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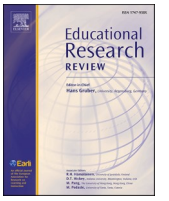

Methodological Reviews

The correlates of teacher turnover: An updated and expanded Meta-analysis of the literature

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ABSTRACT

Rigorous research examining the correlates of teacher turnover has grown in recent years. However, the most recent meta-analytic synthesis of this literature was published over a decade ago. To update our collective understanding and highlight advances in this literature, this meta-analysis reviews findings from 120 studies of factors associated with teacher turnover. In addition to providing a novel synthesis using the most up-to-date meta-analytic methods and better quality data than ever before, we contribute evidence to support an expanded conceptual framework for understanding teacher turnover. This framework adds several underexamined factors influencing teacher turnover, provides more nuance to factors previously studied, highlights the growing influence of educational policies external to the school, and accounts for an emerging awareness of the interplay between teacher and school characteristics. This paper reports both results for how various teacher, school, and workforce factors are associated with teacher turnover and discusses the policy implications using our expanded theoretical framework.

1. Introduction

Educational policy has been firmly shaped by consistent research finding teachers to be the single most important school-based determinant of student achievement (Aaronson et al., 2007; Chetty et al., 2014; Kane & Staiger, 2008; Rivkin et al., 2005). As a result, governments as diverse as those in India, Mexico, Pakistan, and England have invested substantial resources to recruit, develop, incentivize, and retain effective teachers (Barrera-Osorio & Raju, 2015; Foster, 2019; Muralidharan & Sundararaman, 2011; Ross & Hutchings, 2003; Santibañez et al., 2007). Given sizeable investments into teacher recruitment and retention, researchers have built a robust literature examining teacher turnover, with results synthesized in both narrative reviews (Guarino, Santibanez, & Daley, 2006) and a meta-analysis (Borman & Dowling, 2008). However, policy initiatives and teacher labor markets have evolved dramatically since the publication of these prior reviews, and there is a need for an updated synthesis capturing how our collective understanding of teacher turnover has evolved over the last decade.

To meet this need, we contribute an updated meta-analytic review of research on teacher turnover that contextualizes the evolution of knowledge on this topic, integrates new insights into a cohesive theoretical framework, and highlights frontiers for future development. Our review focuses on teacher turnover, defined as teachers exiting their current school. We choose this perspective because

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teacher turnover is consequential for the schools that teachers exit regardless of where they go afterward.[1] However, we also separate teachers who turnover into two categories: switchers and leavers. Switchers exit their school to teach elsewhere, while leavers exit the profession. Given our focus on factors associated with turnover, the term *factor* refers broadly to characteristics of teachers, schools, or external policies/labor market conditions that are potentially associated with turnover.

Research on teacher turnover is important because turnover affects both educational quality and equity. Scholars have found turnover negatively affects student achievement, even among students whose teacher stayed (Ronfeldt, Loeb, & Wyckoff, 2013). Also, when leaving their school, teachers themselves experience emotional and psychological effects, time loss searching for new jobs, and relocation costs, suggesting turnover can have long-term ramifications (Hakanen et al., 2005; Nieto, 2003), Schools also suffer because teacher turnover has substantial monetary costs. For example, researchers find U.S. districts spend from US$10,000 to US$17,000 to replace each teacher who leaves (Barnes, Crowe, & Schaefer, 2007; DeFeo, Tran, Hirshberg, Cope, & Cravez, 2017). In England, the average cost for schools to recruit a replacement teacher is £4600 (PwC, n.d.), and the average cost to train a teacher is £23,000 on average (Allen, Belfield, Greaves, Sharp, & Walker, 2016). Moreover, teacher turnover has important consequences for educational equity because differential sorting of teachers across schools often results in inequitable distributions of teacher effectiveness. Research finds that the most disadvantaged schools are the hardest to staff and are usually staffed by teachers with below-average effectiveness, even after accounting for differences in school characteristics and students' prior achievement (Boyd, Grossman, et al., 2011; Guarino et al., 2006; Ingersoll, 2001).

Through synthesizing the research literature, we help educational authorities to better understand correlates of teacher turnover by answering the following research questions:

1) What factors are correlated with teacher turnover?
2) To what extent are these factors associated with teacher turnover?
3) How has our understanding of teacher turnover evolved over the last decade?

2. Motivating an updated research synthesis

Borman and Dowling's (2008) meta-analysis was a notable contribution because it brought together the variegated literature on teacher turnover, but the time is right to update our understanding of teacher turnover. First, teacher labor markets have changed over the last decade, motivating our efforts to assess whether conclusions from Borman and Dowling continue to be true. For example, research on the long-run trends in teacher quality find that talented women, who historically pursued teaching, now have a broader range of career options. These often better paying or more prestigious alternative employment opportunities may have changed the relationship between teachers' gender and their turnover decisions (Corcoran, 2007; Hoxby & Leigh, 2004; Ingersoll et al., 2014). Second, Borman and Dowling state that their meta-analysis was limited by a lack of longitudinal data tracking teachers over time. Longitudinal data are now widely available in education and have revealed new insights on teachers' career trajectories. Third, the number of studies examining teacher turnover has increased substantially, allowing us to provide more reliable estimates on a larger number of factors correlated with turnover. Fourth, Borman and Dowling's meta-analysis focused primarily on teachers leaving the profession, but teachers who exit their school can also transfer into new schools. Thus, we synthesize information on both teachers who switch schools and teachers who leave teaching. Fifth, meta-analytic methods have advanced considerably since 2008, allowing us to provide more robust summary estimates. Finally, with more empirical research, our theoretical understanding of teacher turnover has expanded. By incorporating new insights, this meta-analysis provides an updated conceptual framework to guide ongoing scholarship.

3. An updated conceptual framework for teacher turnover

The evolution of research examining factors associated with teacher turnover can be divided into three main strands: (1) characteristics of teachers who turnover (personal factors); (2) characteristics of teachers' work environments (school factors); and (3) conditions outside the school that potentially affect teachers (external/policy factors). When Borman and Dowling published their meta-analysis, most of the research on teacher turnover focused on personal and school factors. A key contribution from Borman and Dowling was the organization of factors within these two strands into five categories: teacher-level factors were categorized as either demographic characteristics or qualifications, and school-level factors were separated into organizational characteristics, resources, and student body characteristics. These five categories provided conceptual clarity for understanding teacher turnover, but must now be expanded to include influences from the third strand of research: external/policy factors.

We propose an updated conceptual framework as presented in Fig. 1 to guide both our synthesis of the literature and ongoing scholarship on teacher turnover. Fig. 1 delineates all factors considered in our meta-analysis by incorporating all five categories proposed by Borman and Dowling as either personal or school factors and adds a number of factors not examined by Borman and Dowling in italics (e.g., merit pay and accountability-based teacher evaluation).

[1] There are also data limitations where researchers cannot always determine if teachers are leavers or switchers. Since a substantial number of papers combine leavers and switchers and discuss them as teacher attrition, we have opted to follow this practice, and our main analysis includes studies of both forms of attrition. However, to address the conceptual difference between leavers and switchers, a gap in the teacher attrition literature raised in a recent systematic review on special education teachers (Billingsley & Bettini, in press), we also present separate analyses using studies that compare switchers against stayers.

