



# Revolving School Doors? A Longitudinal Examination of Teacher, Administrator and Staff Contributions to School Churn

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Non-teaching staff comprise over half of all school employees and their turnover may be consequential for school operation, culture, and student success, yet we lack evidence documenting their attrition. We use 11 years of administrative data from Oregon to examine mobility and exit among teachers, administrators, paraprofessionals, and other staff. Although teachers dominate staff turnover conversations, they are consistently the most stable employee group. Some school factors, like the proportion of students being disciplined, predict higher turnover rates for all employees, but within-school turnover between staff groups is weakly correlated and some school context variables are differentially associated with the turnover of various employee groups. Results suggest that employee turnover in schools is not a homogenous phenomenon across staffing groups.

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## **Abstract**

Non-teaching staff comprise over half of all school employees and their turnover may be consequential for school operation, culture, and student success, yet we lack evidence documenting their attrition. We use 11 years of administrative data from Oregon to examine mobility and exit among teachers, administrators, paraprofessionals, and other staff. Although teachers dominate staff turnover conversations, they are consistently the most stable employee group. Some school factors, like the proportion of students being disciplined, predict higher turnover rates for all employees, but within-school turnover between staff groups is weakly correlated and some school context variables are differentially associated with the turnover of various employee groups. Results suggest that employee turnover in schools is not a homogenous phenomenon across staffing groups.

**Keywords:** teacher, administrator, paraprofessional, and school staff turnover

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## INTRODUCTION

Staff turnover in schools is a persistent, widespread concern due to its potential costs to student experiences and learning (Darling-Hammond 1984; Ingersoll, 2001; Goldhaber & Theobald, 2023). To date, the public and research conversations about school turnover have primarily focused on teachers. Nationally, 8.1 percent of teachers moved to another school the next year, while another 7.7 percent of teachers left the teaching profession in 2012-13 (Digest of Education Statistics, 2014). Teacher turnover is often higher in schools with greater proportions of students of color and low-income students, and among teachers of color who are disproportionately concentrated in such schools, exacerbating challenges to improving teacher quality, teacher diversity, and opportunities to learn for minoritized and historically marginalized students (Goldhaber et al., 2020; Grooms et al., 2021; Sun, 2018). Yet, teachers comprise only 45 percent of employees working in K-12 schools (Bureau of Labor Statistics, 2021). While teachers are consequential for student outcomes (Chetty et al., 2014), there are many other adults working in various roles in public education to promote student success.

Teachers, principals, and staff together comprise the institutional structures of schools that are intended to support students. School culture is created by the interactions of all staff, students, and their families within the school community. Evidence increasingly suggests that school staff working in a variety of roles can be quite important to student outcomes (Hemelt et al., 2021; Mulhern, 2020; Best et. al, 2018). Routine turnover among any of the staff groups working in schools may adversely impact colleagues, alter adult-student relationships, and ultimately affect student learning environments (Boyd et al., 2011; Camburn et al, 2010; Hahnel et al., 2010). While teacher turnover is a well-documented concern with implications for student learning and inequality (Goldhaber et al., 2020; Grooms et al., 2021; Sun, 2018), and research consistently finds

higher rates of turnover among school administrators compared to teachers (Beteille et al., 2012; Plecki et al., 2017; Goldring & Taie, 2018; Bartanen et al., 2021), less is known about the prevalence and ramifications of turnover among other staff.

Turnover may be even more common among other school employees, contributing to the instability of school climates in ways that research has not documented as clearly. School staff, particularly those without professional licenses, generally enjoy fewer job protections than teachers or administrators (Bisht et al., 2021). This suggests they may experience even greater turnover than their colleagues, yet to date there has been little work exploring this possibility. Understanding this kind of turnover is important as public conversation during the COVID-19 pandemic has centered on the difficulties posed to the operation of schools lacking essential non-teaching personnel and the toll that this takes on teachers, administrators, and ultimately students (Lieberman, 2021a; Lieberman, 2021b). In part, staff shortages have been attributed to increases in non-teaching staff turnover due to worsening working conditions and a strong labor market (Lieberman, 2022). However, interpreting these changes is difficult because we lack research characterizing the labor markets and typical mobility patterns of these key staff. Moreover, while teacher and principal turnover is correlated (DeMatthews et al., 2022), we do not know if staff mobility patterns mirror those of their school colleagues and how these patterns together shape the total amount of staff churn a school experiences.

We use 11 years of administrative data to characterize the mobility patterns of the universe of public-school employees working in the state of Oregon, their co-occurrence across employee groups within schools, and their relationship to school-level predictors. We find that mobility of all types is relatively stable over time across four broad staff groups (teachers, paraprofessionals, administrators, and other staff). Teachers, though, consistently have the lowest turnover of any of

the staff groups working in public education in the state. Moreover, the sources of turnover vary substantially between groups with some exiting the state public education workforce at higher rates and others moving schools or districts more frequently. Turnover across staff types within a school is not highly correlated, but it is related to several dimensions of the student population served and the organizational context. However, few characteristics consistently predict turnover across groups and sometimes these factors have countervailing relationships with turnover for different groups. By analyzing turnover patterns for the universe of public-school employees in a state, we add nuance to the issue of staffing in schools and demonstrate that there is substantial variability.

## **LITERATURE REVIEW**

Teacher turnover is a longstanding policy concern and the primary focus of most of the literature on school staff turnover (Hanushek et al., 1999, 2004; Harris & Adams, 2007; Kershaw & McKean, 1962; Murnane et al., 1989; Murnane & Olsen, 1989). Teacher turnover has been linked to negative impacts on student achievement and learning, as well as school climate and staff cohesion (Guin, 2004; Hanselman et al., 2016; Henry & Redding, 2020; Redding & Henry, 2018; Ronfeldt et al., 2013), however, turnover of particularly low-performing teachers can benefit student achievement in some contexts (Adnot et al., 2017). Many studies have investigated the causes of teacher turnover finding that a variety of issues including compensation, working conditions, preferences for particular work locations and student populations contribute to teachers' mobility between schools and exit from the profession (see Borman & Dowling, 2008; Grissom et al., 2015; Guarino et al., 2006 for summaries of this work).

The other group whose turnover is increasingly being studied is school leaders. Estimates from various states and time periods consistently show that about one in five principals and one in

four assistant principals leave their schools each year on average (Goldring & Taie, 2018; Grissom & Bartanen, 2019; Bartanen et al., 2021; Plecki et al., 2017). The vast majority of this mobility is not due to exit, but movement between schools and districts, often towards schools with fewer students of color or fewer low-income students (Beteille et al., 2012; Bartanen et al., 2021). As such, rates of school administrator turnover vary quite substantially within states in ways that often exacerbate inequities and lead less effective leaders to be concentrated in lower performing, higher poverty schools (Grissom et al., 2019; Steinberg & Yang, 2019).

These high levels of instability among administrators have consequences for both students and staff. Because principals impact schools through many channels, for example by developing the organizational climate and culture that promotes student, teacher, and community engagement (Leithwood & Jantzi, 2001; Sebastian & Allensworth, 2012; Liebowitz & Porter, 2019), their exit is likely quite disruptive. Indeed, research documents that principal turnover is highly correlated with, if not causally related to (Bartanen et al., 2022), declines in student achievement and increases in turnover among teachers and assistant principals (Miller, 2013; Bartanen et al., 2019; Bartanen et al., 2021). School leader turnover can also adversely impact the climate of a school and the quality of instruction that students receive (Mascall & Leithwood, 2010). Occasionally, administrator mobility has positive effects, particularly when departing leaders were rated as being less effective (Bartanen et al., 2019). Moreover, there is evidence of positive selection of principals into higher-level administrator positions which can benefit school districts (Grissom & Bartanen, 2019). Regardless, though, any turnover has costs and stands to disrupt the organizational climate of a school and frustrate efforts to build positive school cultures, a highly relational task that takes time. Instability in leadership additionally may create cycles of turnover that impact the ability of

schools to recruit and retain staff in the longer term (Guthrey & Bailes, 2022; DeMatthews et al., 2022).<sup>1</sup>

Thus, while substantial progress has been made in documenting rates of turnover and exploring its causes, consequences, and malleability to intervention for teachers and school leaders, the same cannot be said for other staff working in schools. As of 2021, there were over four-million employees in elementary and secondary schools in roles other than teaching or administration across the U.S. (Bureau of Labor Statistics, 2021). These workers include student-facing academic staff like librarians and paraprofessionals, administrative staff like secretaries and instructional coordinators or coaches, health services staff like counselors and nurses, and basic services staff like food service personnel and janitors. Growth in non-teaching staff, particularly among paraprofessionals (also called teaching assistants or instructional aides), has far out-paced growth in the teacher workforce over the past 30 years (Bisht et al., 2021). The high levels of support staff on a per-student basis and the ensuing cost as measured against GDP make the U.S. a major positive outlier among OECD countries in this regard (Richmond, 2014). While this has led some to question the wisdom of such investments (Scafidi, 2017), news reports, qualitative studies, and survey experimental evidence suggest that students and teachers place high value on these staff (Giangreco et al., 2001; Kraft et al., 2015; Lieberman, 2021; Lovison & Mo, 2022) and scholars have warned that drawing conclusions about the utility of staffing investments from aggregate employment numbers alone is premature (Loeb, 2016).

Better understanding the mobility patterns of this large segment of the education workforce is important for two main reasons. The first is that staff turnover could directly affect the quality

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<sup>1</sup> Little research has evaluated efforts to intervene on administrator turnover directly but rather find that reductions in turnover may result from professional development or induction programs (Jacob et al., 2015; Steinberg & Yang, 2020).

of instruction or services students receive in ways that have been documented already for teachers and administrators (Ronfeldt et al., 2013; Bartanen et al., 2019). Mounting evidence points to the importance of paraeducators (Hemelt et al., 2021), counselors (Reback, 2010; Mulhern, 2020), and nurses (Best et. al, 2018) for student success. If non-teaching staff are indeed important educational inputs, then their turnover may result in students receiving services from less effective and experienced staff or, in some cases, no services at all, which could hamper student learning and progress. This is particularly concerning because students experiencing the greatest marginalization, such as students with disabilities, lower-achieving students, English-language learners, and students experiencing trauma, may rely the most on these non-teaching staff (Giangreco et al., 2001; Rueda et al, 2004; Sattin-Bajaj et al., 2018). Thus, staff turnover patterns might aggravate existing disparities between more and less-advantaged students.

A second motivation for studying staff turnover is the effect that their departure may have on their colleagues and the school environment more generally. Schools are organizational units that depend on cooperation and mutual trust amongst its actors (Coburn, 2001; Penuel et al., 2009). Turnover among staff may hamper efforts to build the trusting, positive relationships in schools between students and adults, as well as among colleagues, that are critical to providing quality instructional experiences to students (Frank et al., 2004; Coburn et al., 2012). Within schools, members also develop expertise that colleagues draw on collectively in their work (Spillane et al., 2018). School staff may hold special kinds of expertise related to students and the community that could be lost to the organization with their attrition (Chopra et al., 2004; Conley, Gould & Levine, 2010). Furthermore, staff turnover could impact working conditions for teachers and administrators through increasing their workloads due either to having to train new employees or having to take on the roles of specialized staff themselves (Ghere & York-Barr 2007; Kraft et al.

2015; Liebermann, 2021a). Administrators might additionally need to reallocate their time away from more high leverage practices, like instructional leadership, to hiring staff (Grissom et al., 2013) and expend school or district resources on recruitment, which previous evidence suggests can be quite costly (Barnes et al., 2007). Thus, even absent direct effects of staff turnover on students, attrition of other school employees is a potential concern because it could reduce the effectiveness of teachers and administrators and create working conditions that might precipitate their turnover, contributing to schools with persistent churn among all adults in the building.

To date, few studies have examined the prevalence of turnover among school staff. While states increasingly report attrition and mobility rates for teachers, they rarely report on rates for other employees (but see Washington State Professional Educator Standards Board, 2023). Recent research exploring staff shortages demonstrates that schools report more vacant positions for some non-teaching staff relative to teachers (Goldhaber & Gratz, 2022; Bruno, 2022). This provides suggestive evidence that turnover for staff may be higher than for teachers, explaining the higher vacancy rates. However, increased vacancies can be due to other determinants of demand besides attrition (e.g. an expanding workforce Bisht et al., 2021) making the vacancy data an unclear proxy for turnover.<sup>2</sup> The few studies that have examined turnover directly for non-teaching staff are often limited to studying a single staff group in a single district (Robert, 2022; Bassok, Doromal et al., 2021) or to shorter time periods (Bassok, Hall et al., 2021; Lipscomb et al., 2022). A notable exception is the work of Theobald et al. (2023) who document annual turnover rates of about 28 percent for special education paraprofessionals in Washington state over a nearly 30-year period. Together, this available evidence suggests that lower-paid employees like paraprofessionals or secretaries turn over at higher rates than teachers while licensed staff like nurses or counselors

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<sup>2</sup> Indeed, in his analysis of reported staffing shortages, Bruno (2022) finds that teacher turnover is insignificantly related to teacher vacancy rates.

have similar mobility rates to teachers. Open questions remain, though, about the nature of turnover patterns for non-teaching school staff more broadly and how they track teacher and administrator attrition patterns in schools. To deepen our understanding of employee turnover in schools and their contributions to churn within school sites, we ask the following research questions:

***RQ1:*** How do mobility patterns vary among teachers, administrators, paraprofessionals, and support staff across years?

***RQ2:*** To what extent do teacher, principal, paraprofessional, and support staff turnover co-occur within schools?

***RQ3:*** Does varied staff type mobility differ among schools with distinct social contexts and student populations?

## **DATA AND MEASURES**

### **Data and Sample**

We use statewide longitudinal administrative data containing records for all public-school employees who worked in the Oregon public school system during the 2006-07 to 2016-17 school years. These records include information about educators' school sites and their personal and professional characteristics. In addition, using statewide student-level data, we generate school- and district-level covariates, providing information about educators' working environments and district contexts.

We use the 36 detailed position codes provided in the administrative data to identify 11 smaller staff groups based on the similarity of job types, necessary qualifications, pay and demographics. We then further combine these more detailed staff groups into four simplified

groups, namely teachers, administrators, paraprofessionals, and other staff (see Appendix A.1 for a list of positions and groups). In the simplified groups, teachers include both those working in the general education and special education fields. Administrators include both school- (e.g., principal) and district-level (e.g., superintendent) leaders as well as special education administrators. Paraprofessionals are those who work to support teachers and students in classrooms for both general and special education. Finally, we group the remaining employees together as staff. As such, the staff category is the broadest and includes a diverse array of workers from school psychologists and nurses to library assistants and administrative secretaries. To develop a complete picture of the state education workforce, we include all of these employees in our analysis of mobility patterns by staff groups (N=791,626 person-year observations).<sup>3</sup> We then restrict the sample to employees who work in schools (N=605,441 person-year observations) to answer our research questions at the school level.<sup>4</sup>

Table 1 presents descriptive statistics regarding the demographic and professional backgrounds for the four groups in the full sample (see Appendix Table A.2 for descriptive statistics for the restricted sample). Overall, teachers are the largest group, however, there are a similar number of employees classified in our broad other staff category across the state, making this group a sizable portion of public-school employees. The workforce is primarily White and female with teachers having the fewest employees of color and paraprofessionals having the highest proportion of employees of color but also the highest proportion of females.<sup>5</sup> The Oregon

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<sup>3</sup> For employees with more than one assignment (10.9% teachers, 10.7% administrators, 10.1% paraprofessionals, and 8.1% other staff), we keep the assignment with the largest FTE.

<sup>4</sup> We exclude those who are working at the district level (N=181,357), in very small schools with less than five educators (N=2,778), and in schools that closed the following year (N=6,038).

<sup>5</sup> The Oregon education workforce is substantially less racially and ethnically diverse than the state population of working-age adults, even for the most diverse group which was paraprofessionals. The workforce is also much more female than the working age adult population except for administrators.

teacher workforce is also substantially less racially diverse than the national teacher workforce (8 percent teachers of color in Oregon versus 18 percent nationally; National Center Education Statistics, 2022).

Table 2 presents descriptive statistics for school-level rates of turnover and other employee and student characteristics.<sup>6</sup> The average school has about 25 teachers, 10 paraprofessionals, 12 staff, and 1.5 administrators serving roughly 475 students. Slightly less than half of all school-level employees are not teachers, suggesting the potential for these groups to contribute substantially to the total levels of turnover schools experience. Of note, there is wide variation in average salaries at the school level between each of these groups ranging from \$16,000 for paraprofessionals to \$83,000 for administrators.<sup>7</sup> While the Oregon public education workforce may not be representative of the national public education workforce, an analysis of turnover patterns across this statewide sample is important for two main reasons. First, to our knowledge there have been no prior studies examining turnover patterns for the universe of public-school employees in a state. Our estimates provide a novel baseline for understanding how turnover patterns vary for different school employees. Second, while the absolute levels of turnover might vary by state (Carver-Thomas & Darling-Hammond, 2017), broad trends across states appear to be similar over time. For example, changes in turnover in light of the COVID-19 pandemic across a diverse array of states have followed similar patterns even though the absolute levels differ (see Goldhaber & Theobald, 2023; Bacher-Hicks et al., 2022; Camp et al., 2022). Thus, our estimates containing information about relative turnover patterns of employees may be useful for hypothesizing about trends for other states.

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<sup>6</sup> Appendix Figures 7.1 and 7.2 also display the distributions of each of these school-level variables.

<sup>7</sup> For employees with hourly wages, we impute salaries based on their full-time equivalencies to compare across groups.

## Turnover measures

In order to characterize the mobility patterns for all public-school employees in the state we synthesize common measures of educator turnover in recent literature (e.g., Carver-Thomas & Darling-Hammond, 2017; Goldhaber & Theobald, 2021; Grissom & Bartanen, 2019). We consider both location and position changes of employees (i.e., whether employees stayed in the same school, district, or state public-school system, and whether they changed position types).<sup>8</sup> For school-level turnover, we calculate the proportion of employees in time  $t$  that are not observed in the same school at time  $t+1$  separately for teachers, administrators, paraprofessionals, and other school staff for each year of data.<sup>9</sup> Then, to characterize the extent to which turnover patterns are more transitory or chronic we follow Holme et al. (2018) and transform the school-level annual turnover rates in two ways. First, we calculate three-year rolling averages of turnover rates for each of the different employee groups to discount deviations in turnover from a school's trend. Second, we define having a year of high turnover as being in the top quartile of the percent of a given employee group leaving the school (attriting or moving) and count the number of years a school experiences high turnover for each group during the panel (ranging from 0 to 10).<sup>10</sup> Together, these sets of both individual and school-level turnover measures, in conjunction with student-level data, allow us to comprehensively describe employee turnover patterns in the state.

## METHODS

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<sup>8</sup> For employees who work in multiple schools or school districts, we determine their movements based on all their assignments. If an employee works in any of the schools or districts within a year that matches any of the schools or districts where they work in subsequent years, they are classified as stayers (see Appendix Table A.3 for details).

<sup>9</sup> To simplify the analysis, we define school-level turnover as educators moving from their schools, which include moving to other schools within or across school districts and leaving the state public school system.

<sup>10</sup> We alternately examine an absolute measure of high turnover by identifying the number of years each school had turnover greater than 30 percent for each group. See Appendix Figure A7 for the distributions of school-level turnover by group and how these distributions compare to the 30 percent cut point as well as the 3rd quartile.

