ORIGINAL RESEARCH

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Physician Turnover in the United States

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Background: Medical groups, health systems, and professional associations are concerned about potential increases in physician turnover, which may affect patient access and quality of care.

Objective: To examine whether turnover has changed over time and whether it is higher for certain types of physicians or practice settings.

Design: The authors developed a novel method using 100% of traditional Medicare billing to create national estimates of turnover. Standardized turnover rates were compared by physician, practice, and patient characteristics.

Setting: Traditional Medicare, 2010 to 2020.

Participants: Physicians billing traditional Medicare.

Measurements: Indicators of physician turnover—physicians who stopped practicing and those who moved from one practice to another—and their sum.

Results: The annual rate of turnover increased from 5.3% to 7.2% between 2010 and 2014, was stable through 2017, and increased modestly in 2018 to 7.6%. Most of the increase from 2010 to 2014 came from physicians who stopped practicing increasing from 1.6% to 3.1%; physicians moving increased modestly from 3.7% to 4.2%. Modest but statistically significant ($P < 0.001$) differences existed across rurality, physician sex, specialty, and patient characteristics. In the second and third quarters of 2020, quarterly turnover was slightly lower than in the corresponding quarters of 2019.

Limitation: Measurement was based on traditional Medicare claims.

Conclusion: Over the past decade, physician turnover rates have had periods of increase and stability. These early data, covering the first 3 quarters of 2020, give no indication yet of the COVID-19 pandemic increasing turnover, although continued tracking of turnover is warranted. This novel method will enable future monitoring and further investigations into turnover.

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Medical groups, health systems, and professional associations are concerned about increases in physician turnover (1, 2). Although physicians may turn over—move to a new practice or stop practicing—for many reasons, increasing turnover rates may suggest growing dissatisfaction with the practice of medicine or with the organization in which a physician practices (3). When physicians move to another practice or stop practicing, patients (and physicians) lose the benefits of their mutual knowledge and trust (1, 4). Continuity of care may suffer when a patient is forced to find a new physician; extensive research demonstrates that continuity improves quality, reduces the number of emergency department visits and hospitalizations, and reduces spending (5–13). Turnover could also harm patient access for groups that have historically faced barriers to care, such as rural and racial/ethnic minority patients (14). Finally, turnover has direct economic implications for a practice. Although estimates of the cost of replacing a physician vary, that cost is substantial, with some estimates as high as $500 000 (15–17).

There are no national estimates of physician turnover, so it is not known whether turnover has increased, as is sometimes assumed (2). If changes in turnover over time exist, they could be driven by the large shift in the composition of physicians and their practices as the number of female physicians and the size of practices have grown in recent years. Even if turnover rates have not changed, they may vary by physician and practice characteristics, geographic location, or the composition of a practice's patient population. The degree to which turnover merits additional or targeted organizational and policy intervention and investment requires information on these questions.

We developed a novel method using Medicare billing patterns to identify whether an individual physician moves or leaves a practice. We used this method to create national estimates of physician turnover; examined raw and standardized turnover rates over time; and identified physician, practice, and patient characteristics associated with turnover.

See also:

Web-Only
Supplement

Methods

Data and Sample

Our primary data source was the Medicare Data on Provider Practice and Specialty (MD-PPAS) file from 2009 to 2020, which includes clinician characteristics and billing of claims for traditional Medicare services (18). Of note, this file is based on the universe of billing for traditional Medicare services. In addition, some practice-level variables were generated using the 20% Medicare Carrier file from 2012 to 2020. A clinician must bill Medicare using a Tax Identification Number (TIN); most practices use a single TIN. The MD-PPAS file identifies the 2 TINs

that account for each clinician's largest number of service line (billing) items as well as the months when the 2 TINs were billed.

