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Physician Retention in Community and Migrant Health Centers
Who Stays and for How Long?

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OBJECTIVES. This study used discrete-time survival analysis to estimate the tenure of primary care physicians in Community Health Centers (CHCs), to identify the changing risk of leaving Community Health Center employment as time passes, and to identify factors associated with a physician's likelihood of remaining in a Community Health Center. Because of dramatic differences in physician career trajectories, much of the focus was on differences between physicians with and without National Health Service Corps obligations.

METHODS. Beginning with an administrative dataset at the Bureau of Primary Health Care that listed primary care physicians for each Community Health Center, the completeness and accuracy of the information provided were verified and an analytic database of all physicians working in those centers during a 21-month measurement window from January 1, 1990 through September 30, 1992 was constructed. The data included start and end dates, percent full-time equivalent status, and certain demographic characteristics. In addition, several data elements describing the Community Health Center were merged onto each physician record. These included urban or rural location, expenditure level, productivity, and federal grade. Through the use of discrete-time survival analysis, it was possible to include in the analytic sample all 2,654 physicians who worked during the period, even those who started working before January 1, 1990 and those who were still working on September 30, 1992. Survivor functions were estimated show-

ing the proportion of physicians remaining after each quarter of their tenure (ie, after the fourth quarter of work, after the 12th quarter of work, etc). In addition, hazard functions were estimated showing the risk that a physician who had worked through the end of one quarter would leave during the following quarter. Finally, multivariate analysis demonstrated the relation of certain physician and center characteristics to the likelihood of the physician's leaving the center during each quarter.

RESULTS. The median tenure of primary care physicians in Community Health Centers was approximately 3 years regardless of whether or not the physician had a National Health Service Corps obligation. But the career trajectories for the two groups of physicians varied dramatically. Most physicians left on or about their anniversary date, probably because it coincided with the end of their contract, but the effect was much more pronounced for National Health Service Corps physicians than for non-National Health Service Corps physicians. By the end of 5 years, approximately 36% of physicians who started without an National Health Service Corps obligation were still working compared with only approximately 17% of those with an National Health Service Corps obligation.

CONCLUSIONS. The study demonstrates the value of discrete-time survival analysis in addressing questions related to the tenure of primary care physicians in Community Health Centers, making it possible to use data from physicians whose Community Health Center

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careers began before or ended after a given measurement window. Second, the study measured primary care physician tenure, providing center directors with a yardstick against which to compare their own center's performance. Finally, the data provided some help in trying to explain

differences in the propensity to stay or leave employment in Community Health Centers.

Key words: primary care physicians; community health centers; physician retention; National Health Service Corps; survival analysis; hazard models. (Med Care 1998;36:1198-1213)

Access to appropriate health care services will be a problem for many Americans for many years to come. In some instances, the reason will be lack of insurance coverage, which appears to be a growing phenomenon as competition among private insurers and managed care organizations intensifies under pressure from employers. In others, the primary reason will be the absence of enough providers for the population residing in underserved areas. In many cases, these two aspects of the access problem go together.

In this context, Community and Migrant Health centers (C/MHCs) will continue to have an important role to play even if the national government were to adopt some form of health care reform, which seems unlikely in the near future. Although universal coverage would make access more secure for most Americans, residents of medically underserved communities will continue to need C/MHCs to overcome deficits in the supply of health care services. Underserved communities in isolated rural areas will always have difficulty attracting and retaining providers to meet the needs of the population. At the same time, well-capitalized new or expanding managed care organizations are competing for primary care providers who might be attracted to practice in underserved urban areas, where isolation is not an issue.

Community and Migrant Health centers will continue to need primary care physicians and will face increasing competition for them. Yet, retention of primary care physicians has been a difficult challenge for Centers.^{1,2} As marketplace conditions change and, with them, the demands and opportunities for both physicians and C/MHCs, it will be very important for health center leaders to understand the primary influences that result in physician decisions to continue practicing in C/MHCs or to leave them. In that connection, prior experience can be a useful guide to the future. Several questions are of particular importance:

1. How long do individual primary care physicians stay in C/MHCs?
2. When in their tenure are physicians most likely to leave C/MHCs?