We use a variety of descriptive approaches to detail several features of staff turnover. To compare turnover and mobility across staff types over time (RQ 1), we plot the proportion of teachers, administrators, paraprofessionals, and other support staff who changed their positions or locations each year during the study period.<sup>11</sup> To formally test for differences in turnover rates, we directly compare the average annual turnover of general education teachers to that of the other 10 detailed staff groups by regressing a binary turnover variable on indicators for the other groups with general education teachers as the omitted category. We compare turnover to teachers as they are the modal group and their turnover patterns are the most studied, making them a useful point of reference.<sup>12</sup> To examine the longitudinal nature of turnover differences between groups, for each cohort of employees, we also calculate the proportion of teachers, administrators, paraprofessionals, and other staff that remain in the education system, in their same district, and in their same school from the initial year through the end of the panel using a series of survival curves. For example, for the group of employees we observe in 2007 we calculate the proportion of them that remain in each of the following ten years, for the 2008 cohort we calculate the proportion remaining for the next nine years and so on through the 2015 cohort.<sup>13</sup>

Next, we examine how turnover rates for teachers, administrators, paraprofessionals, and staff are distributed at the school level (RQ 2). First, we plot the distribution of one-year turnover for each staff group for all schools in the state during each school year. While this provides a snapshot of the distribution of school-level turnover, it does not explain whether the same schools consistently have high or low turnover for certain employee groups or across all employee groups.

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<sup>11</sup> We also plot the annual turnover patterns for each of the 11 detailed staff groups in Appendix A.2.2.

<sup>12</sup> All equations of our models are shown in the Appendix.

<sup>13</sup> For employees that leave and return to the public education system, we backfill the years between with their last employment information before their initial leave to indicate them as present to account for their continuation in later years. In total, 31,201 employee-by-year observations (4%) are backfilled. However, results are qualitatively consistent when we use employees' actual years present in the state.

To understand whether schools are consistently experiencing high turnover by certain groups, we plot the percentage of schools that had turnover in the top quartile for that employee group between zero and 10 years separately for teachers, administrators, paraprofessionals, and staff.<sup>14</sup>

To assess the extent to which turnover among different employee groups co-occurs in schools, we regress the school-level teacher turnover rate on the turnover rate for administrators, paraprofessionals, and staff first in separate models and then simultaneously. We consider both one year and three-year rolling average turnover rates.<sup>15</sup> We include year and district fixed effects to address common year shocks and to more closely examine school- as opposed to district-level turnover processes.

Lastly, we explore whether school-level employee turnover rates vary across different types of school contexts (RQ 3). For teachers, administrators, paraprofessionals, and staff, we plot the percent of schools that had three or more years with high turnover (top quartile) for the 10-year panel. We plot these percentages first for all schools and then for schools in the top and bottom quartiles of the proportion of racially/ethnically minoritized students and students in poverty. In order to explore how a more expansive set of factors correlates with turnover, we use OLS regression to predict school-level turnover for each group separately, leveraging a rich array of student and employee characteristics available in the administrative data.

## RESULTS

### Turnover pattern comparison across staff groups

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<sup>14</sup> We use 30 percent as a threshold to define high turnover because it is consistent with previous literature in defining high turnover (see Holme et al., 2018) and it is practically significant, signifying that about 1 in 3 people left. We also use a relative definition of turnover and recreate the same figure defining high turnover as being in the top quartile as opposed to 30 percent. See Appendix Figure A.8

<sup>15</sup> The three-year average was generated by the mean of turnover rates from the prior two years and the current year.

Figure 1 displays the annual turnover rate for each of the simplified staff groups disaggregated by type of turnover. Overall, attrition and mobility are relatively stable across years for all groups.<sup>16</sup> What varies much more clearly in Figure 1 is the attrition and mobility levels between groups. Teacher turnover rates are consistently below 20 percent annually, whereas the rates for the other groups are above 20 percent each year. Moreover, the types of turnover appear to vary by group, with administrators, for example, moving more frequently between districts than other groups (as shown in yellow) and staff having higher exit rates, particularly in the later period (as shown in blue).<sup>17</sup>

Figure 2 directly compares turnover across the 11 detailed staff groups by plotting the coefficients from OLS regressions for the difference in the average annual total turnover rate for each staff group when compared to general education teachers. The general education teacher turnover rate of 19 percent is centered at zero, and each point displays another group's one-year turnover relative to this rate.<sup>18</sup> As all coefficients lie to the right of zero, general education teachers had the lowest turnover rate among public education employees in the state during this period. While the types of turnover (i.e., moving, exiting, or switching positions) vary by group (see Appendix Figure A.3 for the same plot as Figure 2 but disaggregated by type of turnover), general education teachers were still the most stable group overall.<sup>19</sup> In some cases, the differences are

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<sup>16</sup> There was a notable increase in turnover between the 2011-12 and 2012-13 school years which would be consistent with media reports of layoffs due to declining state budgets after the Great Recession, however we do not have the ability to distinguish between voluntary or involuntary exit.

<sup>17</sup> We present the same plots for the 11 detailed staff groups in Appendix Figure A2.2. An additional trend that becomes apparent by looking at these detailed groups is that within each category the groups serving students in special education have higher overall turnover rates relative to those serving general education students, mostly due to their higher mobility between schools or districts.

<sup>18</sup> To obtain the average annual turnover rate for another group, the point estimate is added to the 19 percent teacher rate.

<sup>19</sup> This finding remains largely unchanged even when making comparisons across all 36 position codes in the administrative data (see Appendix A4). In fact, when it comes to exiting public education, only assistant principals exit at lower rates than general education teachers. Every other position code has higher or indistinguishable exit rates. Only school support, district support, and library support (from the School and District Support Staff category) have overall lower turnover rates due to substantially lower rates of movement between schools or districts.

quite substantial. For example, both special education teachers and general education licensed staff have turnover rates that are about 50 percent higher or more (9 percentage points) than general education teachers. All groups have annual average turnover rates that are at least 3 percentage points (16 percent) higher than that of general education teachers. Thus, there appear to be meaningful differences in not only the rates but types of turnover among public-school employees who are not teachers.

In Figure 3, we explore the longitudinal turnover patterns for each of the four broad employee groups. For each of the cohorts we observe from 2007 to 2015 we calculate the proportion of employees who remain in the public education system, in their same district, and in their same school for each of the following years through the end of the panel in 2017. We display these results in Kaplan-Meier survival plots in Figure 3 for the cohorts of 2007 and 2012 and for the remaining cohorts in the appendix (see Appendix Figures A6.1-6.3). Here, we present results for the full sample of employees in the state across years.<sup>20</sup> On average, looking across groups, after five years about two thirds of employees remain in the state, three fifths are in the same district, and less than half are in their same school. For the 2007 cohort, after ten years, less than half of employees remain in the state, around two fifths of employees remain in the same district, and around one fifth of employees are in their same school. However, there are clear differences between groups. Again, teachers are the most stable with the greatest proportion remaining at each point in time and level and the other groups generally pulling further away with each year.<sup>21</sup> The trend is especially pronounced for administrators at the school and district levels. For example,

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<sup>20</sup> For the school survival plots we restrict the analysis to employees who have a school site as their assignment and exclude employees who work at sites other than schools such as district offices. Survival plots for only the restricted school sample that we use in the rest of the analysis are in appendix Figure A6.4.

<sup>21</sup> An exception to teachers being the most stable is in the early years of the 2007 cohort at the school and district levels but eventually among this cohort teachers become the most stable of all groups.

after five years about 30 percent of administrators remain in the same school, while around 50 percent of teachers, 40 percent of paraprofessionals and 45 percent of staff remain in their school. Administrators are no more likely to exit the state than other groups, however.

Another notable trend from the survival plots is that five-year retention rates have declined over time for each of the groups at the state, district, and school levels. For teachers and administrators, this trend is most pronounced at the school level with a five-percentage point drop in five-year retention for teachers and three percentage point drop in five-year retention for administrators from the 2007 to 2012 cohorts, although similar proportions are retained in the state for both groups. For staff and paraprofessionals, the trend is most pronounced with regards to remaining in the workforce at all. The five-year retention rate declined from 66 percent in 2007 to 55 percent in 2012 for staff and declined from 70 percent in 2007 to 63 percent in 2012 for paraprofessionals, suggesting decreasing attachment to these positions across the state over time.<sup>22</sup>

### **School-level turnover for different groups**

Next, we explore turnover dynamics at the school level to examine the extent to which turnover among these various employee groups co-occurs in schools. Table 2 demonstrates that, on average, the school-level turnover rate was 18 percent for teachers, 22 percent for school administrators, 24 percent for paraprofessionals, and 23 percent for staff. These averages, though, obscure the variation in these levels across schools. We first show a snapshot of the distribution of school-level turnover for all schools across two representative school years in Figure 4.<sup>23</sup> For each group, the turnover rate was calculated by dividing the total number of employees in that group who left the school by the total number of all employees in that school across groups separately

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<sup>22</sup> Again, because we lack information about departure reason it is unclear whether these individuals exited voluntarily or involuntarily.

<sup>23</sup> We present the distributions for all 10 school years in Appendix Figure A.6.

for each year. We shade the bars for the relative contribution of each staff group to this total amount of employee turnover. This allows us to see the extent to which turnover is driven by a particular employee group. Although we discussed in Figure 1 that there are relatively small differences in the rates of attrition and mobility over time overall, there is considerable variation in turnover rates across schools. Some schools had no employee turnover in a given year while others lost more than three-quarters of their employees. In addition, Figure 4 shows that teachers are not the only drivers of churn in a school building. As indicated by the height of the green and blue bars compared to the yellow bars, a substantial proportion, half or more, of the total employees lost from a school building each year are paraprofessionals and staff. However, schools vary in the extent to which their total turnover is driven by teachers versus other employees, with teachers accounting for 100 percent of turnover in some schools and less than half in others.

It is not possible to discern from Figure 4, however, whether the same schools have consistently high levels of turnover while others remain unscathed or whether high turnover is widely experienced across many schools at different points in time. Moreover, we cannot tell whether the persistence of turnover in schools is more common for some groups of employees over others. Thus, in Figure 5 we plot the percent of schools that have turnover in the top quartile for zero, one to two, three to five, and six or more years out of the 10 year panel by employee group.<sup>24</sup> Figure 5 shows that about one in seven schools never experience turnover in the top quartile for a particular employee group. At the opposite end of the spectrum, virtually no schools are in the top quartile for six to ten years for administrators while about five percent of schools fall into this category for paraprofessionals or school staff. More schools experience persistently high

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<sup>24</sup> The quartiles vary by group by year. For teachers the value distinguishing the top quartile ranges between 20 and 25 percent, for paraprofessionals it was between 31 and 33 percent, for staff it was between 27 and 35 percent and for administrators it was between 33 and 50 percent.

relative teacher turnover, with about one in fifteen schools having turnover in the top quartile for a majority of the panel (six years or more out of ten). The modal category for all groups is one to two years in the top quartile, suggesting that it is common for schools to have a brief and fleeting experience with high turnover for its various employee groups. About one third of schools experience high turnover with some regularity (between three to five years) for staff, paraprofessionals, or teachers. As such, the persistence of high turnover varies greatly by school with many schools experiencing transitory high turnover for certain groups and others experiencing frequent or none. But are schools that experience high turnover for one group also experiencing high turnover among the other employee groups?

We directly examine the co-occurrence of teacher turnover with other groups by regressing a schools' rolling three-year average teacher turnover rate on its administrator, paraprofessional, and staff three-year turnover rates. Table 3 displays the coefficients from models regressing the rates separately and together with and without district and year fixed effects. Comparing turnover rates within the same districts and years, teacher turnover is significantly related to administrator, paraprofessional, and other staff turnover. However, the magnitude of the correlation is relatively small. For example, as shown in Table 3 model 4, a ten-percentage point increase in other staff turnover is associated with a one percentage point increase in teacher turnover in a school. Unadjusted non-regression based bivariate correlations of turnover rates by group are presented in Appendix Table A.4 and display similarly modest relationships between employee groups within schools. Together these results suggest that the schools that have high teacher turnover are not necessarily simultaneously experiencing high turnover for other employees. This raises the question of what factors predict turnover for these different groups and whether they are shared across staff categories.

### **School context and turnover of different groups**

We consider the relationship between school-level turnover and context by examining high turnover (in the top quartile) in schools with distinct student populations. We plot the proportion of schools that had three or more years of high turnover by the top and bottom quartile proportions of students of color and students experiencing poverty. Figure 6 displays these percentages for teachers, administrators, paraprofessionals, and staff separately. For teachers, we replicate previous work demonstrating that consistently high turnover is more common in schools with more historically underserved students. For example, 52 percent of schools in the top quartile of student poverty have consistently high teacher turnover compared to 33 percent of schools in the bottom quartile of student poverty. A similar pattern also holds related to the proportion of students of color in the school.

By contrast, the relationships are not as consistent and large among other staff groups. As Figure 6 demonstrates, sometimes turnover differences favor more historically advantaged schools, as in the case of teachers. For example, 25 percent of schools in the top quartile proportion of students of color had consistently high administrator turnover compared to just 21 percent of schools in the bottom quartile. In other cases, however, there are no or minimal differences between schools based on student demographics or there are patterns that favor more historically underserved schools. The largest difference in consistent turnover across all comparisons is for paraprofessionals between schools in the top and bottom quartile proportion of students in poverty. While 31 percent of schools serving the most students in poverty have three or more years of high paraprofessionals turnover, 45 percent of schools serving the highest income students had this level of turnover. A differential favoring historically less-advantaged student populations is also present

with regards to staff, but it is small.<sup>25</sup> These differential patterns complicate the picture that emerges from studying teachers in isolation and suggest that different factors might be associated with turnover for different groups.

However, school contexts vary in many ways beyond the racial and socioeconomic demographics of students that are also important predictors of turnover. To better understand how a broader array of factors are correlated with turnover, we regress turnover rates on a set of school-level student and employee covariates (see Table 2 for the means and quartiles of these variables) separately for teachers, administrators, paraprofessionals, and staff. Given that virtually all schools experience relatively high turnover at some point (see Figure 5), we opt to use the three-year rolling average school turnover rates as the dependent variable to smooth over these shocks and instead try to understand predictors of a school's turnover trends. Moreover, we incorporate district fixed effects to better isolate differences in turnover associated with school as opposed to district-level factors. Given that we have observations of the same school across multiple years, we cluster the standard errors at the school level.<sup>26</sup>

The findings presented in Table 4 indicate that some features of school context relate to elevated turnover among all or most groups. Most notably, the percent of students receiving exclusionary discipline (suspension or expulsion), positively predicts turnover among all employees. Another consistent predictor of turnover is getting a new principal.<sup>27</sup> The estimates

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<sup>25</sup> The results discussed come from restricting the sample to schools with more than 5 employees which still leaves many small schools in the sample which mechanically can have high turnover rates with few people leaving. We conduct the same analysis with a sample restriction of having at least 20 employees and present the results in appendix Figure A9. The results are generally the same with the exception of staff who now demonstrate patterns favoring more historically advantaged student groups as teachers do but with differences that are comparatively smaller in magnitude.

<sup>26</sup> We present results from this most preferred model but present results for variations of the model with one-year turnover, with and without district and year fixed effects in the appendix materials (see Appendix Table A5).

<sup>27</sup> For administrators, this relationship is mechanical. Schools within the past three years had to have an administrator turn over in order to receive a new principal explaining the positive association between these variables.

suggest that the arrival of a principal is associated with a one percentage point increase in turnover for teachers, paraprofessionals and other staff.<sup>28</sup> Average salaries also relate to turnover for all employees, except paraprofessionals, with increased salary predicting lower levels of turnover.<sup>29</sup>

There are other school-context variables though that predict turnover among some employee groups but not others. The percentage of novice teachers with less than three years of experience and the percentage of employees of color in a school are positively related to the turnover of teachers only whereas the percentage of veteran teachers with greater than ten years of experience in a school is negatively related to paraprofessional turnover only. If anything, our results also suggest negative associations between the proportion of economically disadvantaged students and employee turnover for paraprofessionals and other staff. Generally, some well-studied correlates of teacher turnover are not replicated when looking at the other staff working in schools. In fact, our models do much better predicting teacher turnover compared to paraprofessional or staff turnover.<sup>30</sup> Together, these results suggest that the factors influencing teacher turnover may be different from those influencing turnover for other employees indicating another way in which the patterns of turnover diverge by group.

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<sup>28</sup> The point estimates are essentially the same for teachers and staff for having a new principal when using the one-year turnover rate which measures turnover at the end of the year the principal arrived. For paraprofessionals, the one-year model suggests that a new principal increases turnover by two percentage points which is double the size from the three-year model. For principals, the one-year results display a negative relationship between having a new principal and the turnover rate of the school-level administration. This implies that in the first year a principal is at a school that they are less likely to leave at the end of that year.

<sup>29</sup> The average salary coefficient for paraprofessionals is a similar direction and magnitude as the others but is not statistically significant at conventional levels once including district fixed effects.

<sup>30</sup> For example, in the naive regressions with just school-level covariates (see Appendix Table A5) and no district-level information, 24 percent of the variation in teacher turnover is explained by the model whereas about four percent of the variation in paraprofessional and staff turnover are explained. Once differences between districts are taken into account with the inclusion of district fixed effects, the R-squareds of the models jump to 0.24 for both paraprofessionals and staff. Thus, the incorporation of substantial amounts of district information are needed to explain the same amount of variation as for teachers with just school-level covariates. Indeed, the inclusion of district fixed effects brings the R-squared of the teacher model to 0.36 which is 50 percent higher than it is for paraprofessionals and staff.

## DISCUSSION AND CONCLUSION

There are currently millions of adults who are not teachers working in U.S. public schools to support students and their families. To the extent that this workforce has expanded rapidly over the past few decades (Bisht et al., 2021), they represent a substantial and increasing societal investment in students' academic and social development, yet little research focuses on understanding the roles or continuity of this group of employees on a broad scale. Given the well-documented concerns related to teacher turnover in schools (Ronfeldt et al., 2013; Carver-Thomas & Darling-Hammond, 2017), it is important to understand the extent and nature of turnover for these other groups of public education employees, particularly as public conversation throughout and after the COVID-19 pandemic has centered on the potential harms of staff churn (Lieberman, 2021a). Moreover, schools, as organizations, fundamentally depend on the mutual cooperation of their various actors to achieve success in serving students (Frank et al., 2004). Turnover of one group of employees stands to affect the colleagues they work with and, ultimately, their students. By better understanding the turnover of all adults within a system, we can more fully capture the experiences of the students and staff in our nation's schools. Our results using over a decade of data for the universe of public-school employees in a large western state suggest that there are meaningful differences in attrition and mobility patterns between the various kinds of roles serving students in schools that previous research has not fully documented. As such, our work helps to further the field's understanding of employment in public schools by expanding the scope of study to all employees in the system (Grissom et al., 2015).

Despite the considerable attention paid to the issue of teacher turnover in research and media (Darling-Hammond 1984; Ingersoll, 2001), we find that teachers are the least likely to leave their jobs in Oregon. All other types of employees had annual turnover rates that were at least three

percentage points higher which, when scaled up across the state, translates to thousands more non-teacher employees leaving or moving each year. We further find that patterns in the types of turnover vary substantially between teachers and other employees. While teachers were about equally as likely to move schools or districts as they were to exit public schools, administrators were much more likely to move whereas staff were more likely to exit.<sup>31</sup> Paraprofessionals had substantial rates of both movement within school districts and attrition from the workforce.

These various types of churn, either within or out of the public school system, have different implications for policy. Movement between schools or districts could be beneficial in some cases as it might lead to better matching between employees and environments (Jackson, 2013), but these moves may also drive sorting of more effective employees away from higher needs schools leading to inequities in access to qualified staff (Lankford et al., 2002). The substantial amount of mobility within the system, especially for teachers and administrators, evinces the need to look at educator labor markets from a state-level perspective. With this view, policymakers can identify the conditions contributing to mobility towards other schools and districts and work to improve them (e.g., Ladd, 2011; Kraft et al., 2015).