We limited our sample to physicians. We excluded physicians who infrequently bill traditional Medicare, including pediatricians, psychiatrists, Kaiser Permanente physicians, and physicians who saw fewer than 4 enrollees in each year of Medicare billing. We also excluded the fewer than 0.5% of physicians who billed more than 2.5% of their service line items to a third TIN not captured in MD-PPAS. Finally, we excluded physicians younger than 33 years to avoid counting as movers physicians who likely moved from a residency or fellowship program into their first posttraining practice. The final sample represented 82% of all physicians or 92% of Medicare physician billing between 2010 and 2020 (Section I of the **Supplement**, available at Annals.org).

Variables

Measuring Physician Turnover

We defined 2 types of physician turnover, physicians who moved from one practice to another and those who stopped practicing (that is, left practice), henceforth "movers" and "leavers."

When identifying movers, our goal was to determine whether a physician who was working with one practice ended the relationship and joined a second practice. In billing data, it is possible to identify the month a physician begins billing a new practice or TIN. However, billing a new practice does not necessarily indicate movement; it could, for example, indicate that a medical group is using more than 1 TIN, that a medical group was acquired by another practice, or that a physician worked part-time in 2 practices. We developed 3 preconditions to determine whether the billing of a new practice constituted a physician moving: A physician had to have a relationship with both the first and new practices through sufficient months of billing—we used 4 months as the primary specification, with 3 and 6 months in sensitivity analyses; the relationships with the first and second practices had to be temporally independent (that is, a physician must bill at least 4 months with their old practice and new practice in different months); and the potential move should not represent a medical group reorganizing its financial structure. Specifically, the old practice had to continue to exist after a physician moved, and a physician could not continue to bill with many of their former peers. Section II of the **Supplement** provides full details on methods and sample flow charts

The goal in identifying physician leavers was to identify physicians who fully retired from practice or stopped practicing for an extended period. This method considered an extended period to be 2 years and identified physician leavers as those who stopped billing for 2 years (Section II of the **Supplement**). In sensitivity analyses, we applied periods of 3 months, 1 year, and 3 years.

Primary measures of moving and leaving were reported on a July-to-June basis because measurement of moving required up to 6 months of billing data before and after a potential month of moving. Rates of moving were reported for years 2010 to 2020. Rates of leaving were reported for years 2010 to 2018 because measurement of leaving required 2 years of billing data after a potential month of leaving.

In a supplementary analysis examining turnover during the beginning of the COVID-19 pandemic, we used modified quarterly measures that could be constructed through the third quarter of 2020. Moving required a physician to have a 3-month rather than a 4-month relationship with both the first and new practices. Leaving required a physician to stop billing for 3 months rather than 2 years.

Physician, Practice, and Patient Characteristics

We identified a limited set of characteristics that might mediate physician turnover, including physician demographics, geographic region, practice size, and the practice's percentage of socially vulnerable patients.

From the MD-PPAS file, we included physician age, sex, specialty, and census region. We used each physician's core-based statistical area, as reported in MD-PPAS, to create an indicator for practicing in a rural area, as defined by the Office of Management and Budget (19).

For a practice variable, we used MD-PPAS to construct a measure of physician practice size (number of unique physician National Provider Identifiers billing under the same primary TIN).

For patient characteristics, we constructed variables to capture a practice's percentage of socially vulnerable Medicare patients using the 20% Medicare Carrier file from 2012 to 2020. We identified the proportions of visits with Black, Hispanic, and other non-White beneficiaries. These racial/ethnic categories were selected because they have the highest validity in Medicare claims data (20). As a proxy for low income, we also calculated the percentage of visits for patients dually eligible for Medicare and Medicaid. This percentage was categorized into quartiles.

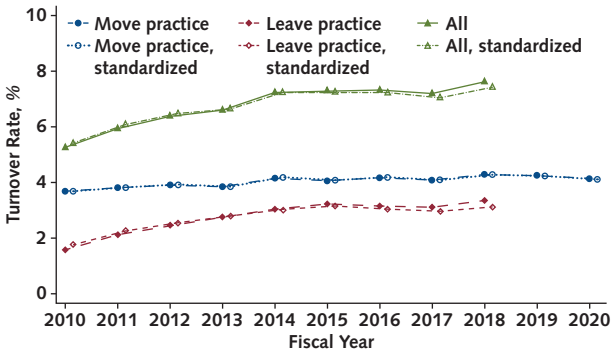
Statistical Analysis

To examine physician turnover over time, we graphed annual and quarterly standardized and nonstandardized rates for each type of turnover—moving and leaving—and overall. We also graphed standardized annual rates of turnover by specialty category. Finally, we compared standardized rates of moving and leaving by physician, practice, and patient characteristics.