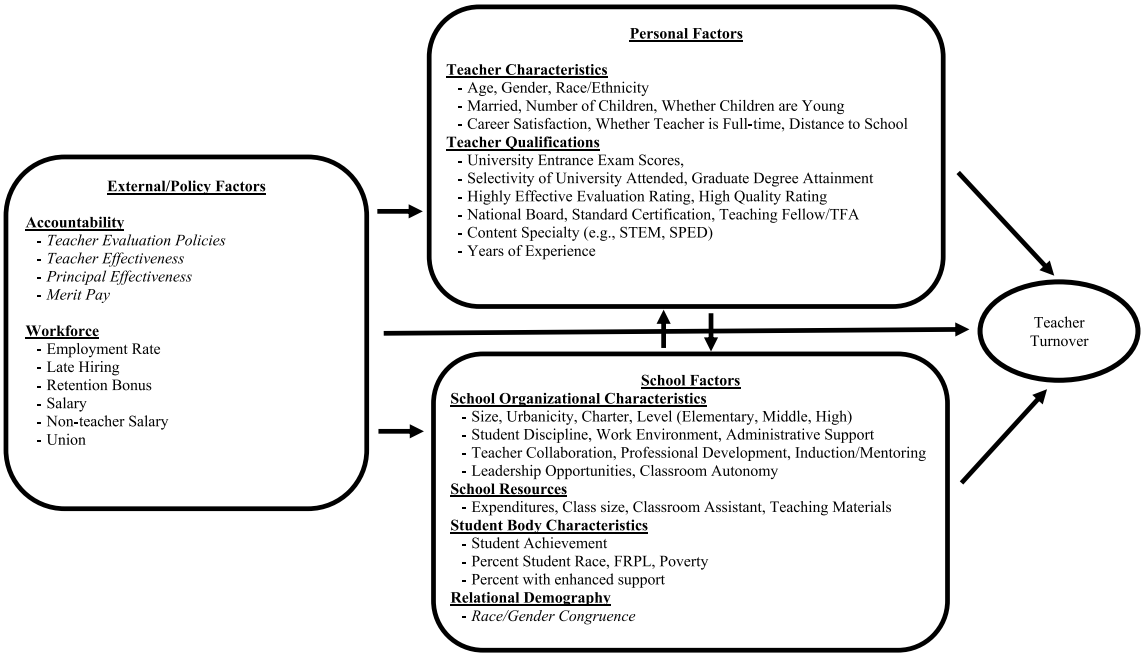

Fig. 1. Conceptual Framework for Synthesizing Empirical Research on Teacher Turnover. Note. TFA: Teach for America; STEM: Science, Technology, Engineering, Math; SPED: Special Education; PD: Professional Development; Elem: Elementary; FRPL: Free-or-Reduced Priced Lunch; Enhanced support includes IEP/LEP: Individualized Education Plan/Limited English Proficiency.

First, our conceptual framework includes personal characteristics of teachers, one of the most thoroughly examined sets of factors associated with turnover. For example, earlier studies found female and White teachers are more likely to turnover than their respective male and non-White counterparts (Adams, 1996; Harrell, Leavell, van Tassel, & McKee, 2004; Ingersoll, 2001). Examining individual teacher characteristics continues to be important because it helps educational authorities assess whether policy investments are successfully improving schools' ability to retain more effective and more experienced teachers. This is especially true for teachers in areas that are difficult to staff such as special education or in subjects where there are more lucrative opportunities outside of education such as science, technology, engineering, or math (STEM). As the literature evolved, researchers recognized the important influence of teachers' work environments on turnover and focused more on school characteristics (Anderson, 2007; Boyd, Grossman, et al., 2011). For example, prior research finds consistent evidence suggesting administrative support and classroom autonomy can influence teachers' satisfaction, performance, and decisions to leave their school (Kraft & Papay, 2014; Ladd, 2011).

In addition to capturing well-established areas of scholarship on personal and school factors, Fig. 1 highlights several novelties in recent studies on teacher turnover. First, Fig. 1 adds external/policy factors as an increasingly important third strand of research. External policy factors may directly influence teacher turnover because many accountability-based policies such as merit pay and retention bonuses explicitly aim to change the composition of the instructional staff in targeted schools (Griffeth, Hom, & Gaertner, 2000; Rubenstein, Eberly, Lee, & Mitchell, 2017). Besides policy influences, Fig. 1 identifies a number of factors that capture how workforce conditions such as employment rates (Barbieri, 2011; Clotfelter, Ladd, & Vigdor, 2011), alternative job opportunities (Rubenstein et al., 2017), and late hiring (Cotton & Tuttle, 1986; Jones, Maier, & Grogan, 2011) may influence turnover.

Second, Fig. 1 depicts an emerging innovation in the literature with arrows from external factors to both personal and school factors. These arrows indicate external conditions and policies can potentially influence teacher turnover through both their effects on individual teachers and on schools overall. For example, salary (Podgursky, Monroe, & Watson, 2004; Springer, 2019) and accountability-based teacher evaluation systems (Cullen, Koedel, & Parsons, 2016; Rodriguez, Swain, & Springer, 2020) will likely affect (1) which teachers choose to work in schools implementing these reforms and (2) the school's working environment.

Third, bidirectional arrows between personal factors and school factors depict a growing awareness among researchers regarding the importance of fit between teachers and their schools (Jackson, 2013). For example, a new area of development, relational demography, examines the race/ethnicity or gender congruence between teachers and principals or between teachers and students (Author et al., 2017; Grissom, Nicholson-Crotty, & Keiser, 2012; Grissom & Keiser, 2011). Moreover, examining which teachers tend to leave which schools have important implications for the equitable distribution of teacher effectiveness. Research finds teachers tend to sort into higher-performing schools serving more affluent students (Falch & Rønning, 2007; Feng & Sass, 2017; Jones & Hartney, 2017) and strategic recruitment incentives can alter this negative sorting (Springer, Swain, & Rodriguez, 2016; Swain, Rodriguez, & Springer, 2019).

Overall, the conceptual framework presented in Fig. 1 captures the correlates of teacher turnover that are theoretically relevant and have been tested empirically. Below, we synthesize relationships between each of these factors and teacher turnover. We use this framework to guide our discussion of new insights from the literature and to clarify areas needing further development.

3.1. Data & methods

Our main goal is to synthesize estimates from quantitative studies examining factors of teacher turnover. We refer to studies included in our review as *primary studies*. While a rich qualitative literature has considered factors associated with teacher turnover, the scope of our synthesis is limited to primary studies producing numerical estimates for meta-analysis. We follow the Preferred Reporting Items for Systematic Reviews and Meta-Analysis standards (Moher et al., 2009) to define which primary studies are eligible for inclusion, search the literature, analyze data, and report results. Due to space constraints, we provide key information about our study methodology below and include additional details in Appendix A.

3.2. Searching and screening the literature for eligible studies

To guide our search of the literature, we developed the following criteria for determining whether primary studies would be eligible for inclusion in this meta-analysis: (a) the study examines teachers in primary or secondary schools and examines at least one of the following (b) teachers' characteristics; (c) school characteristics; (d) compensation policies; (e) pre-service and in-service policies associated with teacher turnover; or (f) workforce or external factors related to teacher turnover. Moreover, the study must contain numerical estimates (e.g., odds ratios, hazard ratios) to quantify the relationship between a factor of interest and teacher turnover, and unlike in previous reviews, we only include primary studies that examine observed turnover and not teachers' self-reported intention to leave. We also do not include studies reporting descriptive differences between teachers who stay and those who turnover. Finally, we examine the literature on teacher turnover without restriction to any one country but note that most of the literature on this topic are based in the U.S, and there is a need for more insight from other contexts (Craig, 2017).