3. How do physician tenure patterns vary with physician characteristics?

4. What factors affect a physician's likelihood of remaining in a C/MHC?

A three-part study, funded jointly by the Agency for Health Care Policy and Research (AHCPR) and the Bureau of Primary Health Care (BPHC), was undertaken to answer these questions. In this report, we present results based on the provider profile data base found in the set of common reports that formerly were submitted by all federally funded health centers to the Bureau of Primary Health Care and its predecessor agencies. First, we will discuss the importance of the issue of physician retention, what was learned from previous studies, and what the present study will contribute. Then, we will describe the methods and raise certain key issues, especially about the "censoring" of data on particular individuals. Findings will be presented in the third section and, finally, we will discuss the meaning of those results.

The Issues

Community and Migrant Health Centers, with financial support from the Bureau of Primary Health Care of the Health Resources and Services Administration (HRSA), are an important source of health care services for residents of medically underserved communities. Currently, more than 550 federal grantees across the country operate approximately 1,500 health centers, with more than 2,100 physicians, serving almost six million people each year. What is common to all of the communities served by the centers is that they have been judged to have too few providers of care to meet the residents' needs. In some cases, the reason is that the communities are rural, and the small population is dispersed over a wide geographic area; in others, it is that the residents tend to have little income and no insurance or are members of minority ethnic or racial groups. Regardless of the main reason in a particular community, residents of

areas served by C/MHCs have few, and in some cases, no alternative sources of care.

A center's ability to provide access to good quality services for its otherwise underserved population depends in part on the extent to which it is able to attract and then retain competent health care professionals. Patients who trust their physicians are more likely to follow a recommended treatment plan, and turnover disrupts the patient-physician relationships necessary to build and sustain that trust. In addition, turnover adds to the cost of care by requiring the center to spend money to recruit new physicians, to offer them attractive compensation and benefit arrangements, to orient them to the center's distinctive mission and procedures, and to both compensate for the patients who will seek care elsewhere and allow the new physician to build his or her own practice at the center. Although some turnover is to be expected, an excessive amount can undermine patient confidence in the center and even in the ability of medical care to produce desired outcomes and can force the center to spend its scarce resources on activities other than delivering services.

In recent years, facing fiscal and other constraints, including the severe reduction in force of the National Health Service Corps (NHSC), many centers have had difficulty retaining clinical staff, especially physicians. Since its creation in 1970, the NHSC had been the single largest source of clinical staff for health centers and other programs in underserved areas; however, NHSC field strength declined steadily after the mid-1980s. Only in the last few years have the numbers of NHSC providers begun to increase again, but they are still far less than previous levels. Moreover, although the number of physicians per capita has grown nationally and some diffusion of primary care physicians has occurred, estimates are that 4,000 primary care physicians are needed in Health Professions Shortage Areas (HPSAs) around the country.³⁻⁵

During the 1980s, many C/MHCs previously reliant on the NHSC began to experience long-term provider vacancies that threatened their survival. In 1992, the number of provider vacancies in C/MHCs nationwide was estimated to be between 700 and 800 full-time positions. Although the problem was recognized in the 1990 NHSC Revitalization Amendments to the federal budget, the projected supply of NHSC scholars or volunteers continues to be considerably less than re-

quired to staff designated HPSAs across the country. Thus, the already large number of vacancies was expected to grow. The National Association of Community Health Centers predicted that, without further assistance, as many as 200 health centers, especially those located in rural areas, would be forced to close.⁶

With the decline of the NHSC Program, in FY 1988 retention of existing physicians and recruitment of volunteer physicians became the highest priority of the BPHC, the agency responsible for the federally funded C/MHC program. A supplemental recruitment and retention grant program committed approximately \$20 million to the enhancement of physician salaries and benefits in C/MHCs and the development of recruitment and retention plans. Department of Health and Human Services Regional Offices and state and regional Primary Care Associations sponsored training sessions for Executive Directors, Medical Directors, and governing boards of health centers around the country targeting retention issues. Repeatedly since FY 1988, BPHC has identified physician recruitment and retention as one of its highest priorities.