Rates of moving and leaving were standardized to account for physician and practice characteristics. We used logit models where the dependent variable was an indicator of whether a physician turned over in a given year. We used separate regressions to estimate standardized rates of leaving and moving because the factors associated with physician decisions to leave and move may differ. Covariates included physician characteristics, practice size, and year. We modeled year as a categorical variable so that standardized year rates were not assumed to follow a linear or any other prespecified trend. In models used to construct annual rates of turnover by specialty, we interacted the year covariate with specialty category.

In sensitivity analyses, rates were also standardized to account for patient characteristics for a sample limited to the years for which these variables were available,

Figure 1. Turnover rate, by year, 2010–2020.



The rate of overall physician turnover, rate of physicians moving practice, and rate of physicians leaving practice, by year, from 2010 to 2020. Year is defined as July to June. Standardized estimates were derived from logit models with robust SEs clustered at the physician level. Separate regressions were used to estimate standardized rates of moving and leaving. The sample for moving estimates was based on 2010 to 2020; the sample for leaving estimates was based on 2010 to 2018, the years in which the leaving measure was available. Estimates were standardized for physician age, sex, specialty, rurality, census region, and practice size.

2012 to 2020. We ran regressions with covariates that included year and state as categorical variables as well as all other physician and practice characteristics (omitting census region). We modeled state as a categorical variable to eliminate possible confounding by state (for example, turnover rates being driven by the large variation in socially vulnerable Medicare patients by state). Our results are therefore based on comparisons within rather than across states. In all regressions, we used robust SEs clustered at the physician level.

We compared the annual turnover rates using more and less conservative definitions and applying various age thresholds to our sample (Sections IV and V of the **Supplement**). We did several sensitivity tests to check the robustness of our results to various modeling choices (Section VI of the **Supplement**). We also examined net migration by census region and rurality (Section VII of the **Supplement**).

The study was done using Stata statistical software, version 16 (StataCorp), and was deemed exempt from review by the relevant institutional review board.

Role of the Funding Source

The Physicians Foundation had no role in the design, conduct, or analysis of the study or in the decision to submit the manuscript for publication.

RESULTS

Primary Analysis

The nonstandardized annual rate of physician turnover increased each year from 2010 to 2014 (5.3%, 5.9%, 6.4%, 6.6%, and 7.2%, respectively); was stable through 2017, ranging from 7.2% to 7.3%; and increased modestly in 2018 to 7.6% (**Figure 1**; Section III of the **Supplement**). From 2010 to 2014, the nonstandardized rate of leavers increased, almost doubling from 1.6% to 3.1%; movers increased modestly from 3.7% to 4.2%. Both rates were stable from 2014 to 2017, and both increased modestly, by 0.2 percentage point, from 2017 to 2018. In the additional years of data available for moving, the rate of moving remained stable through 2020.

Standardized annual rates of physician moving were similar to nonstandardized rates in all years (**Figure 1** and **Table**). The standardized annual rates of physician leaving were slightly higher than the nonstandardized rates in 2010 and 2011–standardized rates of 1.7% and 2.3% relative to nonstandardized rates of 1.6% and 2.1%–and slightly lower than the nonstandardized rates in 2016, 2017, and 2018–standardized rates of 3.1% or 3.3% relative to nonstandardized rates of 3.0% or 3.1%.