With these criteria in mind, we searched commonly used social science databases (e.g., ERIC, WorldCat, ProQuest, JSTOR, NBER and EconLit) using the following search string: *teacher AND (attrition OR turnover OR retention OR leav* OR suppl* OR career OR attitudes OR mobility OR commit* OR persist*)*. Additionally, we examined previous reviews of this literature (Borman & Dowling, 2008; Guarino et al., 2006) and searched for unpublished studies using Dissertation and Thesis Repositories in WorldCat and ProQuest. We restricted the search to primary studies published between 1980 and July 2018 (when our search ended).

Our search yielded approximately 26,000 primary studies. The number of results returned in each database can be found in Appendix Table B1. Then, we used a three-step process to screen for primary studies that meet all eligibility criteria, as illustrated by Fig. 2. In step one, we examined the title, abstract, and introduction for all studies identified in the original search. We retained a study if any of these three sections in the report mentioned numerical results about factors associated with teacher turnover. This phase left us with 332 studies. In step two, we read the full text for each of the 332 remaining studies, further retaining studies that fit the eligibility criteria listed above. In step three, we excluded eligible studies if key information such as standard errors for effect estimates could not be calculated or obtained from authors of the primary studies. After step three, we were left with a sample of 120 primary studies representing over 11 million teacher-year observations that met all eligibility criteria. These 120 primary studies serve as the analytic sample for this meta-analysis.[2]

3.3. Coding primary studies

Three coders independently coded relevant information for each of the 120 eligible studies using a common coding schema. One coder coded all the studies while the other two coders each coded half of the 120 eligible studies. Treating each cell of our coding matrix as an input, coder agreement occurred in 95% of the cells. Any discrepancy was resolved by consensus among the coders. Appendix Table B2 contains a complete list of coded items and their full operational definitions.

Since our primary goal is to synthesize estimates of the relationship between teacher turnover and various personal, school, or external/policy factors, the primary effect size we coded was the log odd ratios (and its associated standard error). When primary studies reported only odds ratios, we calculated its natural logarithm. When primary studies reported only proportions, we used them to calculate log odds ratios (Borenstein, Hedges, Higgins, & Rothstein, 2009). To ease interpretation, both log odds ratios and odds ratios are reported in this paper.

In addition to coding log odds ratios, we coded all factors that primary studies proposed as a correlate of teacher turnover, as presented in Fig. 1 and displayed in Appendix Table B3. Overall, the coded factors can be divided into the three strands captured in our guiding conceptual framework: personal correlates (e.g., gender, age, years of experience, test scores on university entrance exams), school correlates (e.g., perceived level of administrative support, opportunities for collaboration, availability of teaching materials), and external/policy correlates (e.g., whether the school is implementing a merit pay program, whether teachers are eligible for a retention bonus, whether teachers were late hires after the school year had already begun).

3.4. Analytic strategy

Our analytic approach follows methods presented by Borenstein et al. (2009) and Moher et al. (2009). We describe analytical decisions in selecting models, including how we account for multiple estimates within the same study, how we reconcile studies that

[2] To examine possibility of publication bias, Appendix C presents a contoured enhanced funnel plot of gender and attrition. We find no asymmetry because both positive and negative findings (and varying significance levels) are well represented in each cone.

Table 1
Descriptive information on the primary studies by study characteristics.

Study characteristics	Included in prior reviews	New studies
Peer Review	85%	62%
Median Sample Size	2690	9150
Uses Longitudinal Data	8%	19%
Quasi-experimental/Experimental	4%	33%
Median Study Quality (1–5)	2	4
Mean Study Quality (1–5)	2.69	3.45
Number of studies	26	94

Note. Quasi-experimental/experimental studies are studies that provide at least one plausibly causal estimate on a factor of teacher turnover. Study quality is ranked from 1 to 5 on a subjective rating scale where 1 is high risk of bias and 5 is low risk of bias.

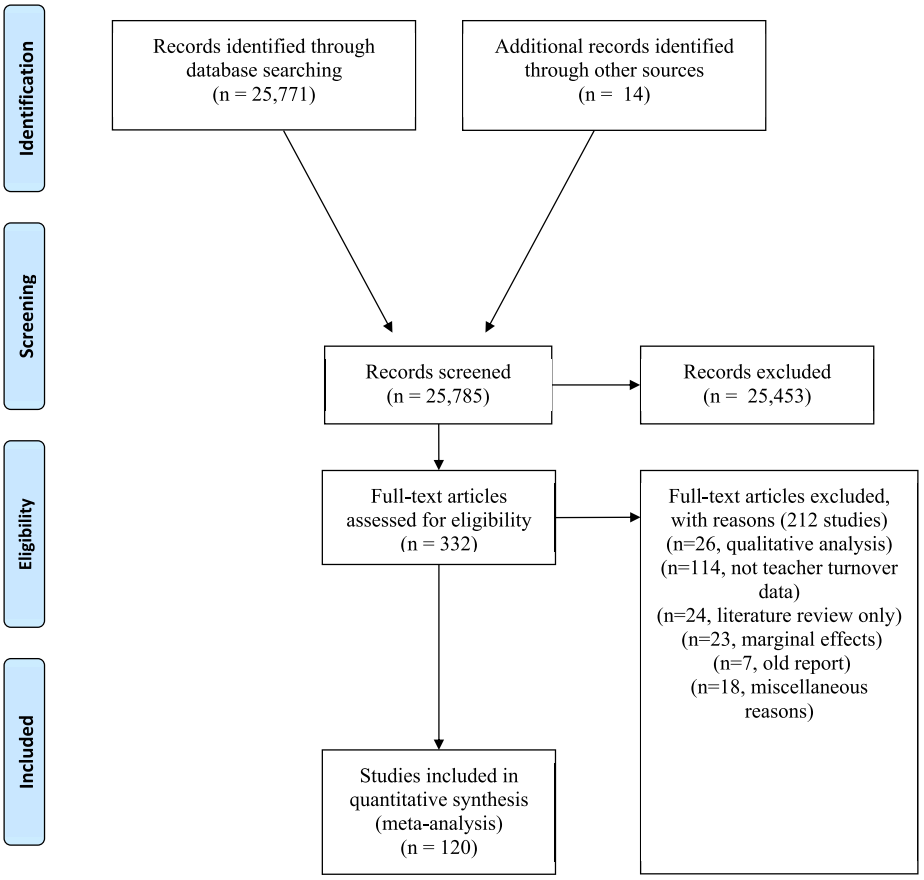

Fig. 2. Flow Diagram. This diagram depicts the literature screening process resulting in the final sample of primary studies included in the quantitative analysis. Adapted from Moher et al. (2009).

use similar data, and how we assess the risk of bias from differences in study quality. An important analytic decision was between a fixed-effect versus a random-effects model. The fixed-effect model assumes a common true effect size across all studies, whereas the random-effects model assumes the effect size will vary across studies (Borenstein et al., 2009). The fixed-effect model assigns weights (W_i) to each study (i) using the inverse of each within-study variance (V_{y_i}):

$$W_{i,Fixed} = \frac{1}{V_{y_i}} \tag{1}$$

The random-effects model weights studies using both the within-study variance and the estimated between-study variance (T^2):

$$W_{i,Random} = \frac{1}{V_{y_i} + T^2} \tag{2}$$

The random-effects model is more suitable here because there is substantial variation across the different contexts in each of the primary studies, and our goal is to estimate summary effects that generalize to different populations and settings. In addition to the

Table 2
Personal factors as correlates of teacher turnover.

