools experiencing leadership turnover. We add to existing literature by considering additional heterogeneous effects across school contexts, principal turnover type, and how the principal is replaced. As with prior studies (e.g., Bartanen et al., 2019; Béteille et al., 2012; Miller, 2013), we find relatively moderate effects of principal turnover on teacher turnover, where a principal turnover event increases teacher turnover by 2.3 percentage points or about 11% the year the principal leaves, and by 2.1, 1.1, 0.8, and 0.6 percentage points (10%, 6%, 4%, and 3%) in subsequent years. These magnitudes are similar to those reported in past studies. Miller (2013) finds effects of 1.3, 1.6, 0.5, and 0.3 percentage points in the last year of the departing principal and the first 3 years of the new principal, respectively. Bartanen et al.'s (2019) school-level results are not directly comparable, but they find that principal turnover increases teacher turnover by 1.4 and 2.6 percentage points in the year the principal leaves in Missouri and Tennessee, respectively, with smaller effects as the new principal gains tenure. They then show that principal *transfers* have the largest effects (as opposed to exits, promotions, or demotions), increasing teacher turnover by approximately 2.9, 2.0, 0.5, and 1.0 percentage points during the last year of the transferring principal and the first 3 years of the new principal. We also find principal transfers are especially harmful for teacher turnover but we show that replacing a departing principal (including a transferring principal) with someone who has experience as an assistant principal or principal can temper principal turnover effects. Further, our results show that principal turnover effects are larger in contexts that tend to face challenges with high educator attrition—higher poverty schools and those that already employ a high percent of novice teachers. While past studies examine the effects of principal turnover on teacher turnover and student achievement, including different types of principal departures, the current study is the first to compare differences in the timing and magnitude of principal turnover effects across different contexts and circumstances. Below we describe research and policy-related implications for our study.

Principal and teacher turnover and their relationship with each other require further investigation. While researchers have investigated principal turnover and the impact of principal turnover on teacher turnover using large administrative data sets, the field would benefit from qualitative research that can provide important insights into the individual decisions and organizational processes that contribute to educator attrition. Future research

should further investigate the underlying reasons for principal turnover. Several questions warrant further investigation. First, are principals in certain schools and districts opting or advocating for transfer at higher rates or are certain districts engaging in decision-making processes that create principal churn in specific school contexts? Second, how are principals identified and placed in to "hard-to-staff-schools" or low-performing schools that serve high-proportions of low-income students of color? Third, what are the causes and criterion used in school districts to make principal transfer or removal decisions? Fourth, what are the reasons principals who recently voluntarily transferred schools within district or sought a position in another district given for their transition? Fifth, what are the principal recruitment, induction, and retention-related policies in districts with lower rates of principal turnover like Austin and El Paso in comparison with Dallas and Houston? Additional qualitative research in this area will provide greater insight into the ways districts and principals make decisions about transfer. Finally, additional qualitative research focused how principal turnover affects working conditions based on teacher perceptions and experiences is warranted, especially in rural, urban, and charter schools (Farley-Ripple et al., 2012; Ni et al., 2015; Pendola & Fuller, 2018).

This study also has important implications for policymakers who focus attention on the principal and teacher preparation and talent pipelines. Philanthropic organizations, non-profits, and state and local education agencies have given increasing attention to the preparation and ongoing development of school leaders. Primarily, these organizations and especially traditional university-based principal preparation programs have focused heavily on preparation and leadership development and more recently on cultural responsiveness, anti-racist leadership, inclusion, and social justice, but tend to deprioritize issues related to principal stability in their position, how principals are matched within specific organizational and community contexts, and the development of leadership succession and stability (McCarthy, 2015; Wallace Foundation, 2016). This study reflected a need for added programmatic emphasis in both preparation and in-service development to principal sustainability on a campus, or at least the development of a leadership succession planning that can limit the impact of principal turnover, particularly in "hard-to-staff-schools." Likewise, organizations and education agencies must also focus attention on teacher turnover, which can extend a teacher's tenure on a campus. This might include a greater emphasis on teacher leadership, advocacy, and collaboration and community building skills that can help teachers

navigate a shift in working conditions that may come about after principal turnover or repeated principal turnover.