The Table presents standardized annual rates of physician moving and leaving by year as well as by physician, patient, and practice characteristics. Younger physicians were more likely to move: 5.6% of physicians aged 35 to 44 years moved in a given year compared with 2.6% of physicians aged 65 years or older (difference, 3.0 percentage points [95% CI, 2.9 to 3.0 percentage points]; $P < 0.001$). Older physicians were substantially more likely to leave, with 9.8% of physicians aged 65 years or older stopping practice relative to 1.4% of physicians aged 35 to 44 years (difference, 8.4 percentage points [CI, 8.3 to 8.5 percentage points]; $P < 0.001$). Physicians residing in rural areas were more likely than those in urban areas to move (5.1% vs. 3.9%; difference, 1.2 percentage points [CI, 1.1 to 1.2 percentage points]; $P < 0.001$) and leave (3.3% vs. 2.7%; difference, 0.6 percentage point [CI, 0.6 to 0.7 percentage point]; $P < 0.001$). Female physicians were more likely to move and leave than male physicians: 0.5 percentage point (CI, 0.5 to 0.6 percentage point; $P < 0.001$) or 13% more likely to move, and 1.0 percentage point (CI, 1.0 to 1.1 percentage points; $P < 0.001$) or 38% more likely to leave.

Relative to those in larger practices, physicians in solo or 2-physician practices were less likely to move (3.4% vs. rates of 3.8% to 4.4% depending on practice size) and leave (2.5% vs. rates of 2.7% to 3.0%). Compared with physicians seeing fewer dual-eligible patients, those seeing a higher proportion of such patients were more likely to move (top vs. bottom quartile: 4.2% vs. 3.9%; difference, 0.3 percentage point [CI, 0.3 to 0.4 percentage point]; $P < 0.001$) and leave (top vs. bottom quartile: 3.5% vs. 2.9%; difference, 0.6 percentage point [CI, 0.5 to 0.7 percentage point]; $P < 0.001$). Across the 3 practice-level variables capturing the proportion of racial and ethnic minority patients–Black, Hispanic, and other non-White–the relationship between a higher proportion of minority patients and moving or leaving was inconsistent.

Across broad specialty categories, hospitalists had the highest annual moving rate (5.4%), followed by surgical specialists (4.5%) and primary care physicians (4.0%). Obstetrician-gynecologists had the lowest annual rate of moving (3.5%). Hospitalists also had the highest rate of leaving (3.6%), followed by primary care, obstetrics-gynecology, and hospital-based physicians (annual leaving rates between 3.1% and 3.2%). Medical and surgical specialists had the lowest rates of leaving (2.0% and 2.4%,

Table. Standardized Turnover Rate, by Physician, Patient, and Practice Characteristics*