		Main effect estimates					
Factor	# of studies	Odds ratio	Logged odds ratio	SE	Lower bound	Upper bound	*p*
Panel A: Teacher Characteristics							
Age (continuous)	10	0.948	−0.054	0.030	−0.113	0.005	0.072
Age (>28)	9	0.698	−0.359	0.189	−0.729	0.011	0.057
Male	37	1.023	0.023	0.036	−0.047	0.093	0.523
Black	14	1.080	0.077	0.320	−0.551	0.704	0.811
Hispanic	11	0.473	−0.749	0.176	−1.095	−0.404	0.000
Non-White	12	0.842	−0.172	0.087	−0.342	−0.002	0.048
Married	4	1.091	0.087	0.050	−0.012	0.186	0.084
Number of children	1~	0.379	−0.971	0.294	−1.548	−0.394	0.001
Young child	2	0.561	−0.578	0.154	−0.880	−0.275	0.000
Career satisfaction	7	0.847	−0.167	0.056	−0.276	−0.057	0.003
Full time teaching	7	0.616	−0.485	0.123	−0.725	−0.244	0.000
Distance to school	1~	1.014	0.014	0.004	0.006	0.022	0.000
Panel B: Teacher Qualifications							
Ability (test scores)	5	1.118	0.112	0.069	−0.024	0.247	0.105
School selectivity	5	1.108	0.103	0.130	−0.152	0.358	0.429
Grad. (PhD v none)	17	1.047	0.046	0.094	−0.138	0.230	0.623
Grad. (MA/PhD v BA)	4	0.929	−0.073	0.151	−0.369	0.222	0.627
National Board	1	0.548	−0.602	0.453	−1.489	0.286	0.184
Teaching Fellow/TFA	2	1.017	0.017	1.009	−1.960	1.994	0.987
Highly quality rating	2	0.932	−0.070	0.354	−0.763	0.623	0.843
Internship	1~	0.459	−0.779	0.395	−1.553	−0.006	0.048
Standard certification	16	0.526	−0.643	0.227	−1.087	−0.199	0.005
Specialty (STEM)	12	1.087	0.083	0.052	−0.019	0.185	0.111
Specialty (Special ed)	6	1.099	0.094	0.061	−0.025	0.214	0.121
Specialty (other)	2	1.353	0.302	0.463	−0.606	1.210	0.514
Experience (cont.)	10	0.996	−0.004	0.017	−0.037	0.030	0.834
Experience (<3)	13	1.542	0.433	0.097	0.243	0.623	0.000

Note. Assumed correlations between multiple, within-study outcomes is 0.5. ~Single study estimate, not meta-analytic results. TFA: Teach for America. STEM: Science, Technology, Engineering, and Math.

conceptual reasons for using a random-effects model, we also provide empirical evidence below showing heterogeneity across the primary studies.

If primary studies provided multiple within-study estimates from different model specifications, Borman and Dowling (2008) opted to maximize the number of effect estimates from each study by using all of the estimates reported in each primary study. This modeling choice maximizes available data, but it assumes different effect estimates reported in the same study are statistically independent. This decision can be inappropriate because effect estimates are likely correlated when they come from the same study using slightly different model specifications. Also, this approach gives more weight to studies providing multiple effect estimates relative to studies providing a single effect estimate. Our preferred model assumes effect estimates from the same study are correlated. As an additional robustness check, we conduct analyses using robust variance estimation (RVE), which does not require information about the covariance structure of the effect estimates (Hedges, Tipton, & Johnson, 2010; Tanner-Smith & Tipton, 2014).

Another major decision is the treatment of hazard ratios, an effect estimate that is similar to odds ratios (our effect estimate of interest). Hazard ratios, which account for the time to event (e.g., when a teacher leaves her school), are not strictly equivalent to odds ratios, but the two statistics have similar interpretations (Nurminen, 1995). Moreover, when the hazard ratios are less than five, they are a close approximation of odds ratios (Stare & Maucort-Boulch, 2016), and the vast majority of the hazard ratios reported in the teacher turnover literature are less than two. Our preferred results reported in this paper do not combine odds ratios with hazard ratios. Still, since many primary studies report hazard models (and they are combined in Borman & Dowling, 2008), we include results that combine odds and hazard ratios in Appendix Table D1. Results combining hazard ratios and odds ratios are qualitatively similar to the results presented here.

3.5. Study quality

To assess study quality, we used the *quality rating approach,* as suggested by Lipsey and Wilson (2001). In this approach, each of the three coders assessed each study on a scale of 1 (high risk of bias) to 5 (low risk of bias) using our professional judgment of the extent to which the study produced estimates that were robust to alternative explanations. Appendix Table B4 contains the criteria we used to determine our rating. The three coders then discussed our ratings until we reached consensus on a final quality rating for each study. Although this method is admittedly subjective, its strength is in allowing us to judge each study based on how well particular methods were implemented and accounts for differences in context and data availability. Moreover, we achieved highly consistent quality ratings between coders, where the vast majority of discrepancies between coders was a difference of one point. This suggests our ratings are consistent within the sample of 120 studies we reviewed. Because they can be subjective, we primarily use these ratings as a robustness check for the main analyses that include all eligible studies. We compare estimates from the highest quality studies (those

Table 3
School factors as correlates of teacher turnover.

		Main effect estimates					
Factor	# of studies	Odds ratio	Logged odds ratio	SE	Lower bound	Upper bound	*p*
Panel A: School Organizational Characteristics							
School size	10	1.001	0.001	0.002	−0.003	0.004	0.792
Urban	9	1.059	0.058	0.090	−0.118	0.233	0.521
High school v. elem	4	1.312	0.272	0.199	−0.119	0.662	0.172
Middle school v. elem	4	1.505	0.409	0.144	0.126	0.691	0.005
Secondary v. elem	7	1.462	0.380	0.165	0.057	0.702	0.021
Charter v. trad public	2	1.983	0.685	0.167	0.358	1.011	0.000
Private v. trad public	2	1.584	0.460	0.428	−0.380	1.299	0.283
Student discip. problem	4	1.186	0.170	0.105	−0.035	0.375	0.103
Better work environ.	5	0.557	−0.585	0.271	−1.116	−0.054	0.031
Administrative support	13	0.796	−0.229	0.061	−0.348	−0.110	0.000
Teacher collaborations	5	0.888	−0.119	0.090	−0.295	0.057	0.186
Teacher leadership	4	1.022	0.022	0.099	−0.172	0.216	0.824
Professional develop.	3	0.838	−0.176	0.077	−0.327	−0.026	0.022
Induction/mentoring	11	0.767	−0.265	0.051	−0.365	−0.166	0.000
Classroom autonomy	5	0.959	−0.041	0.078	−0.194	0.111	0.594
Panel B: School Resources							
Class size	6	1.018	0.018	0.013	−0.008	0.043	0.184
Classroom assistant	2	0.933	−0.069	0.104	−0.273	0.134	0.504
Teaching materials	2	0.845	−0.168	0.062	−0.290	−0.046	0.007
Panel C: Student Body Characteristics							
Student achievement	10	0.901	−0.105	0.020	−0.144	−0.065	0.000
Percent Black	6	1.004	0.004	0.003	−0.002	0.010	0.161
Percent Hispanic	4	1.005	0.005	0.005	−0.004	0.015	0.290
Percent Minority	13	1.003	0.003	0.004	−0.005	0.011	0.492
Percent FRPL	13	1.006	0.006	0.004	−0.002	0.013	0.153
Poverty	4	1.019	0.019	0.072	−0.122	0.161	0.791
Percent with enhanced support	5	0.999	−0.001	0.009	−0.019	0.018	0.945
Panel D: Relational Demography							
Race/gender congruence	2	0.545	−0.607	0.786	−2.147	0.933	0.440

Note. Assumed correlations between multiple, within-study outcomes is 0.5. ~Single study estimate, not meta-analytic results. Enhanced support includes IEP and LEP where IEP is Individualized Education Plan and LEP is Limited English Proficiency. Elem: Elementary; discip: Discipline; FRPL: Free-or-reduced price lunch.

with a rating of four or higher out of five) in a meta-regression framework and find that estimates using only studies with the highest rating are largely similar to results from using all eligible studies, as described further below.