Exit from the school system may require interventions in addition to improving the conditions of particular schools. Attrition from the workforce places additional strain on a system through its loss of employee expertise (Spillane et al., 2018). For these employees who are exiting, incentives may be needed for them to remain in the system at all. Many staff and paraprofessionals, in particular, are only temporarily part of the labor market and exit at much higher rates than other groups, though meaningful numbers of teachers exit each year as well. While some of this turnover

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<sup>31</sup> Examinations of the turnover patterns with more refined staff groupings illuminate further nuances in these differences. We find that groups of employees serving students in special education are more likely to turn over than their general education counterparts but that these higher rates are mostly driven by higher mobility within the system as opposed to exit.

may be to remove undesired employees and some may be driven by budgets shortfalls, particularly following the financial crisis, it is likely that school leaders would like to reduce turnover where possible. Previous experimental work demonstrates the potential of retention bonuses coupled with communication affirming the value of the work provided by this set of non-teaching employees as an effective strategy to reduce attrition (Bassok, Doromal et al., 2021). Future research should explore where different employee groups are going upon exit and what the conditions of these new workplaces are in order to better understand the opportunity costs of public education employment. Previous work suggests that when teachers exit public school jobs many leave the workforce altogether and, when employed, rarely make more money (Goldhaber et al., 2022). However, there is reason to suspect that this might not be the case for other employees and empirical work should explore this possibility to inform policymakers about the broader labor market for the workers they seek to hire and retain.

When considering differences between schools instead of between employees, we similarly find notable variability. There is large variation across schools in the extent of employee turnover experienced and a significant proportion of all school churn comes from staff and paraprofessionals, sources that previously have not been identified in the literature. Nearly all schools in our sample at some point during this period had turnover considered high (e.g., Holme et al., 2018) among their administrators, paraprofessionals and staff. Some schools, though, consistently lose many employees. About one in twenty schools had high turnover for staff or paraprofessionals for a majority of the ten-year panel. The same was true for about one in fifteen schools with regard to teachers, suggesting that some schools persistently lose more teachers year after year compared to others.

However, these high turnover schools for certain employees are not necessarily the same and years with high turnover for one employee group are not always high turnover years for other groups within that same school. We find only a modest correlation between teacher turnover and turnover rates for administrators, paraprofessionals, and staff. In fact, we find that many school context variables predict turnover rates for some groups but not others and even predict turnover in opposite directions. Some of the most well-documented correlations between student demographics and teacher turnover fail to replicate or work against these common findings when applied to other staff, suggesting that theories regarding teacher turnover may not translate straightforwardly to other groups. Future work should focus on more clearly delineating theoretically and empirically the relationship between non-teaching staff turnover and school contexts. That paraprofessionals and staff are more racially diverse and generally have lower turnover rates in more historically underserved schools should be encouraging to states and districts pursuing grow-your-own programs looking to transition these employees into teaching roles (Gist et al., 2019). Evaluating the success of such efforts should similarly be a research priority.

While we provide the first estimates of turnover for the universe of public-school employees in a state, this study has several limitations. For one, this work focuses on a single state which might not be representative of patterns in all contexts. States have unique labor market conditions and policy contexts that non-teaching staff might be more responsive to, potentially creating large variation across contexts.

Another limitation is that our data come from a limited period. While we capture variation surrounding the Great Recession, which had important impacts on educator labor markets (Goldhaber & Walch, 2014; Shores & Steinberg, 2019), expanding the time horizon of analysis

would help to see the variability of trends across different economic cycles (Goldhaber & Theobald, 2021; Nagler et al., 2020). In particular, our data are not able to speak to patterns throughout the COVID-19 pandemic. Emerging evidence from multiple states for teachers suggest that teacher turnover remained flat or declined at first but then began increasing several years into the pandemic, sometimes reaching historic highs (Goldhaber & Theobald, 2023; Bacher-Hicks et al., 2022; Camp et al., 2022). However, at this point, it is mostly unknown whether the labor markets for other employees responded similarly (but see Theobald et al., 2023). As our data show for school staff, transitory shocks, like what occurred in 2011, sometimes lead to durable changes to turnover patterns.

A final limitation of this work is that we are only able to describe patterns in turnover for employees but cannot speak to the consequences of this turnover. The field has only more recently begun to systematically provide description for the half of the public-school workforce who are not teachers or school leaders (see for example Bisht et al., 2021) which was our goal in this paper. However, more work is needed to understand the impact that other school employees have on students. Given the high rates of turnover we document for non-teaching staff, future research should also examine the effect that these levels of employee churn have on students and their teachers. These findings would help to contextualize turnover patterns and help policymakers to make decisions regarding the means and extent to which they should address employee turnover.

As a society, we have chosen to invest substantially in many different kinds of adults to promote the success of our nation's children. While there has been a dramatic increase in the past several decades in the number of these adults who are not teachers, research has not caught up in documenting who these individuals are and how they contribute to school environments. Our research makes clear that staff turnover is not teacher turnover; patterns meaningfully vary by

groups even within the same schools. In order to best support the education workforce in serving students, understanding the variation within this vast sector will be key.

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## Tables

Table 1. Descriptive statistics by staff group (2006/07-2016/17)

	Teachers		Administrators		Paraprofessionals		All other Staff	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Female	<b>0.70</b>	0.46	<b>0.48</b>	0.50	<b>0.90</b>	0.30	<b>0.70</b>	0.46
Age	<b>43.52</b>	10.82	<b>48.36</b>	8.71	<b>46.67</b>	11.49	<b>48.53</b>	11.30
Race/Ethnicity								
White	<b>0.92</b>	0.28	<b>0.90</b>	0.30	<b>0.85</b>	0.36	<b>0.87</b>	0.34
Hispanic	<b>0.03</b>	0.18	<b>0.04</b>	0.20	<b>0.09</b>	0.28	<b>0.07</b>	0.25
Asian/PI	<b>0.02</b>	0.13	<b>0.01</b>	0.12	<b>0.02</b>	0.14	<b>0.02</b>	0.14
Black	<b>0.01</b>	0.08	<b>0.02</b>	0.14	<b>0.01</b>	0.12	<b>0.02</b>	0.13
AI/AN	<b>0.01</b>	0.07	<b>0.01</b>	0.08	<b>0.01</b>	0.09	<b>0.01</b>	0.09
Multi- or Unknown	<b>0.02</b>	0.15	<b>0.02</b>	0.12	<b>0.02</b>	0.15	<b>0.02</b>	0.15
Education Level								
Master's or Doctorate	<b>0.68</b>	0.47	<b>0.95</b>	0.22	<b>0.00</b>	0.07	<b>0.14</b>	0.35
BA degree	<b>0.32</b>	0.47	<b>0.05</b>	0.21	<b>0.02</b>	0.15	<b>0.04</b>	0.19
Less than BA	<b>0.00</b>	0.05	<b>0.00</b>	0.06	<b>0.04</b>	0.20	<b>0.03</b>	0.17
Unknow Education	<b>0.00</b>	0.00	<b>0.00</b>	0.00	<b>0.93</b>	0.25	<b>0.79</b>	0.41
Part-time	<b>0.14</b>	0.35	<b>0.12</b>	0.32	<b>0.88</b>	0.32	<b>0.44</b>	0.50
Base salary (\$1,000)	<b>50.61</b>	14.71	<b>88.74</b>	22.91	<b>16.72</b>	12.24	<b>30.74</b>	22.57
Assignments	<b>1.13</b>	0.40	<b>1.13</b>	0.45	<b>1.11</b>	0.35	<b>1.10</b>	0.40
Years Observed	<b>3.76</b>	3.00	<b>4.49</b>	3.13	<b>3.27</b>	2.93	<b>3.35</b>	2.96
Ever Exited	<b>0.37</b>	0.48	<b>0.38</b>	0.49	<b>0.43</b>	0.50	<b>0.45</b>	0.50
Ever Moved	<b>0.48</b>	0.50	<b>0.80</b>	0.40	<b>0.62</b>	0.49	<b>0.54</b>	0.50
Observations	<b>330,963</b>		<b>23,303</b>		<b>141,718</b>		<b>295,642</b>	

*Note:* Data are organized at staff-by-year level. “Teachers” include general teachers and special education teachers. “Administrators” include those who work at the school level, the district level, and the special education field. “Paraprofessionals” include those both in general education and special education. “Staff” include general education licensed staff, special education licensed staff, school and district support staff, and special education support staff. For educators who hold multiple positions, we keep the single position that has the largest full-time equivalent (FTE) record. “Asian/PI” represents “Asian/Pacific Islander”; “AI/AN” represents “American Indian/Alaskan Native”. Base salary has been imputed for most of the paraprofessionals and other staff, using the hourly rate of their work times their FTE and 8 hours per day for 180 contract days in the year. “Years observed” indicates the number of years observed in the time period of our dataset (11 years, 2006/07 - 2016/17). The statistics are similar for the restricted school sample staff (see Appendix A2.1). See Appendix A2.2 for statistics of 11 detailed groups.

Table 2. School level descriptive statistics (2006/07-2015/16).

	Mean	SD	25th Percentile	75th Percentile
<i>School-level turnover</i>				
School-level teacher turnover	0.18	0.12	0.10	0.23
School-level administrator turnover	0.22	0.37	0.00	0.50
School-level paraprofessionals turnover	0.24	0.20	0.10	0.33
School-level other staff turnover	0.23	0.18	0.10	0.33
<i>Number of employees in schools</i>				
Teachers	25.02	17.16	15.00	29.00
Administrators	1.38	0.93	1.00	2.00
Paraprofessionals	9.74	6.60	5.00	14.00
Other staff	12.05	10.29	6.00	14.00
<i>Teacher-educator ratio</i>				
Teacher : administrator	18.10	6.73	13.00	23.00
Teacher : paraprofessional	3.35	3.24	1.70	4.00
Teacher : other staff	2.53	1.55	1.67	2.92
% Employees of color	0.09	0.09	0.03	0.12
School had a new principal	0.23	0.42	0.00	0.00
% Novice teachers in school	0.14	0.12	0.06	0.20
% Veteran teachers in school	0.55	0.17	0.45	0.67
<i>School average salary</i>				
Teacher salary (\$1,000)	48.95	7.29	44.69	53.67
Administrator salary (\$1,000)	86.32	17.66	80.06	97.43
Paraprofessional (\$1,000)	16.04	6.85	13.19	18.40
Other staff salary (\$1,000)	27.99	13.07	19.54	32.15
<i>Student characteristics</i>				
% Economically disadvantaged students	0.53	0.23	0.37	0.68
% Students of color	0.31	0.20	0.16	0.42
% ELL student	0.19	0.22	0.03	0.28
% Gifted students	0.06	0.06	0.01	0.08
% SPED students	0.15	0.05	0.12	0.17
% Disciplined students	0.06	0.07	0.01	0.08
Student enrollment (in 100)	4.77	3.61	2.64	5.58
<i>Student-employee ratio</i>				
Student : teacher	18.73	4.54	16.57	20.93
Student : administrator	342.53	136.27	238.00	439.00
Student : paraprofessional	61.76	60.80	31.00	71.40
Student : other staff	46.78	29.55	30.65	54.56

*Note:* The number of observations is 10,550. Data are organized at school-by-year level, which include 1,055 schools in 10 years (2006/07 - 2015/16).

Table 3. Associations among turnover rates of teachers, administrators, paraprofessionals, and other staff at the school level

<i>Panel A</i>	<b>Teacher turnover rate</b> (2006/07-2015/16)				
	1	2	3	4	5
Principal turnover rate	0.036*** (0.003)			0.029*** (0.003)	0.025*** (0.003)
Paraprofessional turnover rate		0.080*** (0.006)		0.068*** (0.006)	0.058*** (0.006)
Other staff turnover rate			0.096*** (0.006)	0.086*** (0.007)	0.076*** (0.007)
Year FE					Yes
District FE					Yes
Constant	0.167*** (0.001)	0.157*** (0.002)	0.155*** (0.002)	0.132*** (0.002)	0.155*** (0.004)
N	9631	10106	10448	9340	9340
<i>Panel B</i>	<b>Teacher turnover rate (three-year average)</b> (2008/09-2015/16)				
	1	2	3	4	5
Principal turnover rate 3-year avg	0.058*** (0.004)			0.048*** (0.003)	0.043*** (0.003)
Paraprofessional turnover rate 3-year avg		0.099*** (0.006)		0.080*** (0.006)	0.063*** (0.006)
Other staff turnover rate 3-year avg			0.129*** (0.007)	0.100*** (0.007)	0.101*** (0.008)
Year FE					Yes
District FE					Yes
Constant	0.161*** (0.001)	0.151*** (0.002)	0.145*** (0.002)	0.121*** (0.002)	0.133*** (0.003)
N	8005	8270	8401	7886	7886

*Note:* We aggregate our data at the school level and generate turnover rates for teachers, administrators, paraprofessionals, and staff in their respective schools. We then calculate three-year rolling average turnover rates, which begin with the 2008/09 school year and average each year's turnover rates with those of the previous two years. Panel A presents results using one-year turnover rates, while Panel B presents results using three-year rolling average turnover rates. "Year FE" and "District FE" represent the fixed effects for the year and district, respectively.

Table 4. School context variables predicting turnover rates by staff group (2007/08-2015/16)

	Teachers	Administrators	Paraprofessionals	All other Staff
<i>Student Characteristics</i>				
% FRPL students	0.002 (0.010)	0.006 (0.025)	-0.027 (0.022)	-0.032 (0.017)
% Students of color	0.019 (0.018)	0.033 (0.042)	-0.004 (0.039)	0.005 (0.029)
% ELL students	-0.000 (0.014)	-0.021 (0.034)	-0.035 (0.022)	0.023 (0.020)
% Gifted students	-0.027 (0.031)	-0.035 (0.074)	0.122 (0.072)	-0.029 (0.058)
% SPED students	0.070 (0.043)	-0.016 (0.085)	-0.043 (0.085)	-0.006 (0.065)
% Disciplined students	0.100*** (0.019)	0.151*** (0.045)	0.073* (0.036)	0.113*** (0.027)
Student enrollment (in 100)	0.002 (0.001)	0.000 (0.002)	0.004 (0.002)	-0.001 (0.001)
<i>Employee characteristics</i>				
Average salary (\$1,000)	-0.003*** (0.001)	-0.001*** (0.000)	-0.001 (0.000)	-0.001*** (0.000)
Number of employees	-0.001*** (0.000)	-0.000 (0.000)	-0.001* (0.000)	0.000 (0.000)
% Employees of color	0.067** (0.021)	0.061 (0.045)	-0.029 (0.037)	0.025 (0.036)
School had a new principal	0.011*** (0.002)	0.204*** (0.007)	0.010*** (0.003)	0.016*** (0.003)
% Novice teachers	0.156*** (0.015)	0.039 (0.036)	0.043 (0.025)	0.037 (0.025)
% Veteran teachers	-0.016 (0.014)	0.022 (0.024)	-0.057* (0.023)	-0.026 (0.017)
Constant	0.301*** (0.027)	0.254*** (0.033)	0.297*** (0.025)	0.267*** (0.017)
District and Year FE	Yes	Yes	Yes	Yes
R-squared	0.359	0.270	0.240	0.241
N	7658	7658	7558	7653

*Note:* Turnover measures are a three-year rolling average. Standard errors are clustered at the school level and are shown in parentheses. “District and Year FE” indicates district and year fixed effects. “Average salary” indicates the school-level average salary for each group. “% Novice teachers” is the percentage of teachers who have less than three years of experience. “% Veteran teachers” is the percentage of teachers who have more than ten years of experience.

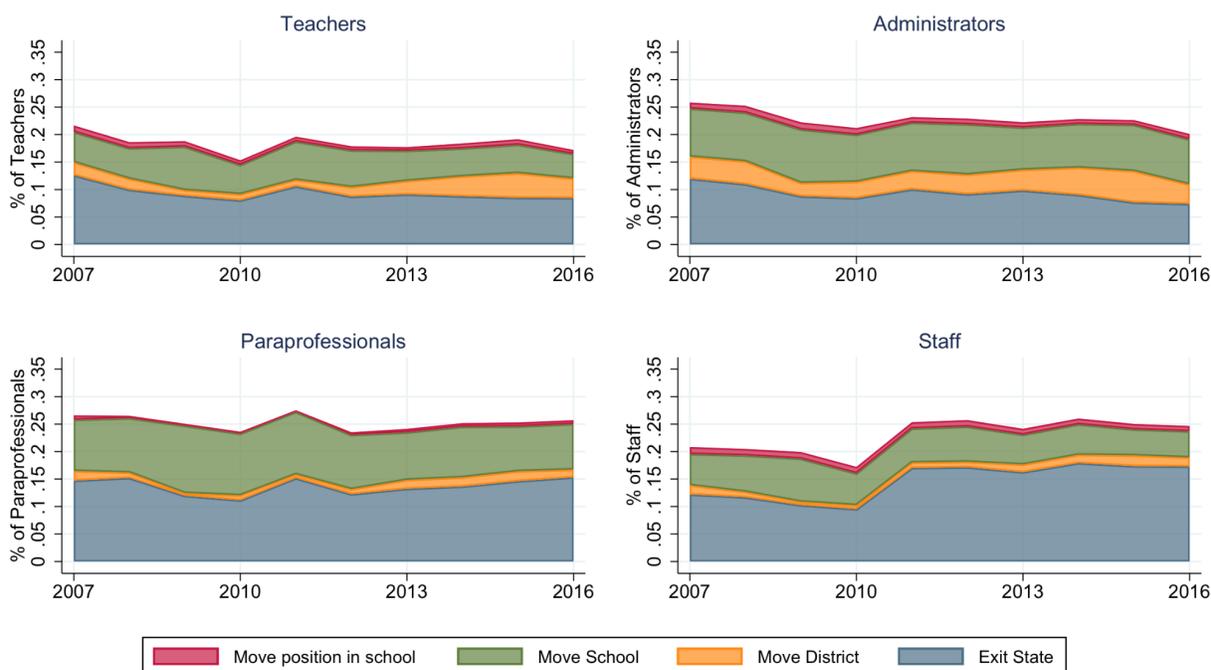


Figure 1. Staff attrition and mobility in the state, 2006/07-2016/17

*Note:* We plot the proportion of teachers, principals, paraprofessionals, and other support staff who changed their positions or locations each year over the panel. “Teachers” include general teachers and special education teachers. “Administrators” include those who work at the school level, the district level, and the special education field. “Paraprofessionals” include those both in general education and special education. “Staff” include general education licensed staff, special education licensed staff, school and district support staff, and special education support staff. Four turnover categories are presented here: (1) “Move position in school (Red)” indicates educators change position in the same school (teachers switch to a non-teaching position and all other groups switch to a teaching position), (2) “Move school (Green)” indicates educators move to another school in the same district, (3) “Move district (yellow)” indicates educators move to another school district within the state; (4) “Exit state (Blue)” indicates educators leave the state public education system.



Figure 2. Differences in Mean Annual Turnover Relative to General Education Teachers by Staff Group

*Note:* Results presented are from an OLS regression of a binary variable for any turnover on staff position groups. Turnover includes moving, exiting or switching positions. Observations are at the staff-year level. General education teachers are the omitted category and, thus, the estimates represent coefficients that can be interpreted as the mean annual turnover difference of that staff group in comparison to teachers. Confidence intervals are at the 95% level. The average annual number of staff in each group during the panel is printed next to the name of the group. For reference, among teachers the annual average number was 26,738 and the rate of annual turnover was 0.19 (19%). To determine the average annual rate of turnover for each group above, one can add the estimate from the figure to the teacher rate. For example, during the panel the total annual turnover rate for school-level administrators was about 25% ( $0.19 + 0.06$ ) and for special education paraprofessionals was about 27% ( $0.19 + 0.08$ ).