Variable	Physicians, *n*	Move Practice		Leave Practice	
		Standardized Rate	Difference†	Standardized Rate	Difference‡
Year					
2010	464 305	3.7	–	1.7	–
2011	477 876	3.8	0.1	2.3	0.6
2012	488 908	3.9	0.2	2.5	0.8
2013	497 707	3.9	0.2	2.8	1.1
2014	505 842	4.2	0.5	3.0	1.3
2015	511 038	4.1	0.4	3.2	1.5
2016	515 532	4.2	0.5	3.0	1.3
2017	522 810	4.1	0.4	3.0	1.3
2018	530 925	4.3	0.6	3.1	1.4
2019	537 477	4.2	0.5	–	–
2020	538 063	4.1	0.4	–	–
Physician covariates					
Age					
35–44 y	1 880 240	5.6	–	1.4	–
45–54 y	1 599 804	3.6	−2.0	1.6	0.2
55–64 y	1 403 222	3.1	−2.5	3.0	1.6
≥65 y	707 217	2.6	−3.0	9.8	8.4
Sex					
Female	1 561 285	4.4	–	3.6	–
Male	4 029 198	3.9	0.5	2.6	1.0
Specialty					
Primary care	1 611 236	4.0	–	3.2	–
Medical	1 150 115	3.7	−0.3	2.0	−1.2
Surgical	1 020 811	4.5	0.5	2.4	−0.8
Obstetrics-gynecology	333 387	3.5	−0.5	3.1	−0.1
Hospital-based	1 246 171	3.9	−0.1	3.1	−0.1
Hospitalist	228 763	5.4	1.4	3.6	0.4
Rurality§					
Nonrural	5 049 009	3.9	–	2.7	–
Rural	541 474	5.1	1.2	3.3	0.6
Census region					
Northeast	1 237 567	4.0	–	2.5	–
Midwest	1 264 658	3.8	−0.2	2.8	0.3
South	1 963 574	4.4	0.4	2.7	0.2
West	1 124 684	3.8	−0.2	3.1	0.6
Practice covariates					
Practice size					
1–2 physicians	1 190 947	3.4	–	2.5	–
3–9 physicians	895 008	4.1	0.7	2.9	0.4
10–20 physicians	550 902	4.3	0.9	3.0	0.5
21–50 physicians	661 642	4.3	0.9	2.8	0.3
51–199 physicians	996 669	4.4	1.0	2.9	0.4
200–499 physicians	590 467	4.2	0.8	2.9	0.4
≥500 physicians	704 848	3.8	0.4	2.7	0.2
Percentage of dual-eligible patient visits‖					
Quartile 1 (lowest)	1 043 025	3.9	–	2.9	–
Quartile 2	1 042 629	4.2	0.3	2.8	−0.1
Quartile 3	1 042 994	4.3	0.4	3.0	0.1
Quartile 4 (highest)	1 042 629	4.2	0.3	3.5	0.6
Percentage of Black patient visits‖					
Quartile 1 (lowest)	1 042 844	4.4	–	3.3	–
Quartile 2	1 042 806	4.3	−0.1	2.9	−0.4
Quartile 3	1 043 012	4.1	−0.3	2.9	−0.4
Quartile 4 (highest)	1 042 635	3.8	−0.6	3.2	−0.1
Percentage of Hispanic patient visits‖					
Quartile 1 (lowest)	1 042 840	3.7	–	3.4	–
Quartile 2	1 042 838	4.0	0.3	2.9	−0.5
Quartile 3	1 042 859	4.4	0.7	2.9	−0.5
Quartile 4 (highest)	1 042 760	4.4	0.7	3.1	−0.3
Percentage of other non-White patient visits‖					
Quartile 1 (lowest)	1 042 831	3.8	–	3.4	–

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Table–Continued

Variable	Physicians, *n*	Move Practice		Leave Practice	
		Standardized Rate	Difference†	Standardized Rate	Difference‡
Quartile 2	1 042 831	4.0	0.2	3.0	−0.4
Quartile 3	1 042 829	4.4	0.6	2.9	−0.5
Quartile 4 (highest)	1 042 806	4.3	0.5	2.9	−0.5

* Results were derived from logit models with robust SEs clustered at the physician level. Separate regressions were used to estimate standardized rates of moving and leaving. The sample for moving estimates is based on 2010 to 2020; the sample for leaving estimates is based on 2010 to 2018, the years in which the leaving measure was available. For all characteristics except percentage of beneficiary visits, covariates included year fixed effects, all physician variables, and practice size. For percentage of beneficiary visits, regressions were based on a sample limited to years for which these variables were available, 2012 to 2020 (moving) and 2012 to 2018 (leaving). Covariates included year and state fixed effects as well as all other physician and practice characteristics (omitting census region).
† *P* values for all differences are <0.001 except for percentage of Black visits, quartile 2 difference ($P = 0.060$).
‡ *P* values for all differences are <0.001 except for the following differences: obstetrics-gynecology ($P = 0.44$); hospital-based ($P = 0.39$); percentage of dual-eligible visits, quartile 2 ($P = 0.054$); percentage of dual-eligible visits, quartile 2 ($P = 0.034$); and percentage of Black visits, quartile 4 ($P = 0.043$).
§ Based on core-based statistical area, as reported in the Medicare Data on Provider Practice and Specialty file, to create an indicator for practicing in a rural area, as defined by the Office of Management and Budget (19).
‖ The proportion of beneficiary visits for a practice (defined as physicians billing under the same Tax Identification Number) was defined using the 20% Medicare Carrier file, 2012 to 2020 for standardized move estimate or 2012 to 2018 for standardized leave estimate. Variables were available only for physicians who billed in years 2012 to 2020. The proportion of visits was categorized into quartiles.

respectively). Across all specialty categories, turnover increased by at least 35% between 2010 and 2018, except for hospitalists, whose rate declined slightly (**Figure 2**).