3.6. Study limitations

There are several important limitations worth noting. First, for each factor, we combine estimates that come from different models, some controlling for more covariates than others. For instance, some studies examining the relationship between teachers' age and turnover control for degree attainment and some do not. Since individual studies are do not control for the same set of covariates, the precise association between each factor and turnover can vary slightly across different primary studies. This limitation is an inherent challenge to meta-analyses in the social sciences (Borenstein et al., 2009; Pigott & Polanin, 2019). Second, odds ratios and hazard ratios are not exactly the same, and the primary results we report do not combine these two effect sizes. Third, not all factors of interest have sufficient numbers of primary studies to allow for meta-analysis. Finally, although the literature on teacher turnover has improved in methodological rigor over time, estimates rarely come from experimental designs. While estimates from the most rigorous research designs are plausibly causal, one must be careful in assigning causal interpretations to these reported estimates, especially because some factors (e.g., student body characteristics) are prone to selection bias and reverse causality. Moreover, since most of the quantitative literature on teacher turnover has been conducted in the United States, the dearth of evidence from other countries is an important limitation.

4. Results

4.1. Characteristics of primary studies in this meta-analysis

There are 26 studies in this meta-analysis that have been included in a prior review. Table 1 shows that among these 26 studies, 85 percent were published in peer-reviewed journals, with a median sample size of 2690 teachers. Two of these 26 studies utilized at least three years of longitudinal data with a sample size greater than 100,000 observations, and one employed a quasi-experimental design. On our quality rating scale of 1–5, the median score among these 26 previously reviewed studies is 2, and the mean is 2.69.

In comparison, there are 94 primary studies included in this meta-analysis not included in a prior review. With advances in the

Table 4
External/policy factors as correlates of teacher turnover.

Factor	# of studies	Main effect estimates					
		Odds ratio	Logged odds ratio	SE	Lower bound	Upper bound	*p*
Panel A: Accountability							
Teacher evaluation	5	0.947	−0.054	0.027	−0.106	−0.002	0.041
Teacher eff. score	7	0.964	−0.037	0.021	−0.078	0.004	0.079
Principal eff. score	3	0.710	−0.342	0.108	−0.553	−0.131	0.001
Merit pay	3	0.784	−0.243	0.099	−0.436	−0.049	0.014
Merit pay (lin. prob.)	10	.	−0.016	0.007	−0.029	−0.003	0.016
Panel B: Workforce							
Employment rate	1~	0.969	−0.032	0.014	−0.059	−0.005	0.022
Late hiring	1~	1.781	0.577	0.124	0.334	0.820	0.000
Retention bonus	1~	0.990	−0.010	0.060	−0.128	0.108	0.868
Non-teacher salary	2	6.305	1.841	2.789	−3.625	7.307	0.509
Salary	18	0.977	−0.024	0.007	−0.038	−0.009	0.001
Union	3	0.745	−0.294	0.173	−0.634	0.046	0.090

Note. Assumed correlations between multiple, within-study outcomes is 0.5. ~Single study estimate, not meta-analytic results. *This is reporting linear probability model estimates, not odds ratios.

search process, we were able to find additional primary studies that help provide a more comprehensive picture of the quantitative literature. We note six of these 94 studies were published before 2005 and were not included in Borman and Dowling (2008). About 62 percent of the 94 additional studies in this meta-analysis were published in peer-reviewed journals with a median sample size of 9150 observations. Relatedly, 18 of these newer studies use longitudinal data with more than 100,000 observations, and a third of them employ quasi-experimental or experimental designs. The median quality rating is 4 (mean of 3.45) out of five, suggesting the quality of the primary studies has considerably improved over the last ten years. In sum, these descriptive statistics indicate that the quantitative literature on teacher turnover has improved substantially, with larger sample sizes, more prevalent use of longitudinal data, more attention to causal designs, and higher quality methods. These differences also highlight the importance of an updated meta-analysis that captures insights from these new studies.[3,4]

4.2. Personal factors

4.2.1. Teacher characteristics

In Panel A of Table 2, we present summary effect estimates of the association between various teacher characteristics and turnover. Compared with previous reviews, the number of studies examining each factor has increased substantially. Across ten studies, we find older teachers are marginally less likely to turnover than younger teachers. For example, the odds of teachers leaving their school decreases by 30 percent for teachers who are more than 28 years old, relative to younger teachers. This finding is robust when age is operationalized as an indicator for 30 years of age or older.[5] In contrast to Borman and Dowling, we find that gender does not have a significant relationship with turnover (i.e., female teachers are not more likely to leave their school than male teachers).

Additionally, we provide a more nuanced treatment of teachers' race/ethnicity by generally examining all non-White teachers and also specifically examining Black and Hispanic teachers. Relative to White teachers, our results show Black teachers are no more or less likely to turnover. However, non-White teachers overall and Hispanic teachers specifically have 16 and 53 percent lower odds of turning over, respectively. The literature on characteristics of teachers' families continue to be thin. Still, across four studies, we find married teachers are more likely to turnover (though the estimate is only marginally significant at the 10 percent level). Finally, the odds of full-time teachers turning over are 0.62 times the odds for part-time teachers, and teachers who are more satisfied with their job are less likely to leave their school (15 percent lower odds).

4.2.2. Teacher qualifications

Panel B of Table 2 shows results for teacher qualifications. We find teachers with higher scores on university entrance exams have a 12 percent increase in the odds of turning over relative to teachers with lower academic achievement. The odds of teachers with graduate degrees turning over are not significantly different relative to teachers with baccalaureate degrees. There is limited evidence to assess relationships for teachers who have National Board certification and alternatively certified teachers. Still, across 16 studies, the odds of turning over are 47 percent lower for teachers who have standard certification than for those who do not. The results also suggest STEM and special education teachers may be more likely to turnover than those who teach in other areas. The coefficients are not significant using only studies reporting log odds ratios, but they are significant when we include studies reporting hazard ratios.

[3] See Appendix Table B5 for descriptive information on the primary studies.

[4] We note the factors with the highest average study quality with low risk of bias are found in the external policy categories such as merit pay programs and teacher effectiveness while factors with the lowest average study quality with high risk of bias are found in the teacher characteristics categories, such as being older than 28 years old and gender.

[5] We note the probability of leaving follows a U-shaped curve as older teachers retire, which is not reflected in this operationalization of age.