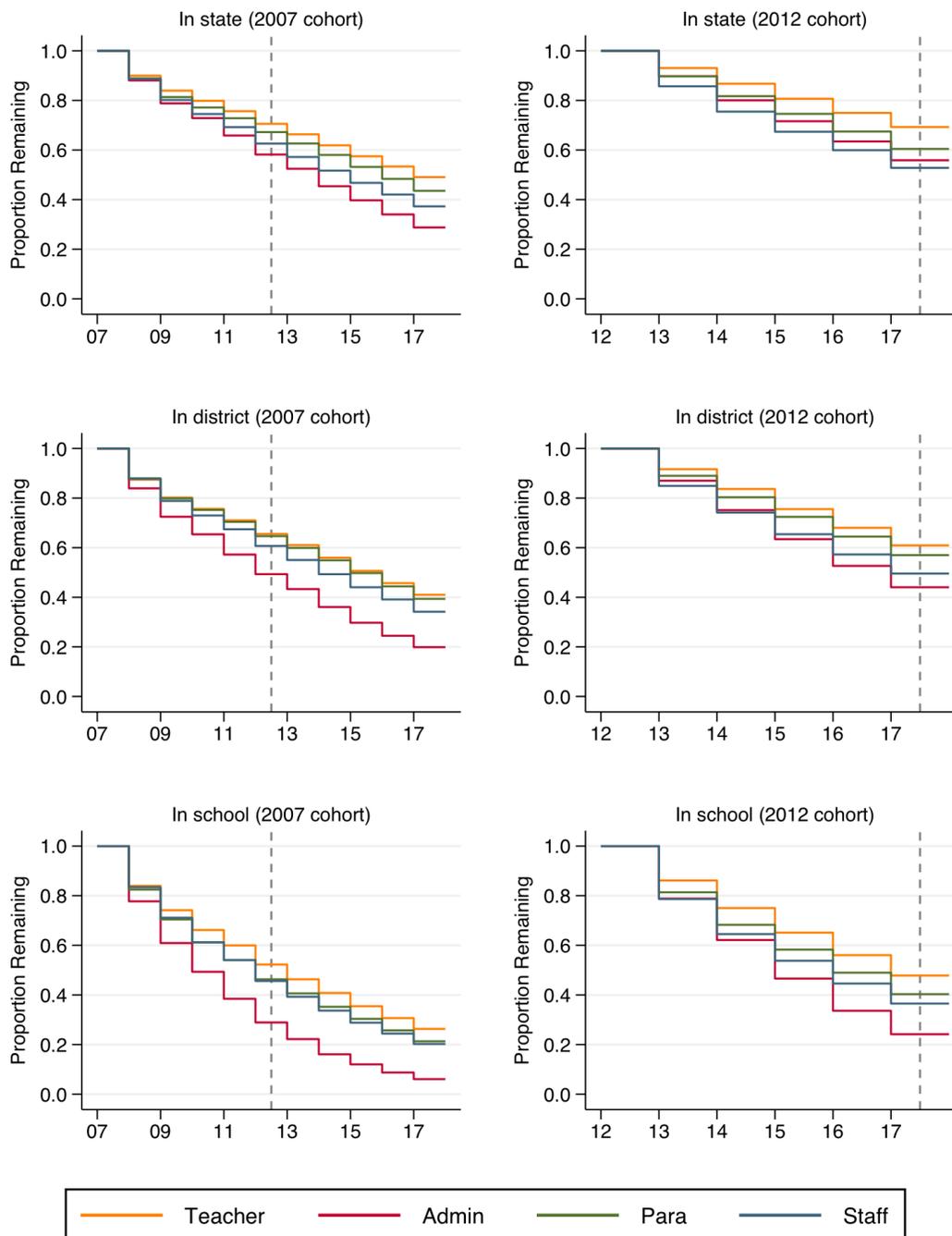


Figure 3. Proportion of teachers, administrators, paraprofessionals, and other staff that remain in the state education system, in their same district, and in their same school from the initial year

*Note:* The y-axis represents the proportion of employees remaining, while the x-axis indicates the academic years (e.g., 07 indicates 2006-07 school year). The initial number of teachers, administrators, paraprofessionals, and staff for the 2007 cohort were 32,000, 2,000, 11,000, and 23,000, respectively. The 2012 cohort had similar initial numbers of employees. The dotted line marks the proportion of employees remaining five years after the initial year for each cohort.

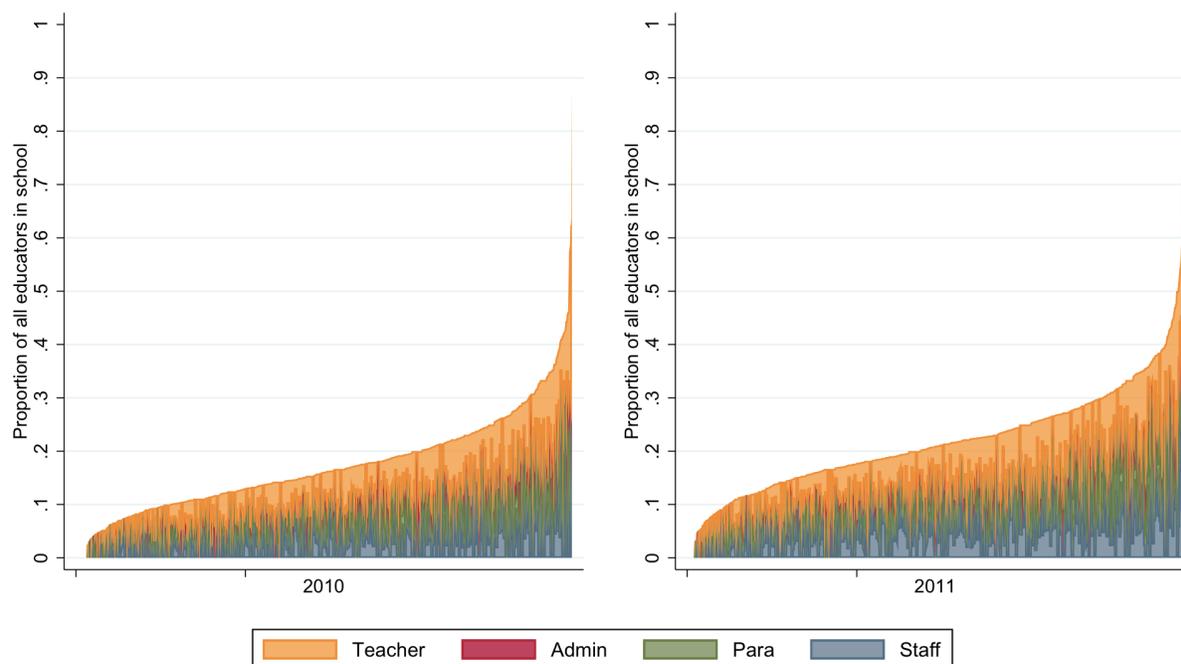


Figure 4. Proportion administrator, teacher, paraprofessionals, and other staff turnover by school, 2009-10, and 2010-2011

*Note:* This figure presents the proportions of turnover across different groups within schools. For each group, the turnover rates were calculated by dividing the total number of employees across groups from each school (i.e. all teachers, principals, paraprofessionals, **and** support staff) by the number of people from each group who left those schools. For example, the teacher turnover rate in one school equals the number of total employees in this school divided by the number of teachers who left this school or moved to non-teaching positions.

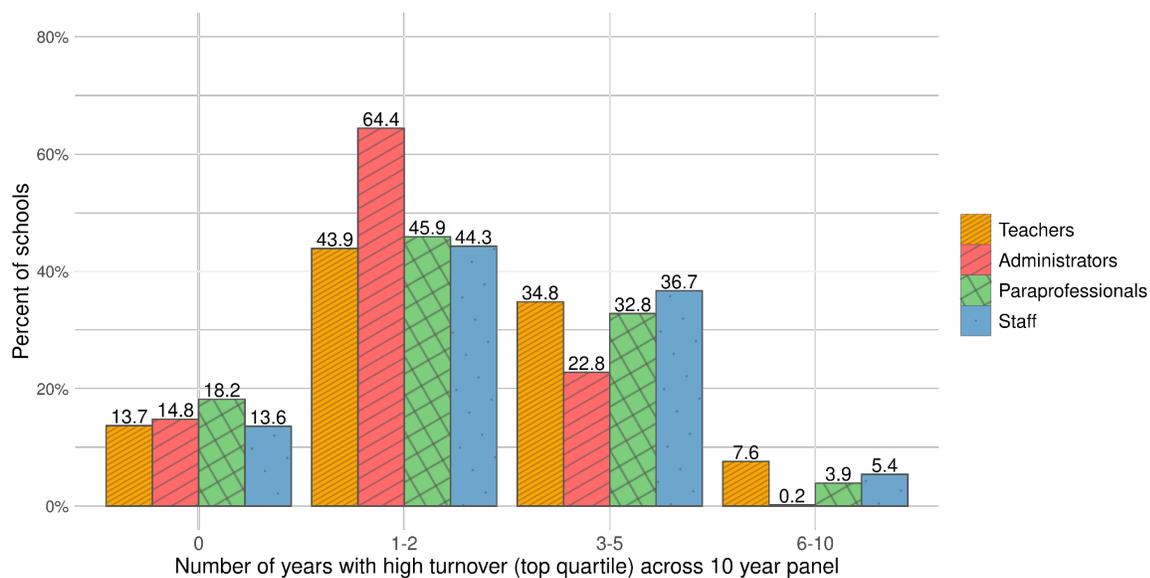


Figure 5. Number of years schools experience high turnover (top quartile) by group from 2006/07-2015/16

*Note:* Figure plots the percent of schools for the number of years that they are in the top quartile of turnover for a given employee group. Only schools with greater than 5 employees and that remained open for all years of the panel are included ( $n = 1,055$ ).

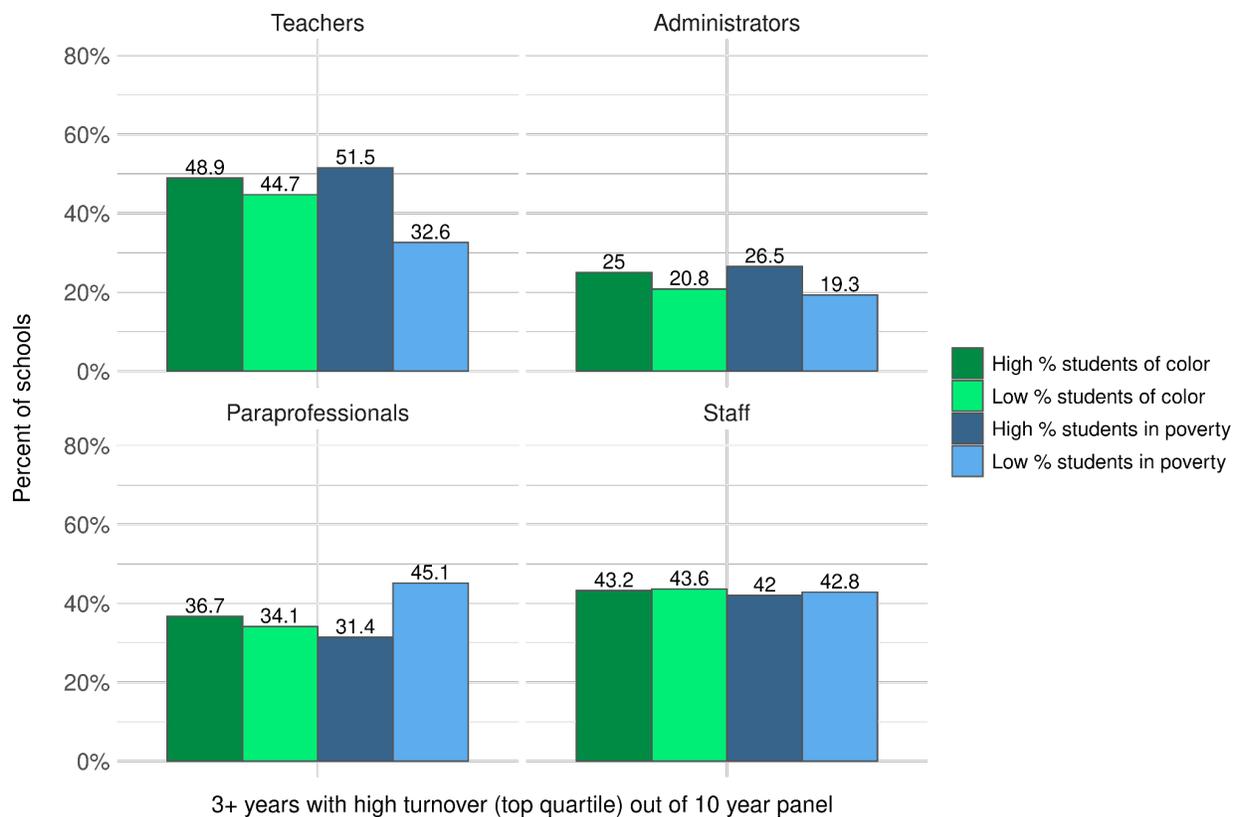


Figure 6. Percent of schools that experience 3 years or more of high turnover (top quartile) by staff group and demographics of students served

*Note:* Figure plots the percent of schools that had 3 or more years of turnover in the top quartile for each employee group separately. The percentage is plotted conditional on being in the top or bottom quartile of serving racially and ethnically minoritized students and students in poverty. Only schools with greater than 5 employees and that were open for all 10 years of the panel are included (N = 1,055).

## Appendix

### Equations of Regression Models

To formally test for differences in turnover rates, we directly compare the average annual turnover of general education teachers to that of the other 10 detailed staff groups by regressing a binary turnover variable on indicators for the other groups with general education teachers as the omitted category. We compare turnover to teachers as they are the modal group and their turnover patterns are the most studied, making them a useful point of reference. The equation for this test is:

$$Turnover_{it} = \alpha + \sum_{r=1}^{r=10} \beta_r DetailedGroups'_{it} + \varepsilon_{it} \quad (1)$$

where  $Turnover_{it}$  represents a binary variable for any turnover for individual  $i$  in the year  $t$ , which includes moving, exiting or switching positions.  $Detailedgroups'_{it}$  is a vector of dichotomous indicators of ten detailed staff groups other than general education teachers.  $\varepsilon_{it}$  is an error term. The general education teacher group is the omitted category and, thus, the estimates  $\beta_r$  represent coefficients that can be interpreted as the mean annual turnover difference of that staff group in comparison to teachers.

To assess the extent to which turnover among different employee groups co-occurs in schools, we regress the school teacher turnover rate on the turnover rate for administrators, paraprofessionals, and staff first in separate models and then together simultaneously. We consider both one-year turnover rates and three-year rolling average turnover rates. We add year and district-fixed effects to address common year shocks and to more closely examine school as opposed to district-level turnover processes. The equation for this test is:

$$TeacherTurnover_{st} = \alpha + \sum_{r=1}^{r=3} \beta_r StaffGroupsTurnover'_{st} + \pi_d + \lambda_t + \varepsilon_{st} \quad (2)$$

where  $TeacherTurnover_{st}$  represents the percentage of teachers leaving their schools or switching to non-teaching positions in school  $s$  in the year  $t$ .  $StaffgroupsTurnover'_{st}$  is a vector of school level turnover rates for three staff groups, namely administrators, paraprofessionals, and other staff. The variable  $\pi_d$  indicates district fixed effects,  $\lambda_t$  indicates year fixed effects, and  $\varepsilon_{it}$  is an error term.

In order to explore how a more expansive set of factors correlates with turnover, we use OLS regression to predict school-level turnover for each group separately leveraging a rich array of student and employee characteristics available in the administrative data. The equation for this test is:

$$TurnoverRate_{st} = \alpha + SchoolContext'_{st} + \pi_d + \lambda_t + \varepsilon_{st} \quad (3)$$

where  $Turnover_{st}$  represents the percentage of turnover for four different groups in school  $s$  in the year  $t$ .  $SchoolContext'_{st}$  is a vector of school level student and employee characteristics. The variable  $\pi_d$  indicates district fixed effects,  $\lambda_t$  indicates year fixed effects, and  $\varepsilon_{it}$  is an error term.

Table A1. Crosswalk of Simplified Staff Groups to Position Codes from Administrative Data

<b>Simplified Staff Group</b>	<b>Detailed Staff Group</b>	<b>Positions Recorded in Administrative Data</b>
Teachers	General Education	Head Teacher, Non-Special Ed Teacher, Non-Special Ed
Teachers	Special Education	Special Education Teacher (Non-PE) Special Education Teacher (PE)
Administrators	School-Level	Principal Assistant Principal
Administrators	Top District-Level	Superintendent Assistant Superintendent
Administrators	Special Education	Special Education Administrator, Director Special Education Administrator, Other Administrative Position
Paraprofessionals	General Education	Paraprofessional (Educational Assistant), Non-Special Ed
Paraprofessionals	Special Education	Special Education Paraprofessional
Staff	General Education Licensed	Instructional Coordinator/Supervisor, Non-Special Ed Psychologist, Non-Special Ed Library/Media Specialist Guidance Counselor, Non-Special Ed Other Licensed Staff, Non-Special Ed Nurse, Non-Special Ed
Staff	Special Education Licensed	Special Education Audiologist Special Education Speech Pathologist Special Education Interpreter Special Education Psychologist Special Education Occupational Therapist Special Education Physical Therapist Special Education Recreational/Therapeutic Specialists Special Education School Social Workers Special Education Medical and Nursing Staff Special Education Counselors and Rehab Counselors Special Education Orientation and Mobility Specialists Special Education Other Services, Licensed
Staff	School and District Support	District Support (Non-Licensed, Non-Special Ed) School Support (Non-Licensed, Non-Special Ed) Student Support (Non-Special Ed) Library/Media Support Other Non-Licensed Staff, Non-Special Ed
Staff	Special Education Support	Special Education Administration, Support Staff Special Education Other Services, Non-Licensed

Table A2.1 Descriptive Statistics by Staff Group (2006/07-2016/17) - Restricted School Sample

	Teachers		Administrators		Paraprofessionals		All other Staff	
	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>
Female	0.70	0.46	0.47	0.50	0.91	0.29	0.76	0.43
Age	43.40	10.79	47.24	8.42	46.92	11.38	48.11	11.10
Race/Ethnicity								
White	0.92	0.28	0.89	0.32	0.85	0.36	0.86	0.35
Hispanic	0.03	0.18	0.05	0.21	0.09	0.28	0.07	0.26
Asian/PI	0.02	0.13	0.02	0.13	0.02	0.14	0.02	0.14
Black	0.01	0.08	0.02	0.15	0.01	0.11	0.02	0.13
AI/AN	0.01	0.07	0.01	0.08	0.01	0.09	0.01	0.09
Multi- or Unknown	0.02	0.14	0.02	0.13	0.02	0.15	0.02	0.14
Education Level								
Master's or Doctorate	0.68	0.47	0.95	0.23	0.00	0.07	0.15	0.36
BA degree	0.32	0.47	0.05	0.22	0.02	0.14	0.03	0.18
Less than BA	0.00	0.05	0.00	0.06	0.04	0.19	0.03	0.18
Unknow Education	0.00	0.00	0.00	0.00	0.94	0.24	0.78	0.41
Part-time	0.13	0.34	0.09	0.29	0.89	0.31	0.47	0.50
Base salary (\$1,000)	50.76	14.58	87.71	19.22	16.40	12.77	25.85	19.33
Assignments	1.12	0.39	1.10	0.34	1.12	0.36	1.13	0.43
Years Observed	3.79	3.01	4.56	3.13	3.28	2.94	3.38	2.95
Ever Exited	0.36	0.48	0.35	0.48	0.43	0.49	0.43	0.50
Ever Moved	0.46	0.50	0.83	0.38	0.60	0.49	0.59	0.49
Observations	<b>313,545</b>		<b>17,577</b>		<b>122,998</b>		<b>151,321</b>	

*Note:* Data are organized at staff-by-year level. “Teachers” include general teachers and special education teachers. “Administrators” include those who work at the school level, the district level, and the special education field. “Paraprofessionals” include those both in general education and special education. “Staff” include general education licensed staff, special education licensed staff, school and district support staff, and special education support staff. For educators who hold multiple positions, we keep the single position that has the largest full-time equivalent (FTE) record. “Asian/PI” represents “Asian/Pacific Islander”; “AI/AN” represents “American Indian/Alaskan Native”. Base salary has been imputed for most of the paraprofessionals and other staff, using the hourly rate of their work times their FTE and 8 hours per day for 180 contract days in the year. “Years observed” indicates the number of years observed in the time period of our dataset (11 years, 2006/07 - 2016/17).