The standardized quarterly rate of turnover increased 33% in the first quarter of 2020 relative to the year prior, from 3.1% to 4.1%, but subsequently declined by 6% and 7% in the second and third quarters, respectively, of 2020 compared with those same quarters in 2019 (**Figure 3**). An increase in physicians who stopped billing for 3 months accounted for the change in the first quarter of 2020.

Sensitivity and Additional Analyses

Analyses using alternate definitions of movers resulted in similar annual rates (Section IV of the **Supplement**). For leavers, we compared rates of leaving as defined by leaving for 1, 2 (original definition), or 3 years as well as 3 months; trends over time were similar across all definitions. However, annual overall turnover rates were 0.8 to 1.0 percentage point (12% to 15%) higher or 0.3 to 0.4 percentage point (4% to 6%) lower when leaving was defined as leaving for 1 or 3 years, respectively, rather than 2 years. The annual turnover rates were considerably higher when restricted to 3 months: 6 percentage points or 2- to 4.5-fold higher. Results were consistent when we applied various age thresholds to the sample and when we applied various modeling choices (Sections V and VI of the **Supplement**).

Between 2013 and 2020, approximately 750 physicians left rural practices to work in a nonrural setting, which represents 1.3% of physicians in a rural practice in 2013 (Section VII of the **Supplement**). Between 2013 and 2020, there was a net migration of physicians out of the Northeast and Midwest of 2.4% and 2.3%, respectively, and a net migration into the South and West of 1.4% and 3.1%, respectively.

DISCUSSION

In these first national estimates using a novel method of identifying physician turnover, the annual turnover rate increased 43%, from 5.3% to 7.6%, between 2010 and 2018. Most of this change occurred between 2010 and 2014. During those years, the rate of leaving practice doubled from 1.6% to 3.1%, whereas the rate of moving increased modestly from 3.7% to 4.2% (14%). Both rates stabilized from 2014 to 2017 and then increased in 2018. These analyses, limited to measuring moving and leaving during the first 3 quarters of 2020, showed no indication yet of an effect of the COVID-19 pandemic on increasing turnover rates. In fact, in the second and third quarters of 2020, turnover was slightly lower than in the corresponding quarters of 2019.

The causes of the increase in physicians leaving practice between 2010 and 2014 are not known. Annual nonstandardized and standardized turnover rates were similar, suggesting that changes in the physician age distribution or other physician and practice characteristics did not account for the increase. Observed changes in physician turnover could be cyclical—related to the overall economy—yet specific to the health care industry. The beginning of our study period coincided with the Great Recession, when worker retirement decreased modestly across the nation (21, 22), which is counter to our finding of an increase in the proportion of physicians leaving. The beginning of our study period also coincided with the "meaningful use" program that strongly incentivized physicians to adopt electronic health records (23). Some studies have suggested a link between electronic health record use and physician burnout (24, 25), whereas other case studies have found an association between physician burnout and turnover (3, 17). Whether or to what extent turnover is linked to burnout is unknown at this time.

There were many differences in turnover rate by physician, practice, and patient panel characteristics. Not surprisingly, older physicians were substantially more likely to leave practice, and younger physicians were more likely to move to another practice. We note 3 additional findings and their implications.

First, rural physicians were more likely to stop practicing than nonrural physicians. Standardized for physician age and other factors, 3.8% of rural physicians left

annually compared with 3.0% of nonrural physicians. Although this difference is relatively small, over time it would compound existing workforce and equity concerns because rural patients, who are generally poorer and older with more chronic conditions, already have less access to health care providers than their urban counterparts (26). Of note, our data did not include nurse practitioners or physician assistants, whose numbers have dramatically increased in the past decade and who might help alleviate workforce concerns in rural areas (27).