Lastly, an additional year of teaching experience does not significantly change the odds of turnover. Nonetheless, the odds of turnover are 54 percent higher for teachers with fewer than three years of experience relative to more experienced teachers.

4.3. School factors

4.3.1. School organizational characteristics

Panel A of Table 3 shows results for school organizational characteristics, ranging from size and urbanicity to opportunities for professional development, induction, and mentoring. We find teachers are not more likely to leave larger schools than smaller schools, and in contrast to Borman and Dowling, we find no evidence teachers in urban settings are more likely to turnover. However, the odds of leaving are 51 percent higher for middle school teachers than for elementary school teachers, and the odds of teacher turnover are higher in charter schools than in traditional public schools (though this estimate is based on only two studies).

We also find that teachers are marginally more likely to turnover in schools with more disciplinary problems and less likely to turnover in schools with more favorable work environments, as characterized by better facilities, teaching assignments better aligned with expertise, and fewer student discipline problems. In particular, the odds of teachers leaving schools with better working conditions decrease by nearly 45 percent compared to schools with less favorable working conditions. Similarly, the odds of teachers leaving schools with stronger administrative supports are 0.80 times the odds of teachers leaving schools with weaker administrative supports, and teachers who experience induction and/or mentoring are also less likely to turnover than those without. Relatedly, teachers who indicated they had good in-service professional development have 16 percent lower odds of leaving than those without. More opportunities for leadership or collaboration do not seem to influence teacher turnover, but with a limited number of studies (five and four, respectively), these results are not precisely estimated.

4.3.2. School resources

Results from school resource factors are shown in Panel B of Table 3. Neither reducing class size nor providing classroom assistants changes the odds of teacher turnover, but increased availability of teaching materials decreases the odds of turnover by 15 percent. However, all of these results are limited by the small number of primary studies examining school resource factors. When we include hazard ratios along with log odds ratios, our estimates suggest having classroom assistants is associated with decreased odds of turnover. Overall, the literature associating school resources with teacher turnover would benefit from further development through a larger number of future studies.

4.3.3. Student body characteristics

In Panel C of Table 3, we find that across ten primary studies, the odds of teacher turnover are 10 percent lower for schools with higher student achievement than schools with lower student achievement.[6] This result is robust when we instead compare high-performing with low-performing schools. The relationships between teacher turnover and percent Black, percent Hispanic, or percent minority students are not significant. Finally, the percent of students eligible for free-or-reduced price lunch (FRPL), students in poverty, and students with enhanced supports are not significantly related to teacher turnover. It is important to note that examinations of the relationship between student body characteristics and teacher turnover are prone to selection bias and reverse causality.

4.3.4. Relational demography

The gender and racial/ethnic congruence between teachers and principals or between teachers and students are an important recent theoretical and empirical development in the study of teacher turnover (e.g., Grissom, 2011). There have been only five studies that examine teacher-principal or teacher-student relational demography, and only two use logistic regression, which we summarize in Panel D of Table 3. We find the odds of teacher turnover may be smaller when there is congruence relative to incongruence, but the result is insignificant. Given a growing literature reporting a positive relationship between student-teacher race/ethnicity match and important student outcomes like attendance (Holt & Gershenson, 2017), test scores (Dee, 2004; Egalite, Kisida, & Winters, 2015; Joshi, Doan, & Springer, 2018), high school graduation (Gershenson, Hart, Lindsay, & Papageorge, 2018), and college enrollment (Gershenson et al., 2018), we see better understanding the relationship between relational demography and teacher turnover as an important route for future empirical developments, particularly as it relates to educational equity.

4.4. External/policy factors

4.4.1. Accountability

Shown in Panel A of Table 4, accountability policies are a new development in the literature on teacher turnover, with almost all of the primary studies published after Borman and Dowling (2008). Five factors are categorized under accountability: teacher evaluation, merit pay, teacher effectiveness, federal or national policies, and principal effectiveness. Across five studies, the odds of teacher turnover are 5 percent lower in schools with a teacher evaluation system. In particular, Feng (2010) finds a reduction in teacher turnover for teachers who experience a "positive shock" to their accountability score and an increase in turnover for teachers who experience a "negative shock."

[6] We note this finding is purely associational since teachers self-select into schools.

The proliferation and study of merit pay in the past decade have also given us new opportunities to examine its impacts on turnover. Since most studies of teacher merit pay use linear probability models instead of logistic regression, we report summary effect estimates for merit pay divided by the three primary studies reporting odds ratios and the 10 studies reporting linear probability estimates. Both sets of studies suggest a lower likelihood of teacher turnover in schools with a merit pay system. Estimates from linear probability models indicate a 1.6 percentage point decrease on average, while estimates from logistic regression models indicate that the odds of teachers leaving a school with a merit pay system are 0.78 times the odds of teachers leaving schools without merit pay systems. Given the importance of these findings, coupled with recent meta-analytic work reporting a positive relationship between merit pay and student test scores (Pham et al., 2020), it is important for future studies of merit pay to closely examine program design and implementation to better inform optimal incentive system design.

Related to the issue of merit pay is teacher effectiveness as measured by either composite evaluation scores or value-added scores. We find that teachers with higher effectiveness scores do not have significantly different odds of turnover. However, when we include hazard ratios, the results suggest more effective teachers have lower odds of turnover than less effective teachers (Appendix Table D1). This result is fairly consistent whether the effect is measured as a standard deviation increase in effectiveness scores or when studies compare effective teachers with less-effective teachers (e.g., Boyd, Lankford, Loeb, & Wyckoff, 2008; Feng & Sass, 2017a; Goldhaber, Gross, & Player, 2011; Loeb, Kalogrides, & Béteille, 2012).

There have also been studies examining the relationship between principal effectiveness and teacher turnover, where principal effectiveness is measured as either school-level value-added measures or as a factor that combines multiple measures such as test scores and supervisor ratings (e.g., Redding & Smith, 2016). Our results suggest higher principal effectiveness scores are associated with lower odds of turnover. For example, Beteille, Kalogrides, and Loeb (2009) find higher principal effectiveness is associated with decreased turnover among teachers with high value-added scores. Similarly, Grissom (2011) and Redding and Smith (2016) find higher principal effectiveness is associated with decreased odds of teacher turnover, but results from both studies are not statistically significant.[7]

4.4.2. Workforce

Specific factors in the workforce category include local employment rates, whether the teacher was hired late (after the school year began), salary, retention bonuses, salaries in comparable professions, and union membership (Panel B of Table 4). Workforce factors are recent additions to the teacher turnover literature, except for the extensive literature on teachers' salary. As these are emerging areas of research, there are not enough primary studies to conduct a formal meta-analysis for many of these factors. For instance, while we find retention bonuses reduce the odds of turnover, it is only statistically significant when we pool odds ratios and hazard ratios together. For teachers who are hired late, there is only one primary study, so we did not conduct a meta-analysis, but results from the one primary study suggests late hiring significantly increases the odds of turnover (Jones et al., 2011).

The most studied factor in the workforce domain is teacher salary, but salary has been operationalized in many different ways. Usually, changes in salary are measured using $1000 increments (Feng, 2010; Fulbeck, 2014), but researchers also commonly use an indicator to compare teachers with high versus low salary or use the log salary (e.g., Boe, Bobbitt, Cook, Barkanic, & Maislin, 1998; Hanushek, Kain, & Rivkin, 2004; Shin, 1995). We included these types together to increase the power to detect an effect as Borman and Dowling were unable to do.[8] Across 18 studies, we find an increase in salary slightly reduces the odds of teacher turnover but note that even though the result is statistically significant, the point estimate is close to one.