The practical implications of focusing attention and resources on both principal and teacher turnover is vital, particularly for achieving equity in low-performing schools that serve low-income students of color. Researchers focused on addressing inequities at the district level have begun to consider the role, priorities, and commitments of the superintendent (Horsford, 2010), but few have viewed principal turnover as a critical equity issue. Perpetual turnover and hiring cycles are financially burdensome for school districts (Barnes et al., 2007) that are increasingly strapped for cash that could be used to provide additional resources and supports to struggling schools. Moreover, the lack of stability on campuses denies students and families from a school staff that has coherence, institutional memory, and a capacity to be continuously learning and responsive to the changing needs of students and communities. Principals and teachers who work in schools that close achievement gaps and address equity issues require multiple years together because they must establish family connections and a school culture and capacity to continuously inquire, learn, and grow. Leadership stability is also critical for building leadership capacity among teachers, which can improve working conditions and reduce turnover (Torres, 2019). District leaders need to focus attention on how they can support sustainable schools and ensure district policies, such as pay-for-performance models (Guarino et al., 2011), do not contribute to teacher or principal turnover or exacerbate inequities in the distribution of experienced teachers that can contribute to the manufacturing of "hard-to-staff-schools."

Conclusion

While a small amount of employee attrition is healthy in professional organizations, chronic turnover disrupts social ties and destabilizes organizational culture (Ingersoll, 2001). Many policy levers designed to reduce teacher turnover focus on individual teachers, rather than addressing underlying school context factors. Our results suggest that efforts to reduce principal turnover may be an effective policy approach to address chronic teacher attrition, particularly in urban schools with high rates of novice teachers and in schools with repeated leadership turnover. Ultimately, improvements to the working conditions in schools are designed to provide all students with a more equal opportunity to learn.

Appendix

Table A1. Regression Coefficients Showing the Probability of a Teacher Leaving Their School, for Selected Large Urban School Districts, 2004–05 to 2016–17.

	Main	Austin	Dallas	Fort Worth	El Paso	Houston
$t-2$	0.0006	−0.0064	−0.0089	0.0048	0.0075	−0.0103
	(0.0014)	(0.0075)	(0.0079)	(0.0073)	(0.0194)	(0.0063)
$t-1$	0.0229***	0.0011	0.0113	0.0076	0.0122	0.0410***
	(0.0015)	(0.0096)	(0.0079)	(0.0083)	(0.0094)	(0.0084)
t	0.0206***	−0.0002	0.0221***	0.0138	0.0183**	0.0373***
	(0.0015)	(0.0093)	(0.0080)	(0.0088)	(0.0087)	(0.0077)
$t+1$	0.0112***	−0.0004	0.0081	0.0128	0.0036	0.0129
	(0.0015)	(0.0114)	(0.0079)	(0.0085)	(0.0092)	(0.0088)
$t+2$	0.0086***	0.0205	−0.0003	0.0105	0.0075	0.0076
	(0.0015)	(0.0134)	(0.0081)	(0.0084)	(0.0113)	(0.0088)
$t+3$	0.0058***	0.0198***	0.0073	−0.0063	0.0115	0.0094
	(0.0016)	(0.0074)	(0.0081)	(0.0076)	(0.0103)	(0.0118)
Obs.	2,888,845	57,571	85,696	47,436	39,321	107,851
R^2	0.0452	0.0436	0.0474	0.0285	0.0330	0.0592

Note. All models include school fixed effects and the same set of principal, teacher, and school covariates. Robust standard errors are in parenthesis (clustered at the school level).
* $p < .05$, ** $p < .01$, *** $p < .001$.

Table A2. Regression Coefficients Showing the Likelihood a Teacher Leaves Their School Leading Up to and Following a Principal Turnover, by, Principal Turnover Type and New Principal's Prior Experience Profile, 2004–05 to 2016–17.