Standardized rates of moving were also higher in rural areas than nonrural areas (5.1% vs. 3.9%). Of note, however, physicians who moved often moved within a rural area, because the net migration out of rural regions due to moving was lower than 0.2% per year (Section VII of the Supplement).

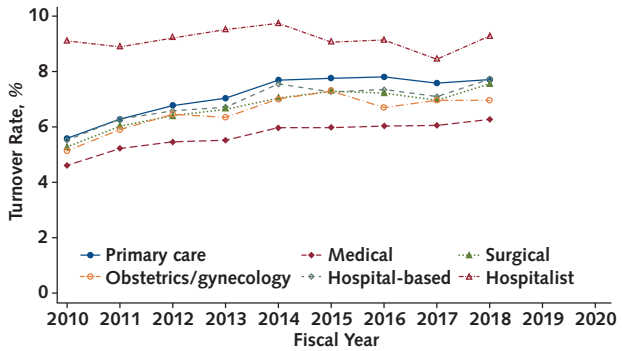
Second, in standardized analyses that accounted for such factors as female physicians being on average younger, women were more likely to move and to leave than men. Because women currently make up more than half of recent medical school graduates, retaining women will become increasingly important for organizations (28). Caring for children and elderly parents continues to fall primarily on women even when they are in a dual-income household (29). Although research has shown that increased parental leave positively affects parents, children, and career satisfaction, many physicians have limited or no access to paid personal leave (30, 31).

Third, standardized rates of moving and leaving were higher for physicians in practices that saw more dual-eligible patients. Similar to concerns for the rural workforce, higher turnover in practices providing more care to dual-eligible patients exacerbates problems of access and continuity of care for these clinically and socially complex patients (32, 33).

To estimate physician turnover nationally, previous studies relied on surveys that had low response rates or measured a physician's intention to move or leave (15, 34–38). More reliable estimates align well with the new findings from our analyses (3, 17, 39). For example, Hamidi and colleagues (17) sampled physicians associated with Stanford University and found a 2-year turnover rate of 13% for 2014 and 2015, similar to our 14.4% national estimate in these years as well as the 13.5% rate we estimated for Stanford medical groups specifically in these years. Neprash and colleagues (40), using 20% Medicare claims data, estimated that 14% of physicians left practice between 2009 and 2016, compared with our estimate of 21.4% between 2010 and 2017. The difference between estimates is likely due to the slightly disparate time frames and differences in measurement. We required a physician to stop billing for at least 2 years to be defined as leaving practice, whereas Neprash and colleagues did not set a limit for leaving—it could be between 1 and 8 years. Further, Neprash and colleagues did not attempt to identify physicians who moved practice, which is a major contribution of our method.

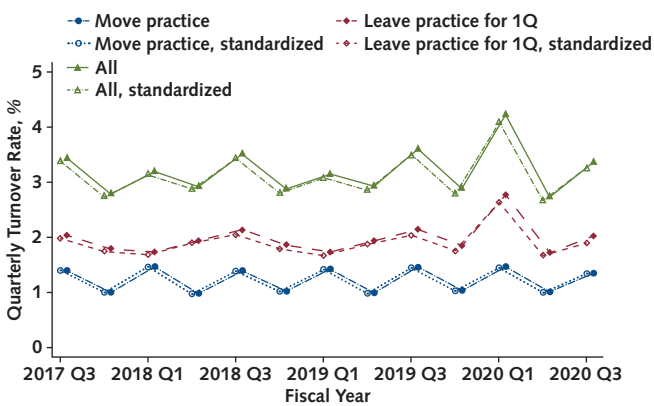
Our study has several limitations. First, we used billing data from traditional Medicare to infer turnover. If a physician continues to practice but stops seeing traditional Medicare patients, we will erroneously count that physician as leaving practice. Second, we could not measure burnout or correlate it with turnover. Measuring this correlation would be difficult on a large scale because measuring burnout through large surveys is expensive and highly subject to nonresponse bias, but it could be attempted on a more local, focused scale. Third, we could include only physician and patient characteristics available in Medicare claims.