Finally, a few studies have estimated the relationship between union membership and turnover. Across three studies, the odds of turnover for teachers who are union members are 0.75 times the odds for teachers who do not belong to unions, but this result is only marginally significant (Kelly & Northrop, 2015; Kukla-Acevedo, 2009; Moore, 2011). The studies in this category are important venues for understanding turnover, but more research is needed to conclusively determine their relationship with teacher turnover.

4.5. Robustness and sensitivity checks

To check the robustness of our findings, we first examine estimates that combine hazard ratios with odds ratios. We generally find similar patterns to our preferred estimates (see Appendix Table D1). In most cases where there are differences, the difference occurs because combining hazard and odds ratios yields statistically significant summary estimates, whereas our preferred estimates using only odds ratios were not significant. This difference is likely due to increased power from the larger sample of primary studies. After combining hazard and odds ratios, we find teachers with higher university entrance exam scores, those who attended more selective universities, STEM teachers, and special education teachers are more likely to turnover. In terms of school factors, teachers are more likely to leave schools where there are more student disciplinary problems. For school resources, two studies suggest teachers are less likely to leave when they have adequate teaching materials. Lastly, for the workforce category, retention bonuses may reduce the odds of teachers leaving by eight percent.

[7] The reason why these two studies are not included in the meta-analytic result is Grissom (2011) uses linear probability models and Redding and Smith (2016) do not provide a standard error for this estimate.

[8] Results are substantively similar when we separate into high/low, but are very imprecise due to limited number of estimates.

Second, we use RVE to help examine whether our results are robust to the potential correlation between multiple within-study effect estimates (Appendix Table D2). However, RVE tends to be unreliable when there are fewer than ten studies and 20 to 40 effect sizes (Hedges et al., 2010; Tanner-Smith & Tipton, 2013), so we do not display RVE estimates from fewer than seven studies.[9] When there are sufficient studies and effect sizes, RVE estimates lead us to similar conclusions as in our preferred models. We find that, despite technical and conceptual challenges, our preferred estimates are robust when we examine potential issues with having multiple within-study estimates, and combining hazard ratios and odds ratios.

4.6. Differentiating leavers and switchers: switcher only results

There is a conceptual concern with using effect estimates that compare both leavers and switchers together against stayers (e.g., Feng, 2010). To address this concern, we drop all effect estimates that combine leavers and switchers, leaving only estimates that compare leavers with stayers (Appendix Table D3). The leavers-only estimates are similar to our main results. The more relevant question for some policymakers is whether the factors associated with leavers have comparable relationships with factors related to switchers.

When we examine only teachers who switch to different schools, most of the relationships are similar to our main findings, with a few exceptions (Appendix Table D4). First, older teachers and married teachers are less likely to switch than younger teachers and non-married teachers, respectively, as the opportunity costs for them may be higher (Boe et al., 1998; Kukla-Acevedo, 2009). Non-White teachers are more likely to switch than White teachers, as they may seek a better school fit or more support (Harris, 2007; Imazeki, 2005). Teachers with graduate degrees are more likely to switch than teachers without graduate degrees, which we attribute to teachers seeking better compensation or working conditions as schools prefer teachers with more education (Elfers, Plecki, & Van Windekens, 2017). For similar reasons, National Board-certified teachers are more likely to switch schools than their peers (Goldhaber & Hansen, 2009). Teachers in urban schools are also more likely to change schools than teachers in rural areas, as there are more job opportunities available (Clotfelter et al., 2011; Perda, 2013). Finally, teachers with more classroom autonomy are less likely to switch schools, as they are more inclined to stay in schools where they have more independence (Djonko-Moore, 2016).

4.7. Determinants of turnover from studies using experimental or quasi-experimental designs

Although most of the research on teacher turnover provides correlational evidence, more studies are using quasi-experimental and experimental research designs to provide plausibly causal estimates, especially for factors such as teacher evaluation policies, mentoring and induction, and retention bonuses. We defined studies as quasi-experimental if they employed longitudinal data with high-dimensional fixed effects, difference-in-differences, instrumental variables, propensity score matching, and regression discontinuity designs (Murnane & Willett, 2010). We then reviewed the authors' stated intentions of their work and their methodology. We used the preferred estimates of the primary authors based on their explicit mention of their preferred estimates or their discussion. If the primary authors did not have preferred estimates, we used our professional judgment to select the most plausible causal estimates based on the methods used and how they addressed internal validity issues. For instance, we account for whether studies using regression discontinuity provide evidence for non-manipulation of the forcing variable, covariate balance checks, and falsification tests. Ultimately, we identify 32 studies meeting these inclusion criteria.

Under accountability, we find that teacher evaluation, merit pay, and principal effectiveness likely affect teacher turnover. Teachers in schools implementing merit pay programs are less likely to turnover than teachers without (e.g., Booker & Glazerman, 2009; Springer, Lewis et al., 2010). Teachers who are evaluated for accountability purposes are not more likely to turnover (Boyd, Lankford, et al., 2008), and in fact, some studies suggest that teachers are less likely to turnover in schools with accountability-based evaluation systems (Feng, 2010; Nah, 2015). We also find evidence that mentoring and induction may reduce turnover (Helms-Lorenz, van de Grift, & Maulana, 2016; Rockoff, 2008; Ronfeldt & McQueen, 2017). Finally, retention bonuses may also reduce turnover (Springer et al., 2016), but the effect appears to fade out when the bonuses are no longer offered (Cowan & Goldhaber, 2015; Feng & Sass, 2018).

5. Discussion and conclusion

With over a decade of additional research, the teacher turnover literature has expanded considerably since Borman and Dowling (2008), providing more reliable results and introducing new factors correlated with turnover. In this meta-analysis, we provide a new conceptual framework for understanding teacher turnover in light of these developments. Our updated conceptual framework contextualizes how the study of teacher turnover has evolved, integrates new insights into a cohesive framework, and highlights areas of future research. Using this framework as a guide, we find updated results that contrast with prior findings and new findings that advance our understanding of why teachers turnover. In contrast to Borman and Dowling (2008), we find that female teachers and teachers with graduate degrees are not more likely to turnover than male teachers and teachers without graduate degrees, respectively. However, STEM and special education teachers have significantly increased odds of turnover relative to teachers in other content

[9] We used a cutoff of seven studies instead of ten because many of the factors we examined have been tested in fewer than 10 studies. Thus, a cutoff at seven provides a reasonable number of studies within in each factor while also preserving our ability to report effect estimates for the majority of factors.

areas. In these cases, we suspect two potential reasons for contrasting findings: (1) the additional studies provide a more accurate picture of turnover than previously known; and (2) the influence of these factors may have changed over time (e.g., Barbieri, 2011). To examine these two potential explanations, we conducted meta-regressions to test whether results from new studies included in our meta-analysis differ from results in earlier studies reviewed by Borman and Dowling. The meta-regression results are based on a small sample of studies and yielded insignificant differences between earlier and later studies (see Appendix Table D5). Although we lack the statistical power to detect differences between earlier and later studies, there is reason to believe that patterns in teacher turnover are changing as labor markets evolve. For example, in an increasingly technology-dependent global economy, teachers with expertise in STEM may have alternative employment opportunities that take them away from teaching. The differences over time uncovered by our study raise important questions for future research to examine how changing economic activity and social expectations have affected teacher turnover.