To try to learn what might be done to encourage physicians to remain working in centers, several regional offices conducted or commissioned studies that produced a number of common findings.⁷⁻¹⁰ First, not surprisingly, compensation was clearly important to physicians in C/MHCs and, below some threshold, appeared to contribute strongly to a decision to leave a center. Given "reasonable" compensation (which may be at some level below that of the private sector), the majority of physicians in C/MHCs identified a number of other factors that may have even higher priority, including personal fulfillment, professional satisfaction, manageable workload (including shared call duties), professional participation in organizational decision-making, and long-term security.

In the past few years, in response to the staffing strains identified both nationally and locally, individual C/MHCs have attempted to improve retention practices. Yet, as the numbers presented earlier demonstrate, retention remains a critical issue for many C/MHCs. A comprehensive study of physician retention can contribute to solving this dilemma by, among other things, estimating the true extent of the retention problem, providing a more complete understanding of the role of the NHSC in light of its recent expansion, and focus-

ing on factors related to practice in a health center, especially the relationship between professional physicians and center management.

The larger study, of which the present report is a part, attempts to address those issues using data from BPHC records, surveys of physicians, and case studies comparing centers with stable and unstable staffing patterns. In addition, it was designed to avoid some of the methodological weaknesses of previous studies. First, it includes data from physicians who have actually left centers, not just those who still worked there and thought they may be leaving. Second, in addition to comparing physicians who have left with those who have remained in centers, the study provides data on when in their tenure at a center physicians were at greatest risk of leaving. And, third, the larger study also will examine individual health center organizations and the role that internal operational factors and conditions play in affecting retention.

In this report, data are presented on the number and proportion of physicians who leave health centers, the periods in their tenure when they are at greatest risk for leaving centers are estimated, and, given the limits of the available dataset, some of the factors associated with the decision to leave are identified.

Methods

Sample

The BPHC provided data from the computerized information system known as BHCDANET on all physician personnel working in federally funded C/MHCs on January 1, 1990. We focus here on data for primary care physicians, defined as those specializing in family practice, general internal medicine, pediatrics, obstetrics and gynecology, or general practice. For each provider, we were able to obtain his or her health center identification number, employment start date and end date, degree, specialty, NHSC affiliation (if any), last known full-time equivalent (FTE) status, last known salary, birthdate, and race.

Because a number of data elements were missing from individual records and because the recency of the data available from the Provider Profile varied from center to center, the set of provider information for each individual health center was forwarded to the center's Executive Director for review. We created a special form and, separately for each center, listed each person

known to be working on January 1, 1990, along with start and end dates and the additional items of information just listed. Each form was sent to the Executive Director of the appropriate center with a request that it be corrected and updated through September 30, 1992, the end of the 1992 federal fiscal year, so that we could have confidence that the information for each person was accurate and so that personnel omitted from the original list, but who had in fact been working there on January 1, 1990 could be added. Each form and request was accompanied by a letter from Dr. Marilyn Gaston, the Bureau's Director, who asked for the Executive Director's assistance in verifying the data. With mail and telephone follow-up, responses were received from 350 centers (69.2%) by January 1993. In addition to the provider information, variables were created and added to each record describing certain health center characteristics. These variables were rural/urban designation, type of grant funding (CHC, MHC, or both), total FTE staff, number of medical visits, total center expenditures, medical visits per FTE provider team, percent of self-pay users, and center "grade" in 1991, which was the result of an assessment applied by the BPHC to reflect overall organizational quality and stability.