Table A2.2 Descriptive Statistics by 11 Detailed Staff Group (2006/07-2016/17) - Full sample

	<u>Teachers</u>		<u>Administrators</u>			<u>Paraprofessionals</u>		<u>Other Staff</u>			
	1	2	3	4	5	6	7	8	9	10	11
Female	0.69	0.78	0.47	0.29	0.73	0.92	0.88	0.75	0.89	0.66	0.90
Age	43.34	44.90	47.33	53.88	50.07	46.59	46.73	46.60	46.80	48.97	48.64
<i>Race/Ethnicity</i>											
White	0.91	0.93	0.89	0.95	0.96	0.81	0.88	0.90	0.92	0.85	0.90
Hispanic	0.04	0.02	0.05	0.02	0.02	0.13	0.06	0.04	0.02	0.07	0.05
Asian/PI	0.02	0.01	0.02	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.01
Black	0.01	0.01	0.03	0.01	0.00	0.01	0.02	0.01	0.00	0.02	0.01
AI/AN	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01
Multi- or Unknown	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.03	0.02	0.02
<i>Education Level</i>											
Master's or Doctorate	0.66	0.80	0.95	0.97	0.94	0.01	0.00	0.77	0.69	0.01	0.02
BA degree	0.33	0.20	0.05	0.02	0.06	0.03	0.02	0.16	0.13	0.01	0.02
Less than BA	0.00	0.00	0.00	0.00	0.01	0.04	0.04	0.01	0.03	0.03	0.04
Unknow Education	0.00	0.00	0.00	0.00	0.00	0.93	0.94	0.06	0.15	0.95	0.92
Part-time	0.14	0.14	0.10	0.19	0.22	0.86	0.90	0.26	0.45	0.46	0.51
Base salary (\$1,000)	50.66	50.18	87.55	104.43	81.32	14.96	17.99	54.23	47.81	24.44	24.68
Base salary <i>SD</i>	(14.77)	(14.13)	(19.38)	(34.11)	(24.88)	(16.49)	(7.57)	(22.20)	(17.65)	(19.17)	(11.97)
Assignments	1.13	1.14	1.10	1.23	1.26	1.14	1.09	1.21	1.32	1.06	1.16
Years Observed	3.77	3.71	4.53	4.33	4.43	3.08	3.40	3.95	3.75	3.22	3.53
Ever Exited	0.36	0.41	0.36	0.51	0.39	0.44	0.43	0.43	0.42	0.46	0.46
Ever Moved	0.45	0.72	0.83	0.65	0.79	0.56	0.66	0.75	0.69	0.49	0.73
<b>Observations</b>	<b>294,120</b>	<b>36,843</b>	<b>18,111</b>	<b>2,598</b>	<b>2,594</b>	<b>59,597</b>	<b>82,121</b>	<b>32,821</b>	<b>22,275</b>	<b>233,065</b>	<b>7,481</b>

*Note:* Data are organized at staff-by-year level. 1, General education teachers; 2, Special education teachers; 3, School-Level administrators; 4, Top district-level administrators; 5, Special education administrators; 6, General education paraprofessionals; 7, Special education paraprofessionals; 8, General education licensed staff; 9, Special education licensed staff; 10, School and district support staff; 11, Special education support staff.

Table A3. Crosswalk of present turnover categories to representative literature

<b>The Present Study Main Version</b>	<b>The Present Study Detailed Version</b>	<b>Goldhaber &amp; Theobald, 2021</b>	<b>Grissom &amp; Bartanen, 2019</b>	<b>Carver-Thomas &amp; Darling-Hammond, 2017</b>
0 Stayers	0 Stayers	Stayers	Stayers	Stayers
1 Switching position (for administrators, paraprofessionals, and other staff)	1 Moving to a teaching position in the same school (for administrators, paraprofessionals, and other staff)	NA (analysis does not include non-teaching positions)	NA (analysis does not include non-teaching positions)	NA (analysis does not include non-teaching positions)
1 Switching position (for teachers)	2 Moving to a non-teaching position in the same school (for teachers)	(2) Leave their current teaching position for a non teaching position (e.g., administration) within the state's public school system	(3) Changing positions (e.g., instructional coach, assistant principal)	(4) Left teaching
2 Moving within-district	3 Moving to a teaching-position within-district	(3) Leave their school for another public-school teaching position in the state (black)	(1) Moving to another school in the same district	(1) Move to a public school in same school district
2 Moving within-district	4 Moving to a non-teaching position within-district	(2) Leave their current teaching position for a non teaching position (e.g., administration) within the state's public school system	(3) Changing positions (e.g., instructional coach, assistant principal)	(4) Left teaching
3 Moving across-district	5 Moving to a teaching-position across-district	(3) Leave their school for another public-school teaching position in the state (black)	(2) Moving to a different district	(2) Move to a public school in different district
3 Moving across-district	6 Moving to a non-teaching position across-district	(2) Leave their current teaching position for a non teaching position (e.g., administration) within the state's public school system	(3) Changing positions (e.g., instructional coach, assistant principal)	(4) Left teaching
4 Exiting the state public schools (leaving the education system)	7 Exiting the state public schools (leaving the education system)	(1) Leave their schools and the state's public-school workforce entirely)	(4) Leaving the education system	(4) Left teaching (3) Move to a private school

Table A.4 Pearson correlations among turnover rates of different groups in schools

<i>Panel A: One Year Turnover</i>				
	Teacher	Administrator	Paraprofessionals	Staff
School-Level Teacher Turnover	1			
School-Level Administrator Turnover	0.12***	1		
School-Level Paraprofessional Turnover	0.14***	0.06***	1	
School-Level Staff Turnover	0.15***	0.07***	0.16***	1
<i>Panel B: Three Year Rolling Turnover Average</i>				
	Teacher	Administrator	Paraprofessionals	Staff
School-Level Teacher Turnover	1			
School-Level Administrator Turnover	0.17***	1		
School-Level Paraprofessional Turnover	0.17***	0.07***	1	
School-Level Staff Turnover	0.17***	0.10***	0.24***	1

*Note:* Pearson correlations using both one year and three year average turnover rates of different groups present small associations.

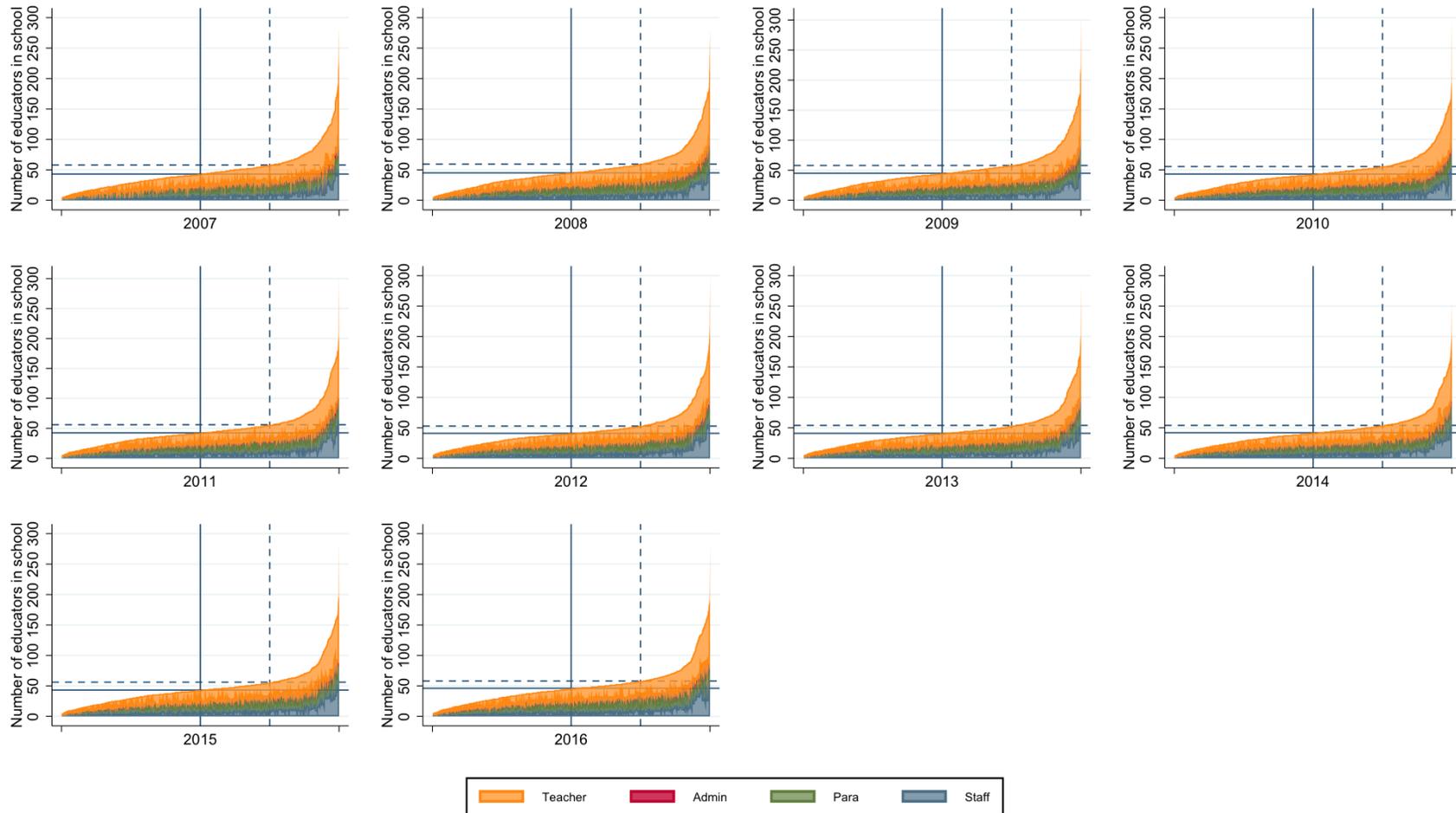
Table A5. School context variables predicting turnover rates by staff group (Additional Models)

	One-year outcome with naïve regression				One-year outcome with district and year FE				Three-year average outcome with naïve regression			
	Teacher	Admin	Para	Other staff	Teacher	Admin	Para	Other staff	Teacher	Admin	Para	Other staff
<i>Student Characteristics</i>												
% FRPL students	-0.010 (0.010)	-0.006 (0.027)	-0.036* (0.016)	-0.022 (0.017)	-0.004 (0.012)	-0.015 (0.035)	-0.037 (0.019)	-0.008 (0.020)	-0.015 (0.009)	0.003 (0.019)	-0.019 (0.018)	-0.040* (0.016)
% Students of color	0.062*** (0.014)	0.140*** (0.034)	0.067** (0.024)	0.014 (0.021)	0.022 (0.021)	0.079 (0.055)	-0.021 (0.039)	-0.040 (0.032)	0.060*** (0.012)	0.094*** (0.025)	0.070** (0.024)	0.047* (0.020)
% ELL students	-0.020* (0.009)	-0.074*** (0.020)	-0.039** (0.015)	-0.024 (0.014)	0.007 (0.014)	-0.052 (0.041)	-0.011 (0.022)	0.017 (0.019)	-0.016 (0.008)	-0.046** (0.015)	-0.054*** (0.015)	-0.025 (0.013)
% Gifted students	0.023 (0.025)	0.080 (0.081)	0.328*** (0.059)	0.146** (0.048)	-0.033 (0.035)	-0.043 (0.097)	0.131* (0.064)	0.031 (0.059)	0.036 (0.024)	0.079 (0.060)	0.334*** (0.069)	0.112* (0.045)
% SPED students	0.110** (0.042)	0.031 (0.101)	0.167* (0.082)	0.066 (0.071)	0.076 (0.046)	-0.014 (0.118)	-0.037 (0.076)	-0.080 (0.074)	0.106** (0.039)	0.023 (0.071)	0.092 (0.082)	0.087 (0.065)
% Disciplined students	0.053* (0.022)	0.147* (0.059)	0.033 (0.041)	0.046 (0.033)	0.077*** (0.022)	0.168** (0.059)	0.076 (0.041)	0.095** (0.029)	0.071*** (0.020)	0.123** (0.045)	0.029 (0.038)	0.040 (0.031)
Student enrollment (in 100)	0.001 (0.001)	-0.000 (0.003)	-0.007* (0.003)	-0.005 (0.003)	-0.002 (0.002)	-0.002 (0.004)	-0.012*** (0.003)	-0.012** (0.004)	0.003*** (0.001)	0.002 (0.002)	0.008** (0.003)	0.003 (0.002)
<i>Employee characteristics</i>												
Average salary (\$1,000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.005*** (0.001)	-0.002*** (0.000)	-0.001 (0.001)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000 (0.000)	-0.000** (0.000)
Number of employees	-0.000** (0.000)	-0.000 (0.000)	0.001* (0.000)	0.001 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.001*** (0.000)	0.001** (0.000)	-0.001*** (0.000)	-0.000 (0.000)	-0.001*** (0.000)	-0.000* (0.000)
% Employees of color	0.084*** (0.022)	0.030 (0.057)	0.086** (0.033)	0.182*** (0.034)	0.074** (0.026)	0.051 (0.067)	-0.003 (0.040)	0.045 (0.042)	0.055** (0.019)	0.036 (0.041)	0.062 (0.033)	0.133*** (0.031)
School had a new principal	0.015*** (0.003)	-0.043*** (0.009)	0.014** (0.005)	0.025*** (0.004)	0.013*** (0.003)	-0.066*** (0.009)	0.011* (0.005)	0.021*** (0.004)	0.013*** (0.002)	0.221*** (0.007)	0.016*** (0.003)	0.020*** (0.003)
% Novice teachers	0.102*** (0.020)	0.061 (0.046)	0.044 (0.026)	0.007 (0.023)	0.061** (0.020)	0.041 (0.051)	0.026 (0.027)	0.017 (0.023)	0.181*** (0.016)	0.068* (0.033)	0.072** (0.024)	0.056* (0.025)
% Veteran teachers	-0.012 (0.013)	0.011 (0.031)	-0.003 (0.021)	-0.011 (0.018)	0.023 (0.017)	-0.008 (0.034)	-0.033 (0.020)	-0.026 (0.018)	-0.038** (0.012)	0.020 (0.023)	-0.022 (0.023)	-0.010 (0.018)
Constant	0.232*** (0.015)	0.326*** (0.037)	0.185*** (0.021)	0.210*** (0.017)	0.367*** (0.030)	0.391*** (0.046)	0.279*** (0.023)	0.269*** (0.019)	0.215*** (0.014)	0.181*** (0.026)	0.211*** (0.021)	0.218*** (0.017)
District and Year FE	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No
R-squared	0.077	0.011	0.022	0.019	0.157	0.046	0.110	0.114	0.237	0.215	0.061	0.048
N	8625	8625	8450	8596	8617	8617	8442	8589	7668	7668	7568	7663

*Note:* Standard errors are clustered at the school level and are shown in parentheses. “District and Year FE” indicates year and district fixed effects. “Average salary” indicates the school level average salary for each group. “% Novice teachers” is the percentage of teachers who have less than three years of experience. “% Veteran teachers” is the percentage of teachers who have more than ten years of experience.

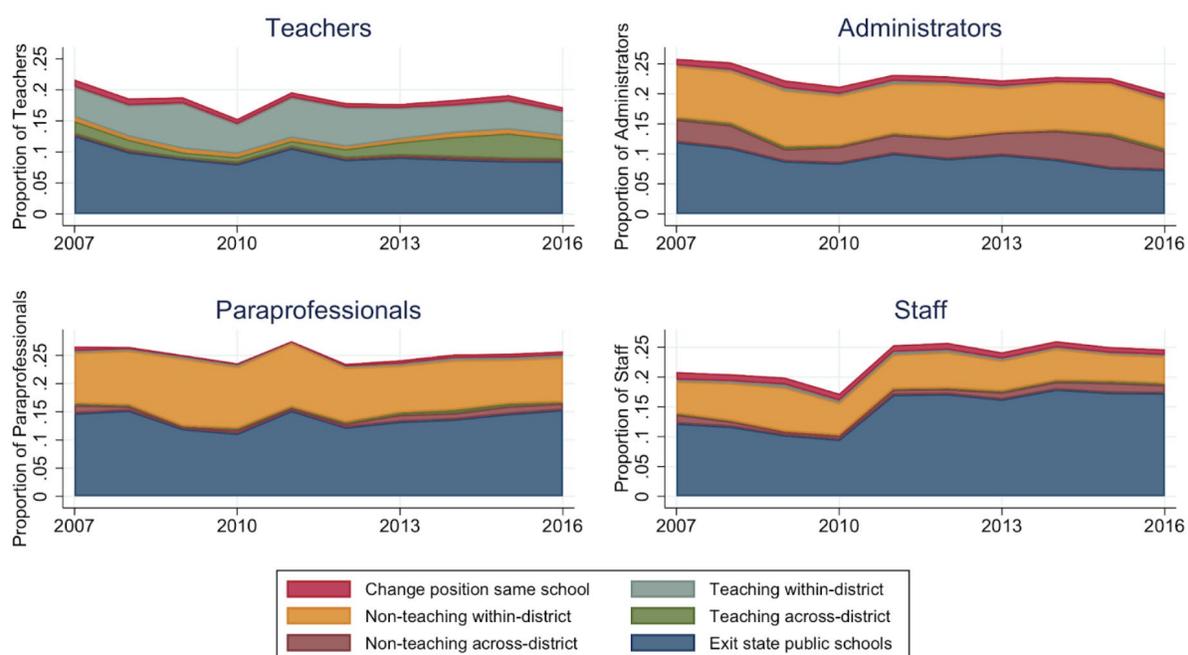


Figure A1.2 Number of different employees in schools each year, 2006/07-2016/17



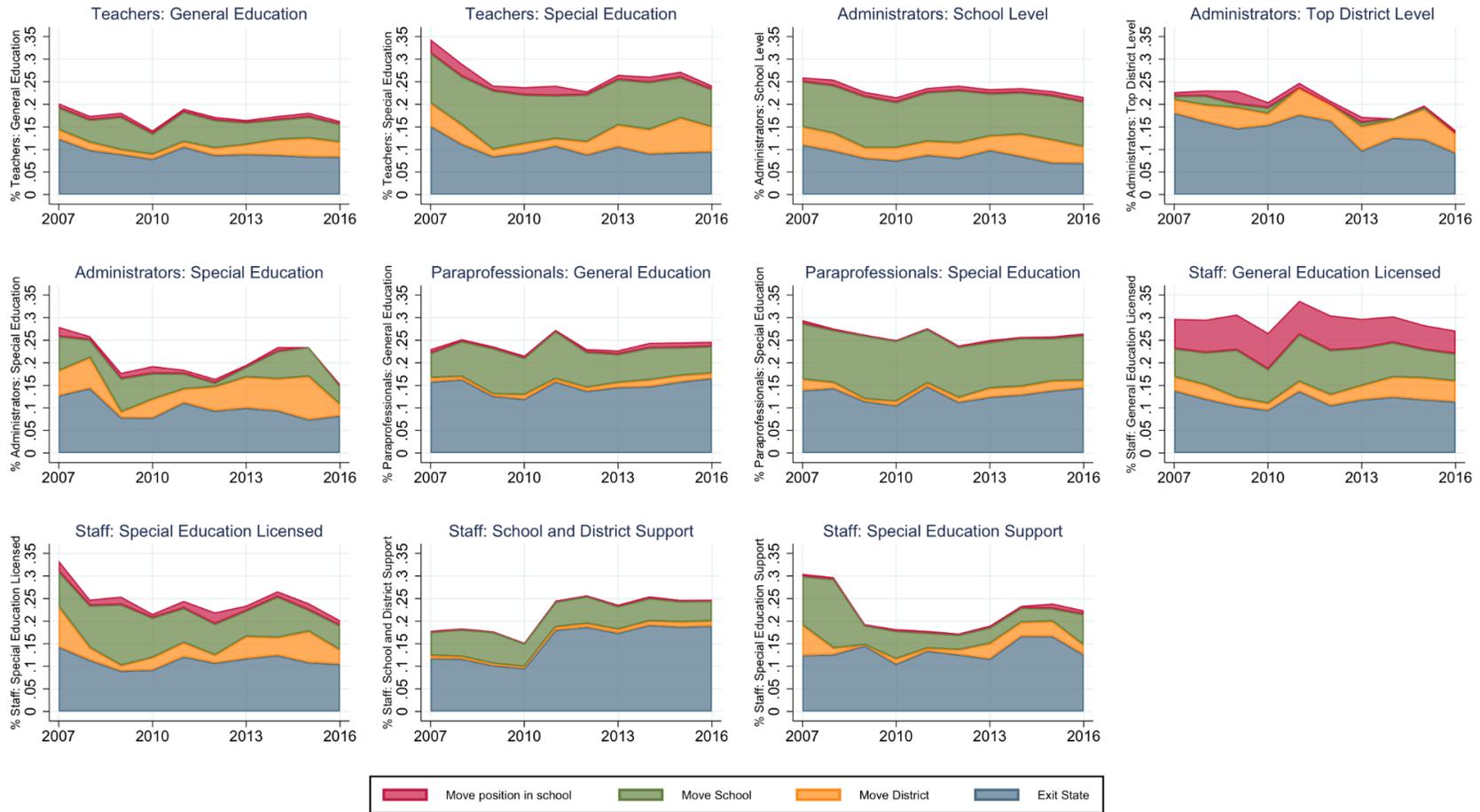
*Note:* Solid lines indicate the median of the total number of employees, and dash lines indicate the 75th percentile of the total number of employees.