Turning to the first major strand in our conceptual framework, we find personal factors continue to be important when examining teacher turnover. Our results suggest turnover is higher among teachers with higher academic ability, STEM teachers, special education teachers, younger teachers, and less experienced teachers. For instance, younger and newer teachers are more likely to turn over because they may not be as committed to teaching as their more experienced counterparts (Rockoff, 2008; Smith, 2007). Teachers with higher university entrance exam scores also have a higher likelihood of turnover, likely because they have more opportunities outside of teaching (Perda, 2013). Relatedly, teachers in high demand areas such STEM and special education are also more likely to turnover than teachers in other areas (Gilmour & Wehby, 2019; Ingersoll & May 2012). Demographic trends suggest that policymakers looking to invest in recruiting higher quality educators need to recognize two important stipulations. First, teachers have an ever-increasing number of employment options outside of the education sector. And, second, there is a need to strengthen schools' ability to compete for young and talented teachers in high-need subject areas. Finally, the finding that minority race teachers have reduced odds of turnover relative to White teachers also deserves more attention, especially in schools serving larger proportions of non-White students, because research finds sizeable positive effects for non-White students who have non-White teachers (Redding, 2019).

The second major strand in our conceptual framework focuses on school factors, and some of the most consistent evidence from our meta-analysis supports working conditions and salary as highly influential in teachers' turnover decisions. We find teachers are less likely to turnover when they are satisfied with the school environment or when they report adequate support from administrators. The same is true when there are fewer disciplinary problems in the school, when a more effective principal leads their school or when salaries are higher. In addition to the importance of salary, these findings suggest other effective strategies for retaining teachers are factors that school leaders have the power to control, such as creating a consistent approach to discipline and providing teachers with opportunities for professional development. Moreover, we also find many of these school characteristics have differential relationships with teachers leaving the profession relative to teachers switching to another school. For instance, teachers working in urban areas have more alternative options in schools than teachers in rural areas, and teachers who have more classroom autonomy are more likely to stay than those with less autonomy. These results highlight relationships between school-level characteristics and teacher turnover, but we urge ongoing research to clarify key environmental features that school leaders should focus on building in order to retain teachers.

Our results suggest increasing teacher salaries can increase teacher retention. However, to address costs associated with across-the-board pay increases as well as concerns for more direct ways to elevate the quality of the teacher workforce, districts should target monetary incentives such as retention bonuses and merit pay, which we describe in more detail below. In contrast to working conditions and salary, we find that the demographic characteristics of students in their schools are not significantly correlated with teacher turnover. That is, the proportions of Black students, Hispanic students, FRPL-eligible students, or students needing enhanced supports do not predict teacher turnover, suggesting that teachers are not leaving their schools because of students' characteristics. Together the results for working conditions and student body characteristics suggest that teachers will likely stay in schools serving higher proportions of traditionally disadvantaged students if they feel supported and are satisfied with their working conditions.

One of the major developments in the teacher turnover literature in recent years has been a greater focus on external/policy factors that will likely affect teacher turnover, such as retention bonuses, teacher evaluation, and merit pay. Overall, our evidence suggests these various factors are influential in teachers' turnover decisions. These studies also collectively have the highest average study quality with a low risk of bias. First, we find evidence to suggest that retention bonuses, which directly incentivize teachers to stay, are correlated with lower odds of turnover (e.g., Feng & Sass, 2018; Jones et al., 2011; Springer et al., 2016). Second, contrary to concerns about the adverse effects of teacher evaluations and accountability (Darling-Hammond, 2013; Darling-Hammond, Amrein-Beardsley, Haertel, & Rothstein, 2012), we find that performance evaluations do not create negative sorting. Primary studies suggest evaluation systems can provide teachers with a sense of empowerment and growth because they can observe their strengths and identify areas of improvement (Boyd, Lankford, et al., 2008; Feng, 2010). Moreover, a recent study finds that the rollout of a teacher evaluation system was associated with higher retention among more effective teachers, with more substantial differences in turnover between highly and minimally effective teachers in urban districts and low-performing schools (Rodriguez et al., 2020). Although there continues to be legitimate concerns about evaluation and accountability policies, teachers may perceive them more positively than previously recognized.

Third, we find merit pay is linked with reduced teacher turnover, adding to previous research finding positive effects of merit pay on student achievement (Pham et al., 2020) and suggesting teachers are attracted to pay schedules that recognize their performance. However, the structure of merit pay programs can vary widely (e.g., different pay criteria and amounts), and we know less about how to structure merit pay programs to increase teacher retention. We also have less evidence about whether merit pay programs are attracting more effective teachers. However, the overall positive influence of retention bonuses and merit pay, coupled with positive effects on test scores, support future policy efforts that emphasize alternative compensation structures leveraging targeted monetary

incentives. Relatedly, even though higher salary is associated with reduced turnover, its magnitude is small relative to targeted bonuses. As education systems search for ways to recruit and retain a more diverse and higher-quality workforce with limited resources, our work suggests the higher leverage approach may be differentiated compensation systems as opposed to across-the-board pay raises.

In terms of future research, our conceptual framework uncovers two critical areas that warrant ongoing attention. First, the interplay between personal and school factors appear to be important but is not well understood. Researchers have begun exploring how well teachers fit within their current school context and the role of fit in teachers' decisions to turnover. For example, a few studies have explored relational demography (i.e., racial/ethnic or gender matches between teachers and principals and between teachers and students), and find evidence suggesting teachers are less likely to turnover when these matches occur (Grissom et al., 2012, 2016). While relational demography represents an exciting area of development, the idea of fit extends far beyond demographic characteristics like race/ethnicity and gender. Expectations for collaboration, leadership opportunities, and work hours are a few examples of ways that teachers' personal preferences may or may not fit with the culture at their school. Future research needs to quantify how the interplay of personal and school factors influences teacher turnover.

A second area of development suggested in our conceptual framework is a more comprehensive understanding of the mechanisms through which external labor market conditions and policies affect teacher turnover. Primary studies suggest external policies likely change the personal characteristics of teachers and working conditions in a school, both of which are then correlated with teacher turnover. For example, instituting a school-level merit pay program could lead to a more collaborative work environment, which correlates with lower turnover. Thus, the effect of policy factors on teacher turnover may be mediated by changes in personal and school factors. While these proposed mediating mechanisms are theoretically appealing, we are unaware of any rigorous quantitative studies that use mediation methods to formally test them. Thus, we urge future research to open the black box in examining *how* personal, school, and policy factors influence teacher turnover.

Our goal in this meta-analysis is to provide a more robust synthesis of previous and current developments in the teacher turnover literature. To do so, we developed a coherent and comprehensive conceptual framework that captures areas where research evidence remains consistent and areas where the literature needs further development. Moreover, our synthesis provides important insights into the changing teacher labor market, and we urge ongoing scholarship in this area to monitor how changing economic conditions and social expectations will continue to affect patterns in teacher turnover.

CRediT authorship contribution statement

Tuan D. Nguyen: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization, Supervision. **Lam D. Pham:** Methodology, Formal analysis, Data curation, Visualization, Writing - original draft, Writing - review & editing. **Michael Crouch:** Formal analysis, Data curation. **Matthew G. Springer:** Conceptualization, Methodology, Formal analysis, Data curation, Writing - original draft, Writing - review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.edurev.2020.100355.

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