	Prior principal exited			Prior principal demoted			Prior principal transferred			Prior principal promoted		
	None	AP	Prin.	None	AP	Prin.	None	AP	Prin.	None	AP	Prin.
$t-2$	−0.0004	−0.0059**	−0.0025	0.0052	0.0038	−0.0020	−0.0173*	−0.0013	−0.0050	0.0011	−0.0103	0.0026
	(0.0078)	(0.0025)	(0.0031)	(0.0112)	(0.0037)	(0.0040)	(0.0099)	(0.0033)	(0.0039)	(0.0132)	(0.0066)	(0.0071)
$t-1$	0.0245***	0.0109***	0.0149***	0.0064	0.0109***	0.0182***	0.0539***	0.0500***	0.0342***	0.0157	−0.0060	0.0115
	(0.0081)	(0.0026)	(0.0036)	(0.0116)	(0.0040)	(0.0043)	(0.0116)	(0.0043)	(0.0052)	(0.0123)	(0.0059)	(0.0071)
t	0.0212**	0.0140***	0.0250***	0.0295***	0.0174***	0.0274***	0.0114	0.0196***	0.0249***	0.0348***	0.0028	0.0182***
	(0.0089)	(0.0031)	(0.0036)	(0.0101)	(0.0041)	(0.0040)	(0.0087)	(0.0033)	(0.0038)	(0.0133)	(0.0057)	(0.0069)
$t+1$	0.0018	0.0062**	0.0099***	0.0054	0.0084**	0.0107***	0.0031	0.0075**	0.0097***	−0.0025	0.0011	−0.0024
	(0.0059)	(0.0030)	(0.0037)	(0.0062)	(0.0037)	(0.0040)	(0.0061)	(0.0032)	(0.0036)	(0.0066)	(0.0052)	(0.0053)
$t+2$	0.0089**	0.0102***	0.0094***	0.0094**	0.0091***	0.0121***	0.0087*	0.0081***	0.0077**	0.0078	0.0069	0.0049
	(0.0045)	(0.0029)	(0.0032)	(0.0045)	(0.0034)	(0.0036)	(0.0046)	(0.0029)	(0.0032)	(0.0048)	(0.0042)	(0.0042)
$t+3$	0.0107***	0.0071**	0.0096***	0.0103***	0.0087***	0.0114***	0.0100**	0.0090***	0.0074**	0.0094**	0.0080**	0.0076*
	(0.0040)	(0.0030)	(0.0033)	(0.0039)	(0.0033)	(0.0034)	(0.0040)	(0.0030)	(0.0032)	(0.0040)	(0.0038)	(0.0039)
Obs.	1,105,341	1,381,692	1,286,188	1,098,293	1,271,469	1,241,754	1,097,750	1,350,767	1,292,273	1,080,492	1,132,645	1,127,827
R^2	0.0548	0.0495	0.0517	0.0557	0.0528	0.0538	0.0548	0.0507	0.0524	0.0547	0.0534	0.0533

Note. All models include school fixed effects and the same set of principal, teacher, and school covariates. None refers to a new principal with no prior leadership experience, AP = prior experience as an assistant principal, Prin. = prior experience as a principal. Figure shows, for example, that teachers were 2.12 percentage points more likely to leave their school at the end of the current year if the newly hired principal has no prior administrative experience and replaced a principal who exited the K-12 state workforce. Robust standard errors are in parenthesis (clustered at the school level).

* $p < .05$, ** $p < .01$, *** $p < .001$.

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Notes

1. The final 2% of principals were from schools that reported the principal left but were unable to report their new occupational status.
2. Anecdotally, the researchers found that principal turnover, and even rapid turnover (e.g., three principals in 5 years) does not necessarily lead to significant challenges to school culture and student achievement if leadership is well-distributed, when collaborative structures are in place, or if new principals do not feel pressure due to organizational legitimacy to make rapid reforms, such as a history of high-levels of student achievement on state-mandated assessments.
3. For brevity, we refer to administrative experience as prior experience as an assistant principal or principal in public school in Texas, recognizing that some new principals may have administrative experience as teacher leaders, department heads, central office staff, or through administrative positions in other states or in private schools.
4. The total effect across the last year of the departing principal and first four years of the new principal is 6.9 percentage points, suggesting that a school of 40 teachers that typically replaces eight teachers per year due to turnover would need to replace an additional three teachers over those 5 years.
5. Note that we sometimes refer to "effects" to avoid confusing sentence structure, but we remind the reader that we do not rule out all plausible threats to valid causal inferences.

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