Figure A 2.1 Detailed staff attrition and mobility in the state, 2006/07-2016/17



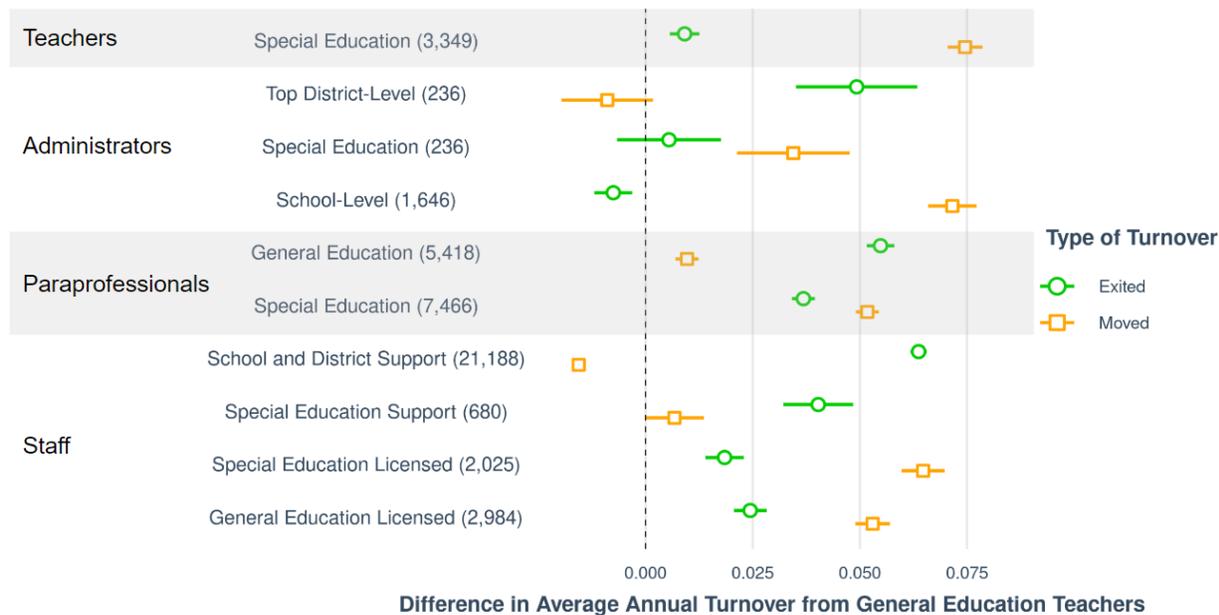
*Note:* We plot the proportion of teachers, principals, paraprofessionals, and other support staff who changed their positions or locations each year over the panel. “Teachers” include general teachers and special education teachers. “Administrators” include those who work at the school level, the district level, and the special education field. “Paraprofessionals” include those both in general education and special education. “Staff” include general education licensed staff, special education licensed staff, school and district support staff, and special education support staff. Six turnover categories are presented here: (1) “Change position same school (Red)” indicates educators change between teaching and non-teaching positions within their schools (teachers switch to a non-teaching position and all other groups switch to a teaching position), (2) “Teaching within-district (Light blue)” indicates educators move to a teaching-position in another school within the same district, (3) “Non-teaching within-district (Yellow)” indicates educators move to a non-teaching position in another school within the same district, (4) “Teaching across-district (Dark green)” indicates educators move to a teaching-position in another school district within the state, (5) “Non-teaching across-district (Dark red)” indicates educators move to a non-teaching position in another school district within the state, and (6) “Exit state public schools (Dark blue)” indicates educators leave the state public education system.

Figure A2.2 Staff attrition and mobility in the state (eleven groups), 2006/07-2016/17



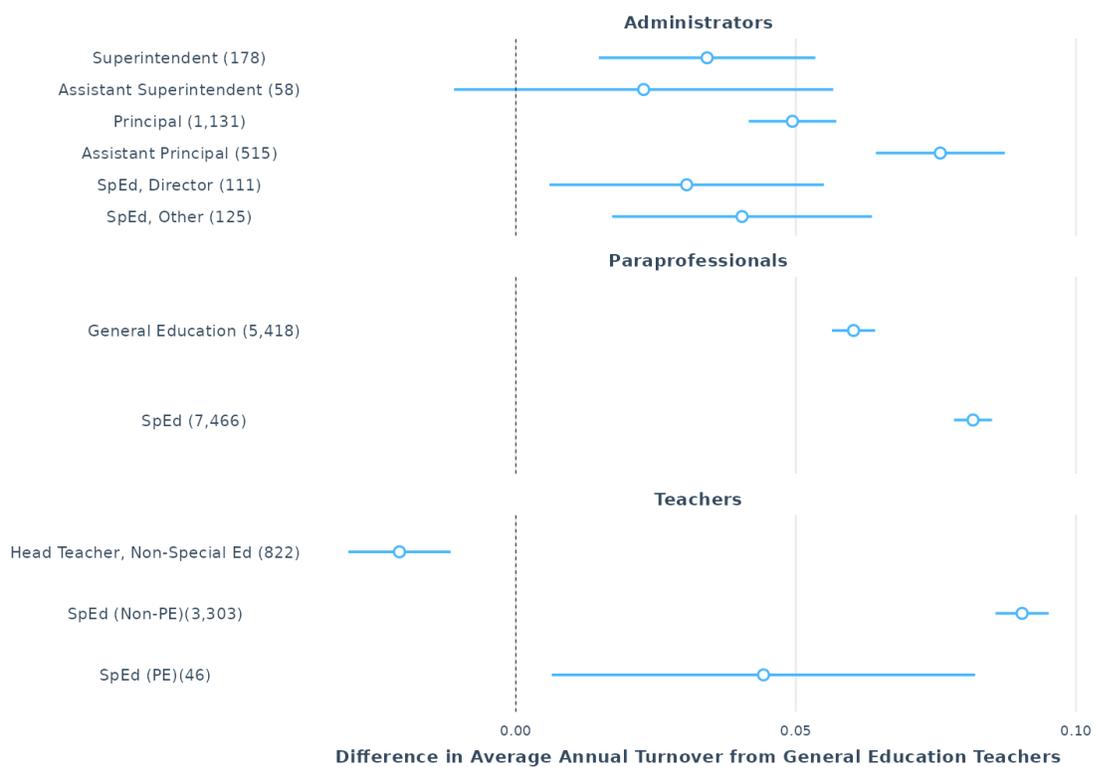
*Note:* To present the trends across groups in a clearer way, we simplify the turnover measure to four categories: (1) “Move position in school (Red)” indicates educators change position in the same school (teachers switch to a non-teaching position and all other groups switch to a teaching position), (2) “Move school (Green)” indicates educators move to another school in the same district, (3) “Move district (yellow) indicates educators move to another school district within the state; (4) “Exit state (Blue) indicates educators leave the state public education system.

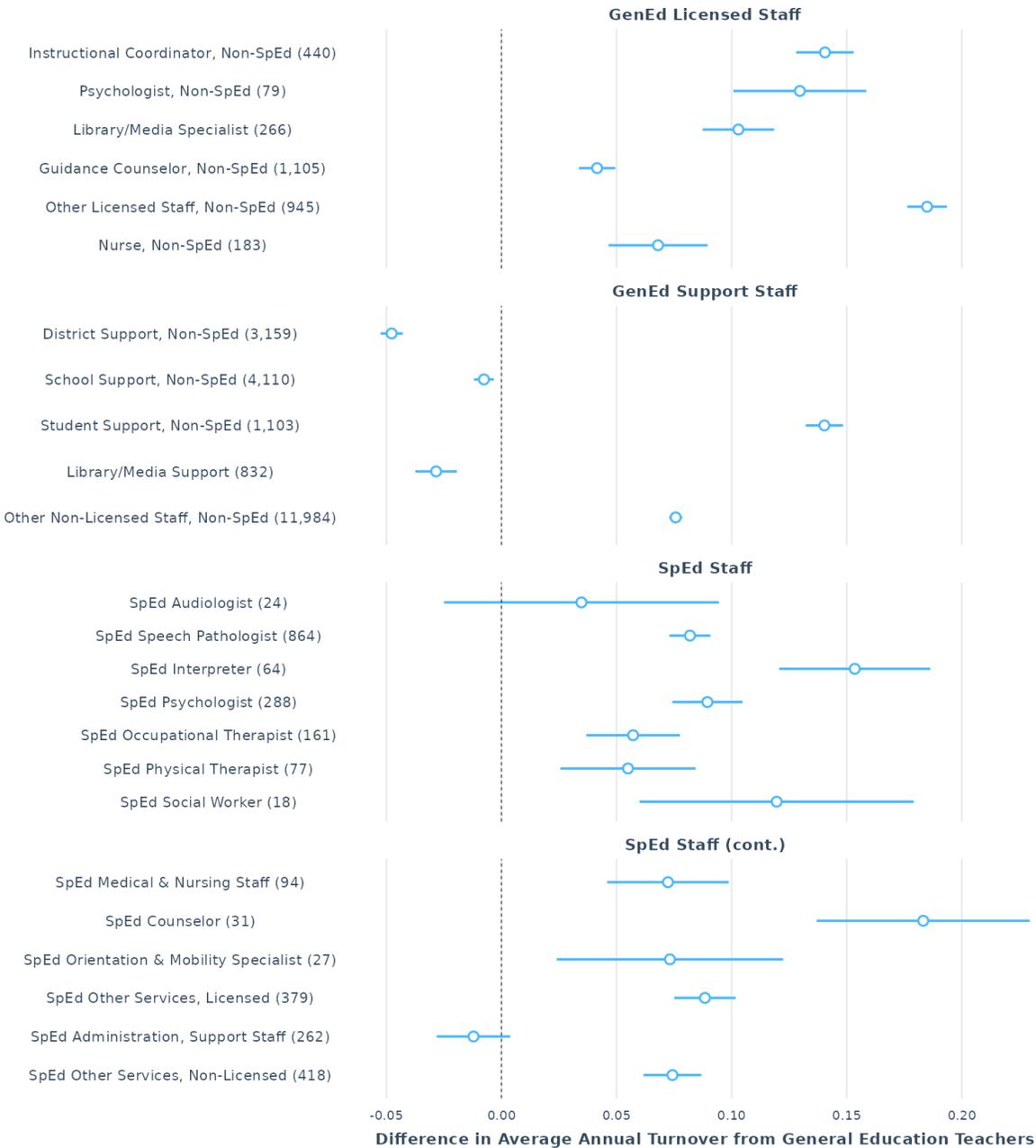
Figure A3 Differences in Mean Annual Turnover Relative to General Education Teachers by Staff Group and Type of Turnover



*Note:* Results presented are from two OLS regressions of binary turnover variables on staff position group indicators. “Moved” includes moving schools within districts or moving across districts. Observations are at the staff-year level. General education teachers are the omitted category and, thus, the estimates represent coefficients that can be interpreted as the mean annual turnover difference of that staff group in comparison to teachers. Confidence intervals are at the 95% level. The average annual number of staff in each group is printed next to each group. For reference, the annual average number of teachers was 26,738, the rate of exit was 0.09 (9%), and the rate of moving was 0.08 (8%).

Figure A4 Differences in Mean Annual Turnover Relative to Teachers by Staff Position Recorded in Administrative Data





*Note:* Results presented are from an OLS regression of a binary turnover variable on staff position code indicators for all positions recorded in the administrative data. Observations are at the staff-year level. General education teachers are the omitted category and, thus, the estimates represent coefficients that can be interpreted as the mean annual turnover difference of that staff group in comparison to general education teachers. Confidence intervals are at the 95% level. The average annual number of staff in each group is printed next to each group. For reference, the annual average number of general education teachers was 26,738 the rate of turnover was 0.19 (19%)

Figure A5 Differences in Mean Annual Turnover Relative to Teachers by Staff Position Recorded in Administrative Data and Type of Turnover

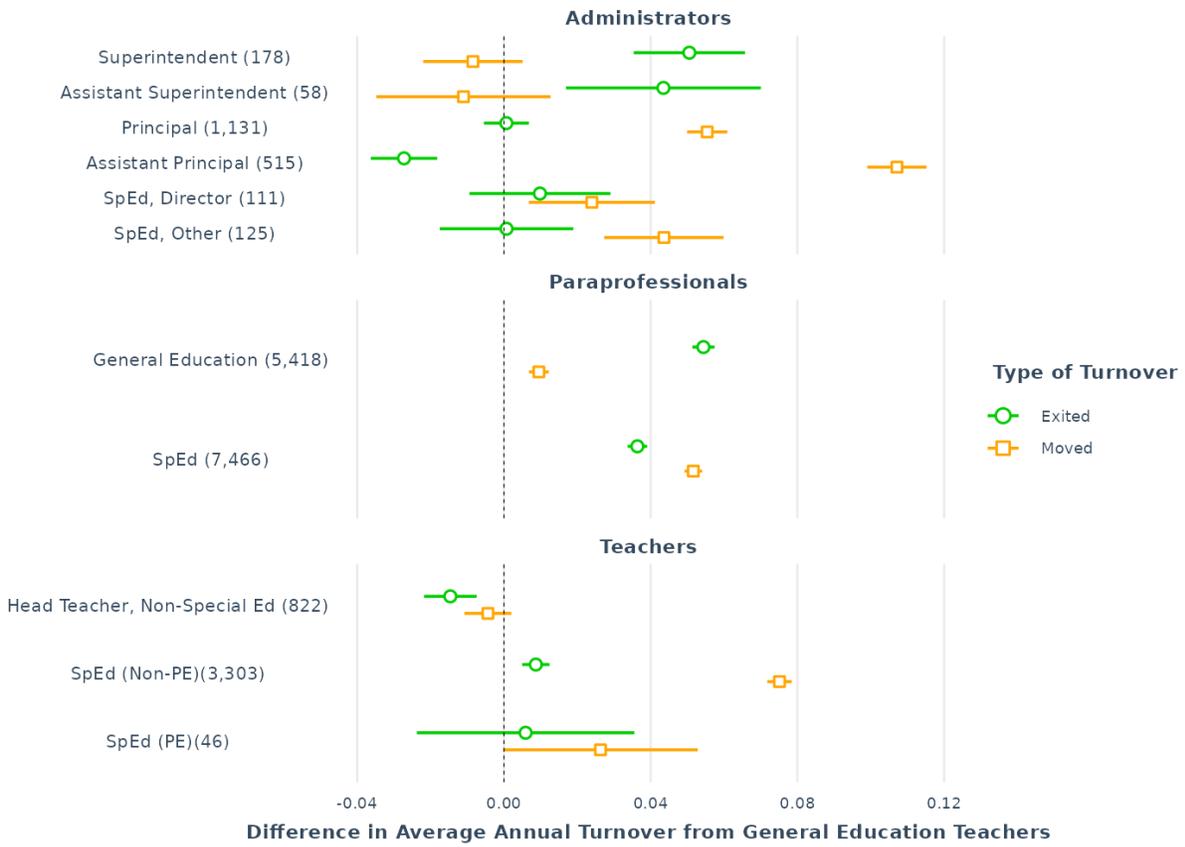
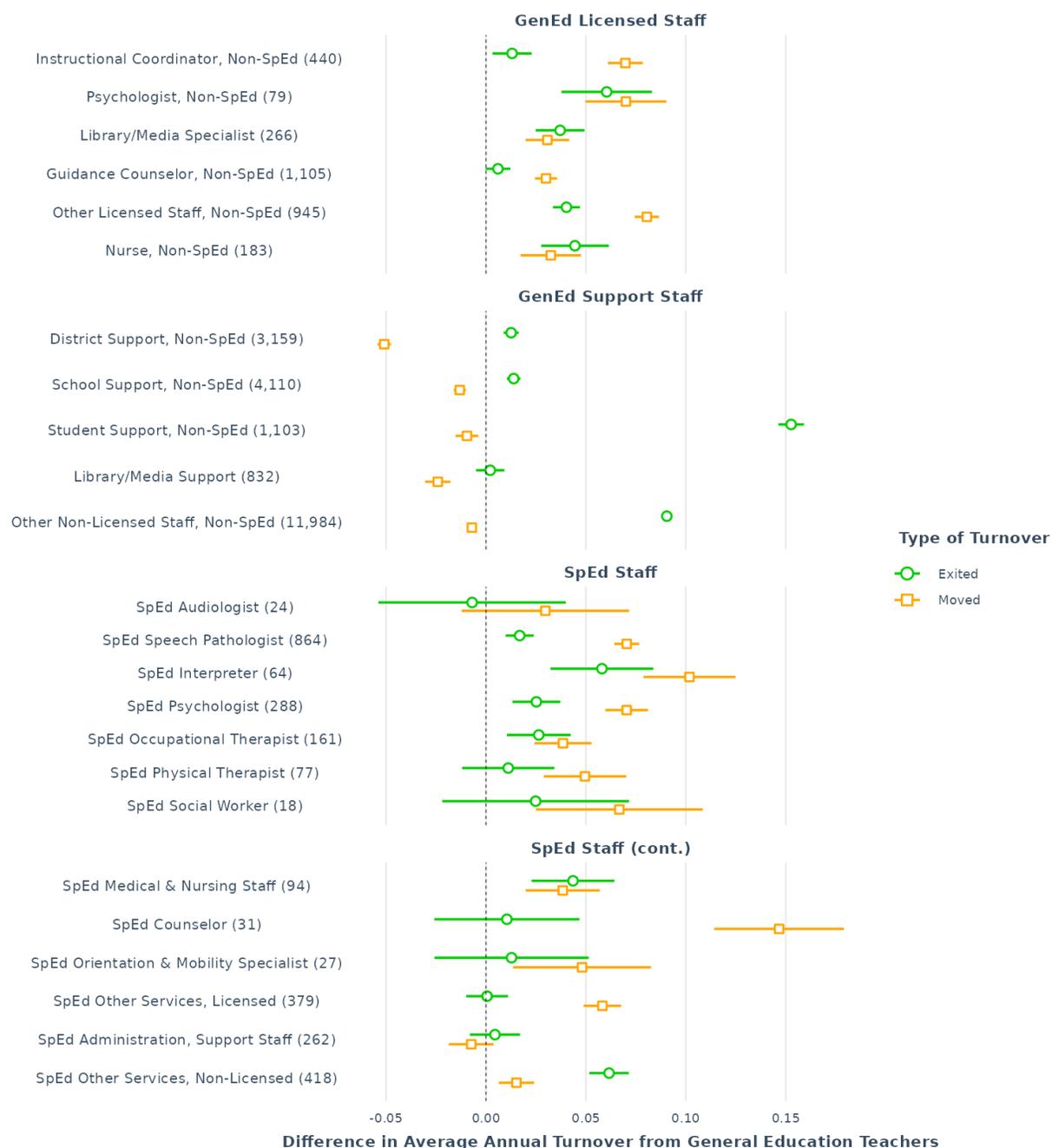
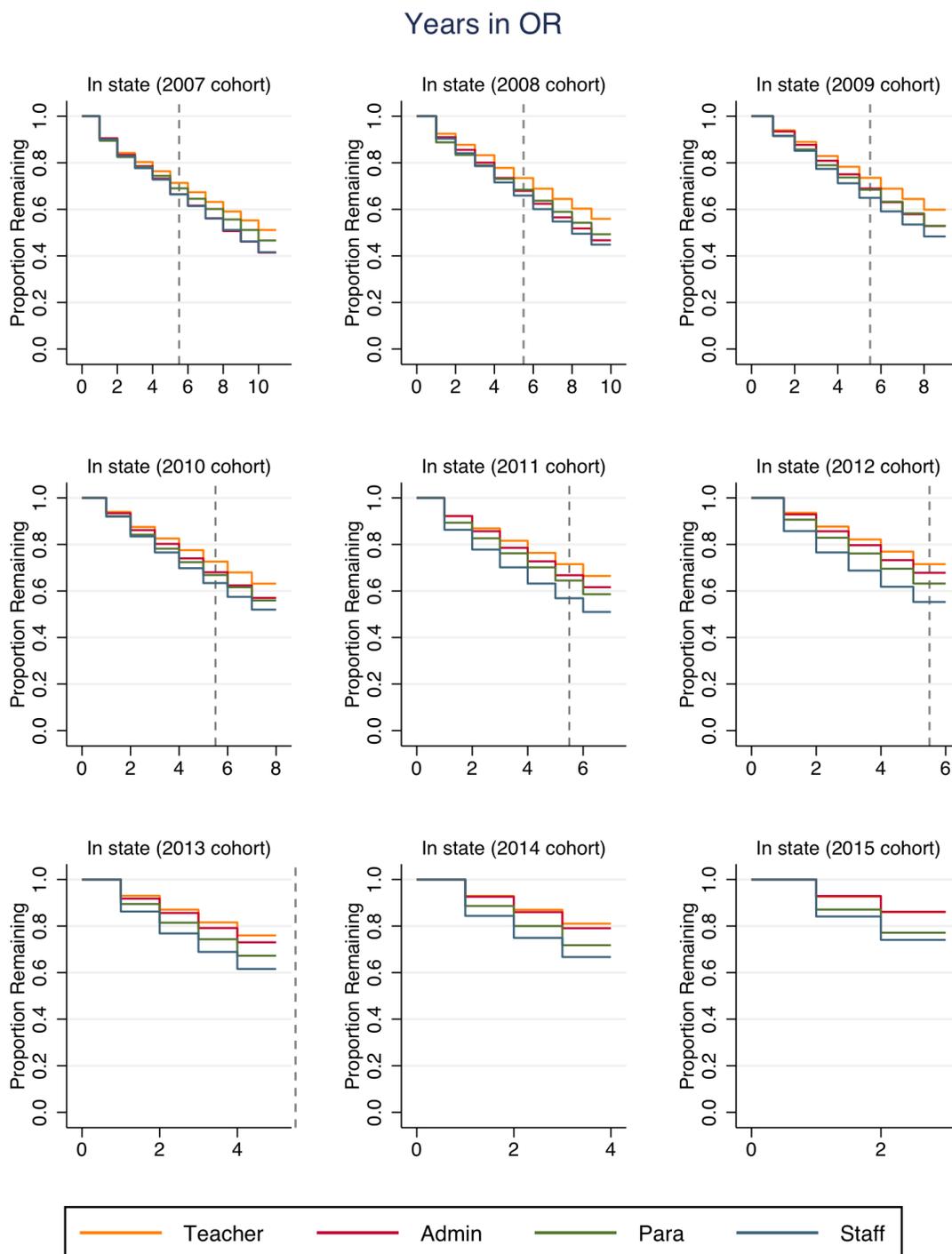