Figure 2. Standardized physician turnover rate, by year and specialty, 2010–2020.



The overall standardized rate of physician turnover, by specialty and year, from 2010 to 2020. Year is defined as July to June. Standardized estimates were derived from logit models with robust SEs clustered at the physician level. Standardized physician turnover rate is the sum of standardized rates of moving and leaving. Separate regressions were used to estimate standardized rates of moving and leaving (see Appendix Figure, available at Annals.org). Estimates were standardized for physician age, sex, specialty, rurality, census region, and practice size.

Figure 3. Quarterly turnover rate, third quarter of 2017 to third quarter of 2020.



The quarterly rate of physician turnover, quarterly rate of physicians moving practice, and quarterly rate of physicians leaving practice, by year, from 2017 to 2020. Physician leaving is defined as a physician who stops billing for at least 1 quarter. Standardized estimates were derived from logit models with robust SEs clustered at the physician level. Separate regressions were used to estimate standardized rates of moving and leaving. Sample estimates are based on 2017 to 2020. Estimates were standardized for physician age, sex, specialty, rurality, census region, and practice size. Q = quarter.

The new method provides a consistent estimate of national rates of physician turnover—a metric that has never been rigorously and systematically captured. Furthermore, the method enables comprehensive analysis of physician turnover—both movers and leavers—at the physician level, allowing researchers to observe annual and even monthly rates of turnover at the national, regional, local, and medical group levels, and stratified by physician, practice, and patient panel characteristics. The claims-based method used in this study may be particularly important because reliable annual estimates of physician turnover from national surveys are costly and could have low response rates. The method should be useful for various future research studies and be of practical interest to leaders of medical groups, medical specialty associations, health systems, health insurers, and federal and local policymakers.

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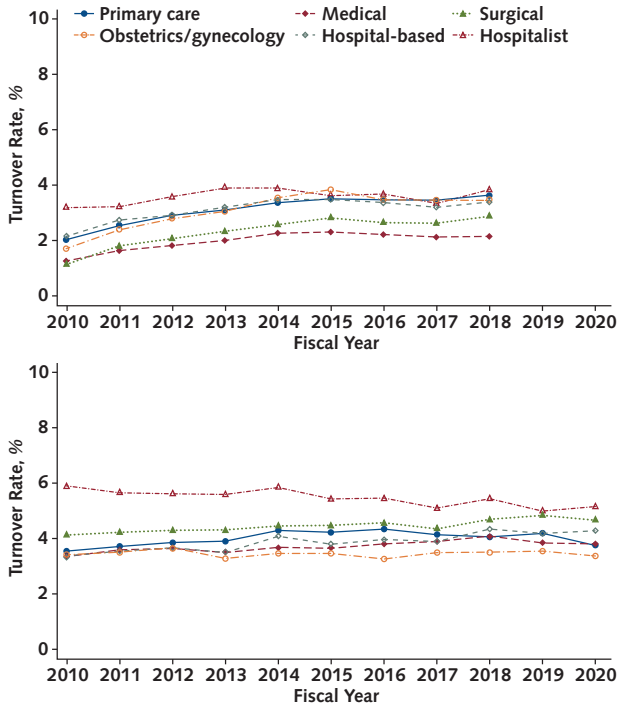
Appendix Figure. The standardized rate of physician leaving (*top*), and standardized rate of physician moving (*bottom*), by specialty and year, from 2010 to 2020.



Year is defined as July to June. Standardized estimates were derived from logit models with robust SEs clustered at the physician level. Separate regressions were used to estimate standardized rates of moving and leaving. The sample for moving estimates is based on 2010 to 2020; the sample for leaving estimates is based on 2010 to 2018, the years in which the leaving measure was available. Estimates were standardized for physician age, sex, specialty, rurality, census region, and practice size.