Figure A5 Differences in Mean Annual Turnover Relative to Teachers by Staff Position Recorded in Administrative Data and Type of Turnover (Continued)



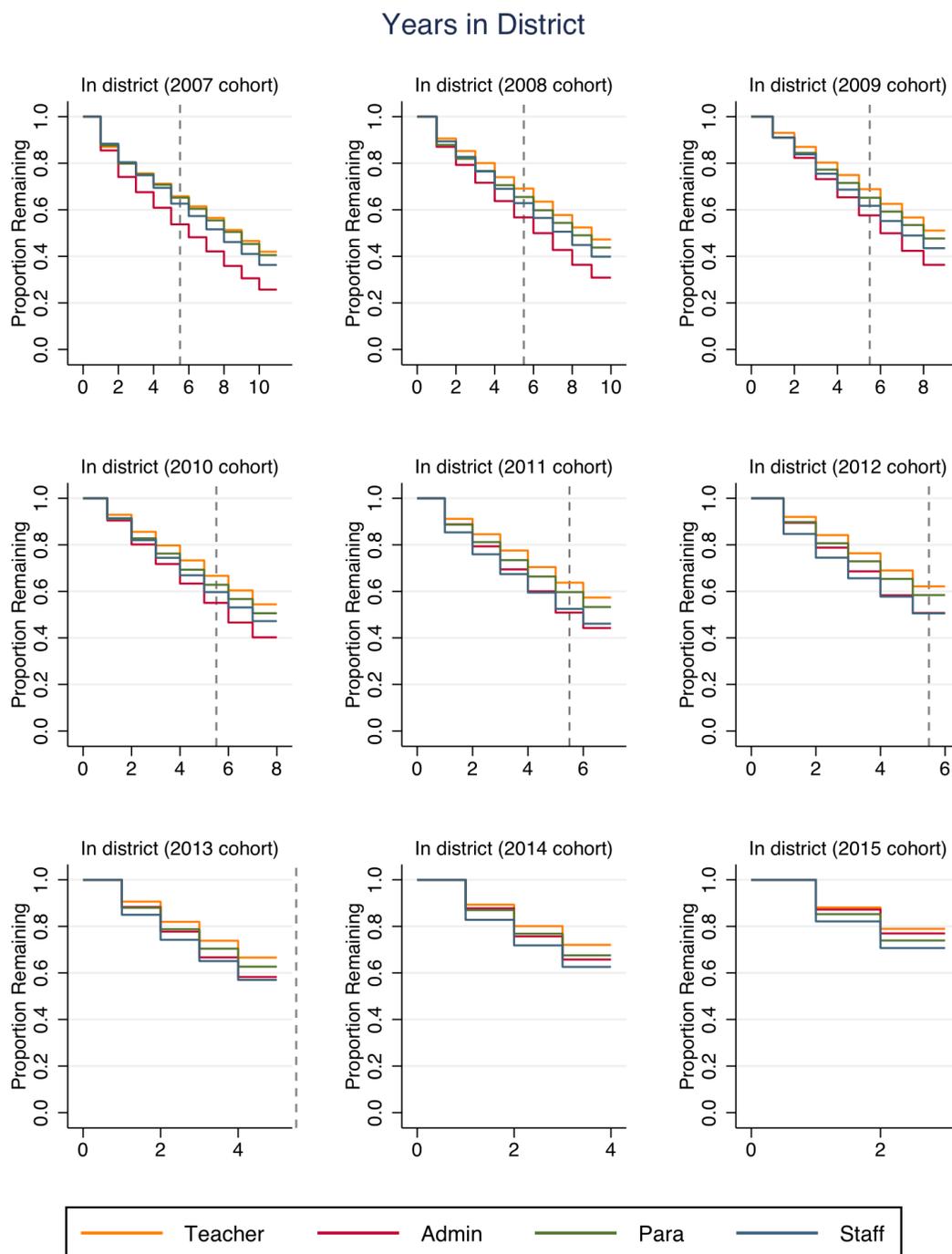
*Note:* Results presented are from two OLS regressions of binary turnover variables on staff position code indicators for all positions recorded in the administrative data. “Moved” includes moving schools within districts or moving across districts. Observations are at the staff-year level. General education teachers are the omitted category and, thus, the estimates represent coefficients that can be interpreted as the mean annual turnover difference of that staff group in comparison to teachers. Confidence intervals are at the 95% level. The average annual number of staff in each group is printed next to each group. For reference, the annual average number of teachers was 26,738, the rate of exit was 0.09 (9%), and the rate of moving was 0.08 (8%).

Figure A6.1. Proportion of educators remaining at the state public schools (nine cohorts)



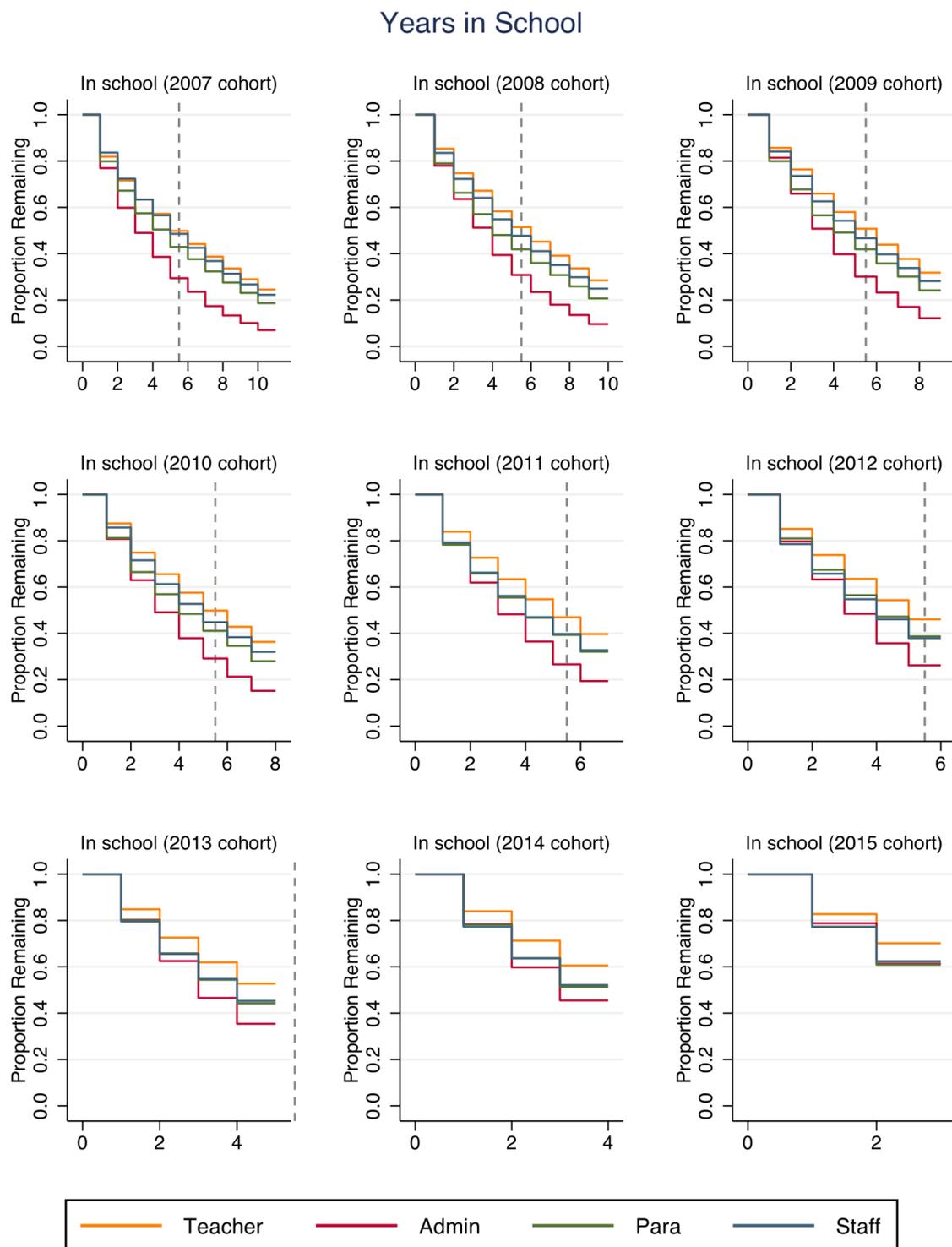
*Note:* This figure presents the proportion of employees who remained at the state public schools over time for nine cohorts. The y-axis represents the proportion of employees remaining, while the x-axis indicates the number of years since the initial year for each cohort. The dashed line marks the proportion of employees remaining five years after the initial year for each cohort.

Figure A6.2. Proportion of educators remaining at their school districts (nine cohorts)



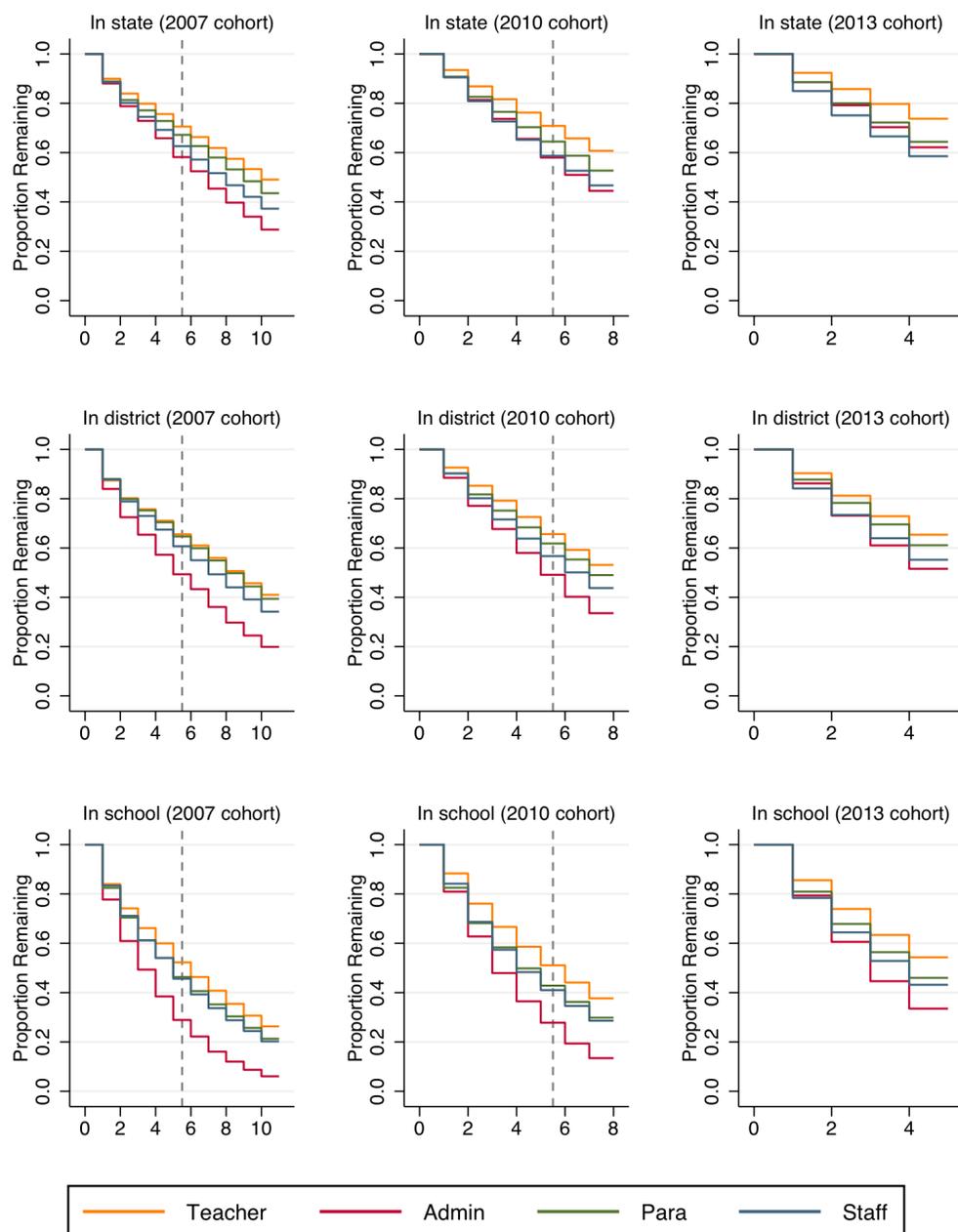
*Note:* This figure presents the proportion of employees who remained at their school districts over time for nine cohorts. The y-axis represents the proportion of employees remaining, while the x-axis indicates the number of years since the initial year for each cohort. The dotted line marks the proportion of employees remaining five years after the initial year for each cohort.

Figure A6.3. Proportion of educators remaining at their schools (nine cohorts)



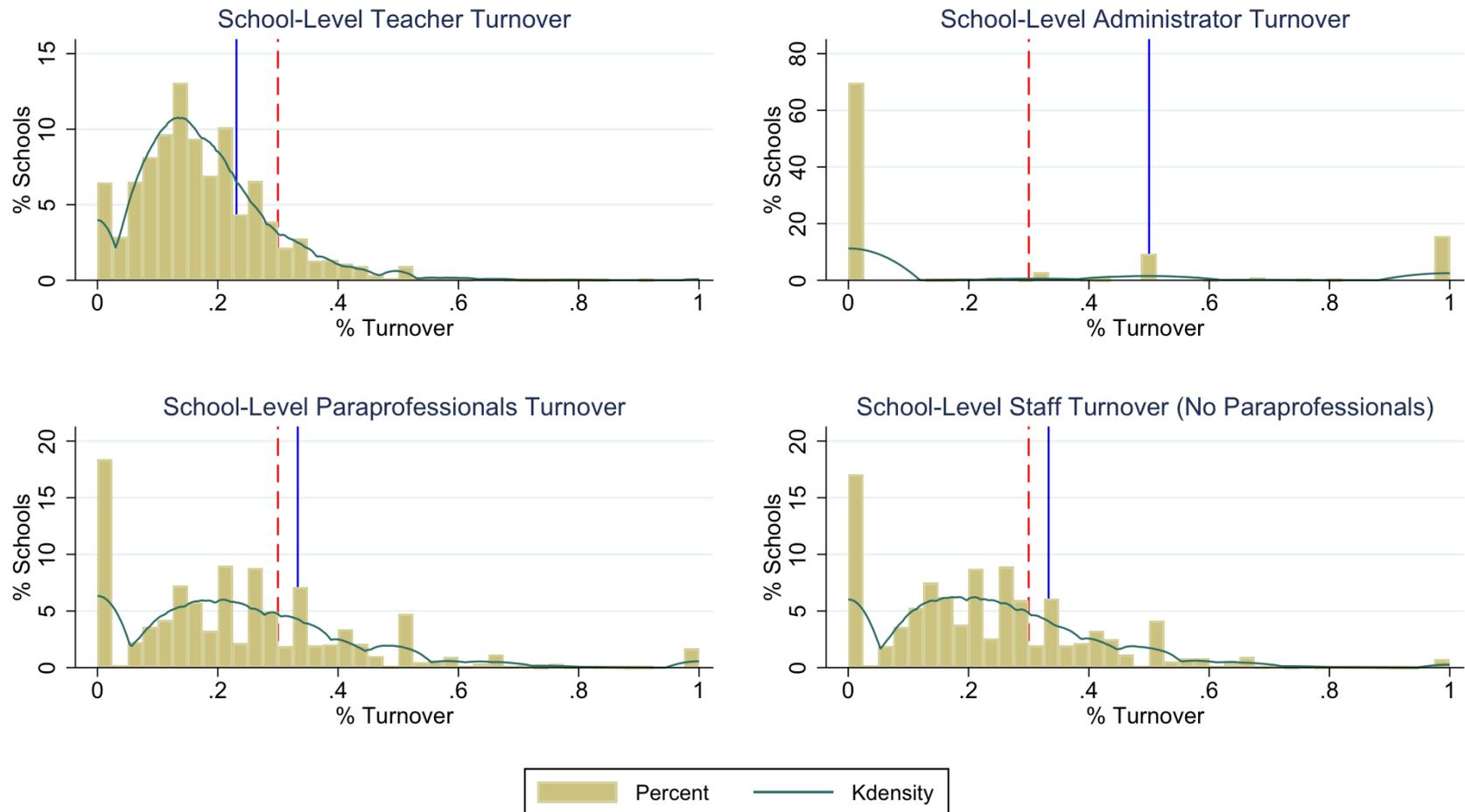
*Note:* This figure presents the proportion of employees who remained at their schools over time for nine cohorts. The y-axis represents the proportion of employees remaining, while the x-axis indicates the number of years since the initial year for each cohort. The dotted line marks the proportion of employees remaining five years after the initial year for each cohort.

Figure A6.4. Proportion of educators remaining at initial schools, districts, and state public schools (Restricted School Sample)



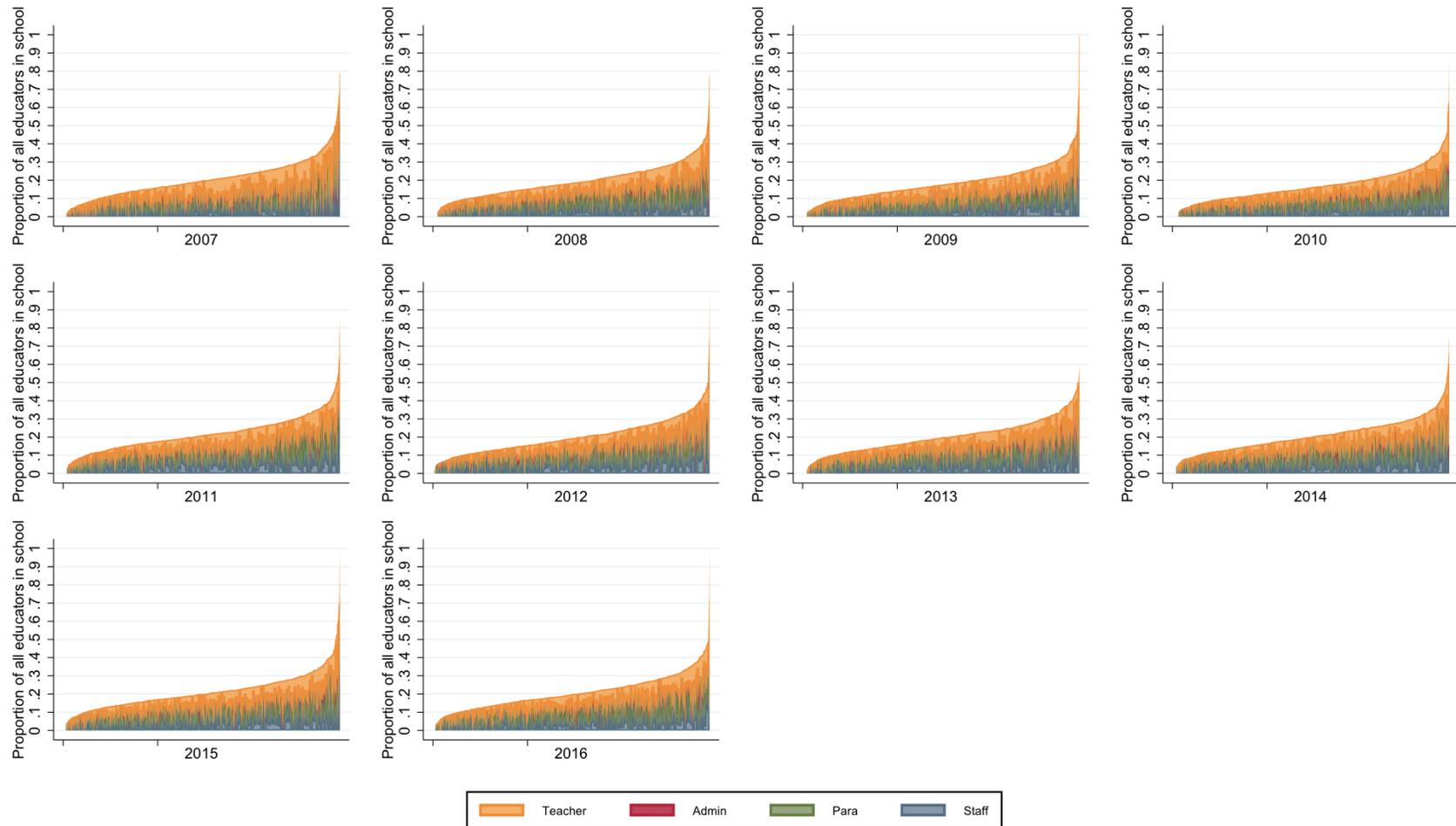
*Note:* This figure presents the proportion of employees who remained in their initial schools, districts, and state public schools over time for three cohorts (2007, 2010, and 2013) with the restricted school sample. The y-axis represents the proportion of employees remaining, while the x-axis indicates the number of years since the initial year (2007, 2010, or 2013) for each cohort. The initial number of teachers, administrators, paraprofessionals, and staff for the 2007 cohort are above 30,000, 1,500, 10,000, and 12,000, respectively. The initial numbers of employees are similar for the other two cohorts. The dotted line marks the proportion of employees remaining five years after the initial year for each cohort.

Figure A7. Histogram distribution of school level turnover rates for different groups



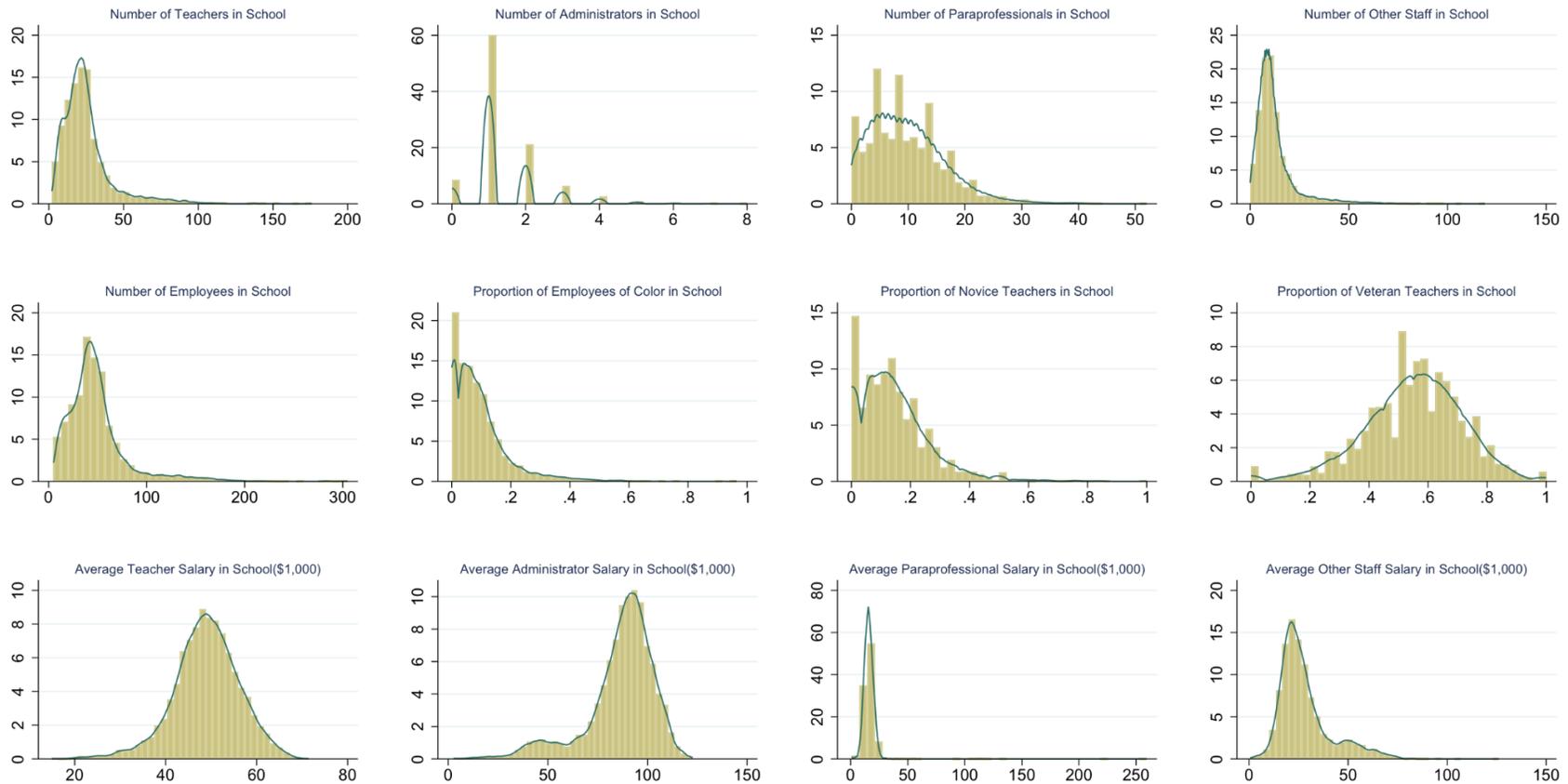
*Note:* The school-level sample includes 1,055 schools spanning a period of 10 years (2006/07 - 2015/16). Kernel density estimation is added in the histogram figures. The red dashed line indicates a 30% turnover rate; the blue solid line represents the average top quartile turnover rate for each group (teachers 23.1%, administrators 50%, paraprofessionals 33.3%, and other staff 33.3%).

Figure A8. Proportion principal, teacher, paraprofessionals, and other staff churn by school, 2006-07 to 2015-16 school years



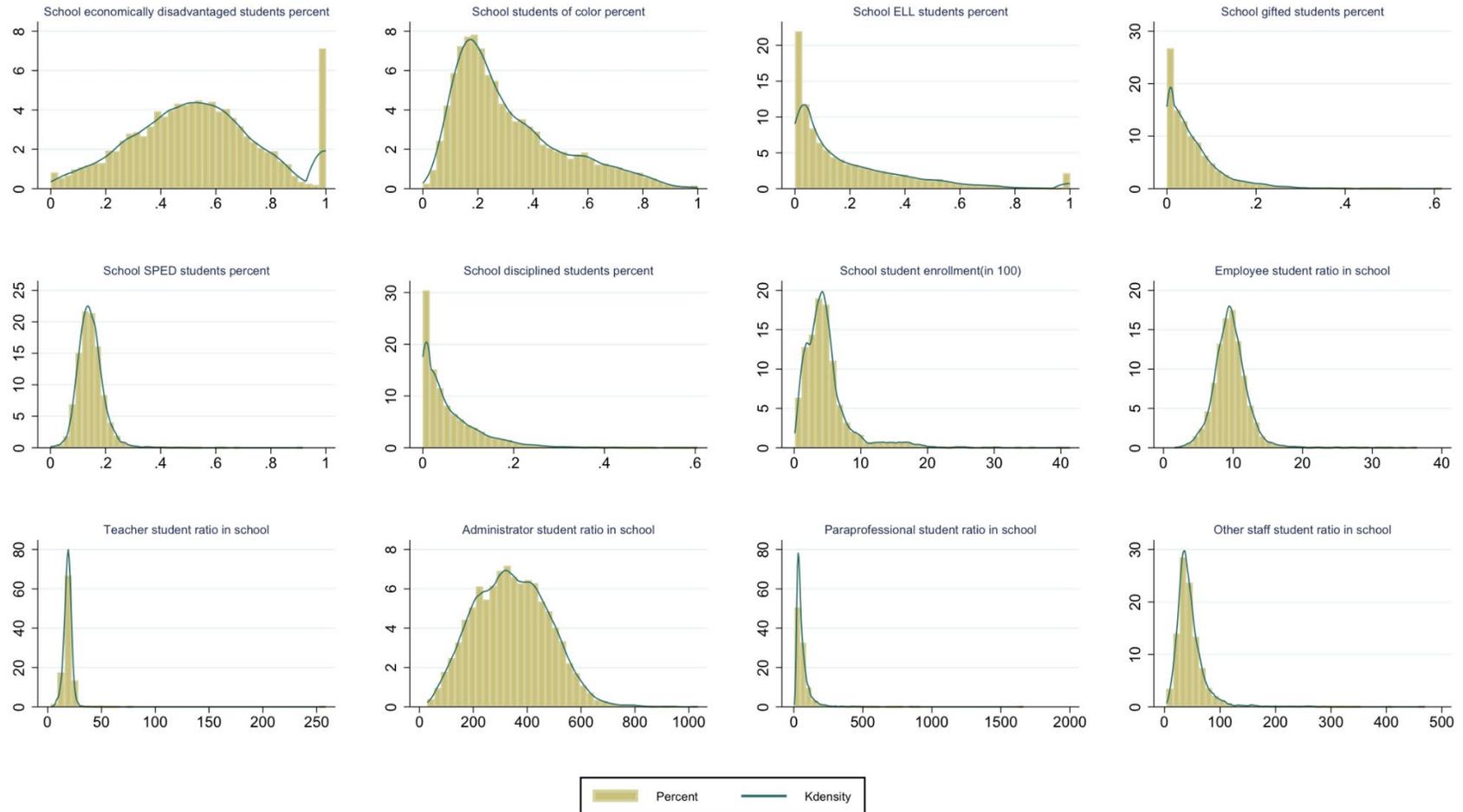
*Note:* This figure presents the proportions of turnover across different groups within schools. For each group, the turnover rate were calculated by dividing the total number of employees across groups from each school (i.e. all teachers, principals, paraprofessionals, **and** support staff) by the number of people from each group who left those schools. For example, the teacher turnover rate in one school equals the number of total employees in this school divided by the number of teachers who left this school or moved to non-teaching positions.

Figure A9.1 Distribution of school level variables (staff characteristics)



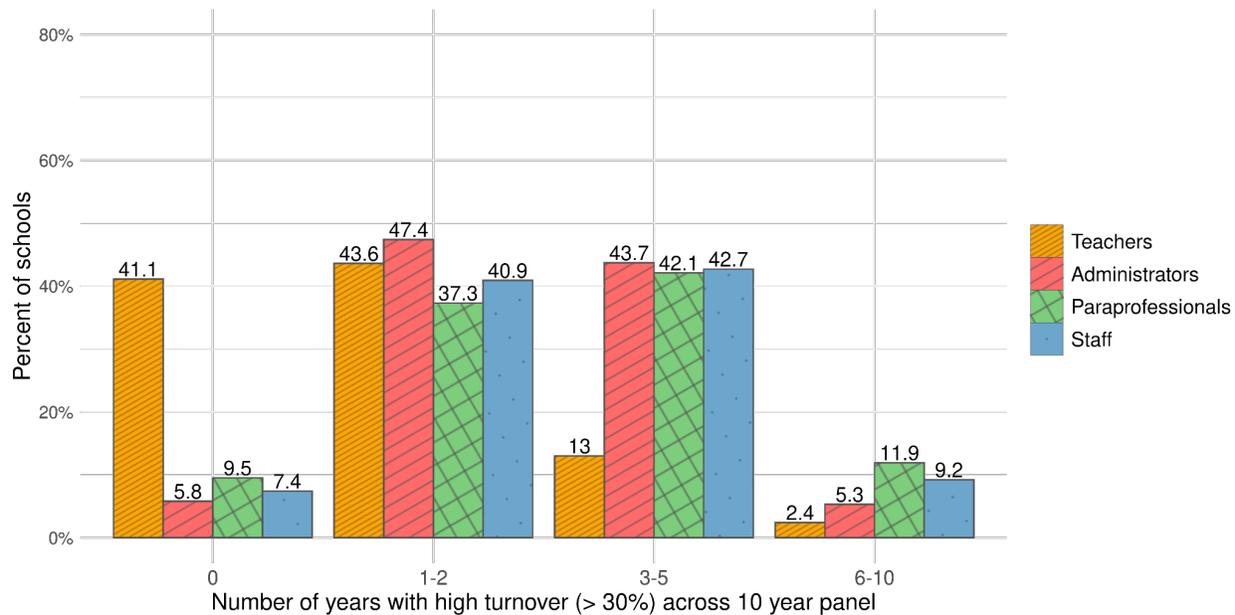
*Note:* The school-level sample includes 1,055 schools spanning a period of 10 years (2006/07 - 2015/16). Kernel density estimation is added in the histogram figures. Among the 10,550 school-year observations, 906 do not have any administrator, 444 do not have any paraprofessional, and 105 do not have any other staff.

Figure A9.2 Distribution of school level variables (student characteristics)



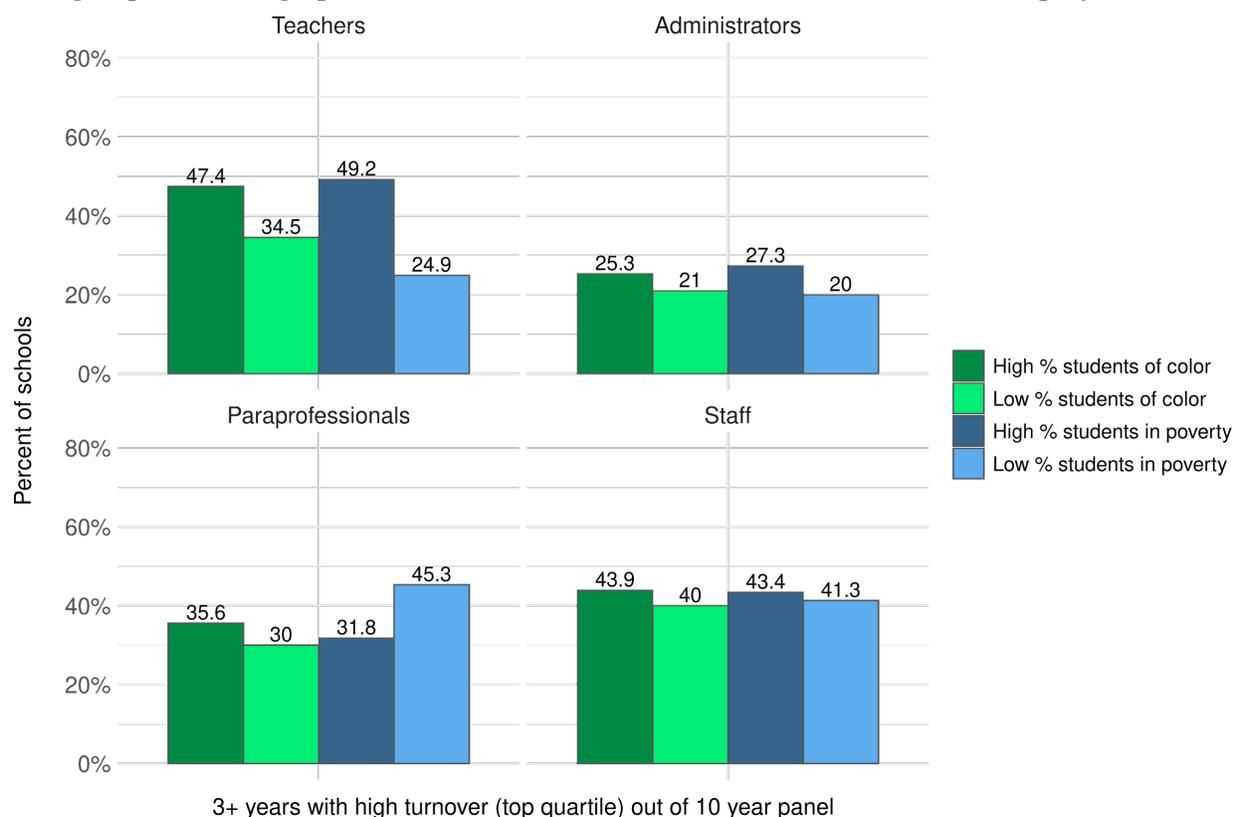
*Note:* The school-level sample includes 1,055 schools spanning a period of 10 years (2006/07 - 2015/16). Kernel density estimation is added in the histogram figures.

Figure A10. Number of years schools experience high turnover (> 30%) by group from 2006/07-2015/16



*Note:* Figure plots the percent of schools for the number of years that they have higher than 30% turnover for a given employee group. Only schools with greater than 5 employees and that remained open for all years of the panel are included (n = 1,055).

Figure A11. Percent of schools that experience 3 years or more of high turnover (top quartile) by staff group and demographics of students served with schools with at least 20 employees



*Note:* Figure plots the percent of schools that had 3 or more years of turnover in the top quartile for each employee group separately. The percentage is plotted conditional on being in the top or bottom quartile of serving racially and ethnically minoritized students and students in poverty. Only schools with greater than 20 employees and that were open for all 10 years of the panel are included (N = 970).