Because of the great heterogeneity in entry cohort within the group of primary care physicians (it included people hired as long as 30 years earlier), we selected for analysis only those individuals on the corrected lists who were hired initially in calendar year 1986 or later. Thus, the database used in this study consisted of the updated records of all physicians working during the 21-month measurement window of January 1, 1990 through September 30, 1992.* This analytic sample comprised 2,654 physicians—915 of whom were in the NHSC and 1,739 of whom were not.

Measures

We explored the relation between employment duration and two sets of predictors in the dataset: those characterizing the physicians themselves

*This updated list also was the population from which separate samples of physicians still working at a center (stayers) and physicians who were no longer working at a center (leavers) were selected for surveys concerning their job satisfaction and other factors relating to their decision to continue working at a C/MHC or to leave. Additional reports are being prepared with the results of those surveys.

and those characterizing the centers in which they worked. Physician characteristics included the usual set of demographics (gender, race, and age at hire) as well as three dummy variables that indicated whether the physician was NHSC obligated,[†] working part-time, and a specialist. Centers were characterized in terms of their total annual expenses, number of visits per year, number of FTEs, productivity (visits/full-time staff), Federal grade, urban or rural location, and by whether they served a migrant population (either exclusively or in addition to a community population).

For each physician, we measured his or her employment duration by computing the length of time between the date of hire and the date of exit (if no longer employed at a C/MHC) or between the date of hire and the date of censoring (30 September 1992). Because the use of these updated personnel records provided us with seemingly precise information on the physicians' dates of hire and exit, we initially considered measuring length of service in days (or weeks) and analyzing the data using continuous-time survival methods. Instead, however, we decided to express employment duration in quarterly (3-month) intervals for two reasons: first, for 99 physicians, the data tape indicated only the physician's start or exit month, not day. As a result, we were forced to measure duration using a minimum of month-long intervals. Second, exploratory statistical analyses revealed a pronounced periodicity in physicians' exit patterns, with concentrated portions of the sample leaving on or near annual anniversary dates. To highlight this finding, we needed to summarize career durations in an aggregated unit. After comparing empirical results obtained from analyses with time measured in 1-month intervals and those obtained in analyses with 2-month, 3-month, and 6-month intervals, we chose to use the quarterly intervals presented here, in large part because they both allowed us to highlight the prominent anniversary effects and provide sufficient specificity to observe the decrease in risk of leaving a center immediately after the anniversary quarter ends.

[†]NHSC physicians include both currently obligated physicians and those who were previously obligated and remained in their centers even after having fulfilled their contract. We included the previously obligated physicians in the NHSC group for the purpose of understanding long-term retention of NHSC physicians.

The issue of missing start dates raises the issue of missing data more generally. For all but two of the predictors, relatively little data were missing (usually less than 2% of the sample; see Table 1). For age at hire and race, however, information was missing for just more than 15% of the sample. We set these cases aside and conducted sensitivity analyses by refitting models using only those cases with complete information on the predictors (as described in the next section on the analytic approach).

Analytic Approach

Quantitative research on physician retention in underserved areas must confront several methodological challenges.^{11,12} The core dilemma in the present case was how to include the 1,604 physicians in our sample who were still working when data collection ended and for whom the outcome, employment duration, therefore cannot be known (that is, was censored). For these physicians, who represented 60.4% of the sample, we did not know precisely how long they would stay; all we knew was that they remained at a C/MHC from their start date at least until September 30, 1992. Although some may have left soon thereafter and others will work at these centers for years to come, there was no way of knowing how many years any individual physician would ultimately remain. In spite of this, censored physicians provide much information, especially about the probability that physicians will continue to work at centers for relatively long periods of time. Accurate analysis of career path data must include censored physicians even though their eventual employment durations are unknown.

Survival analysis is one statistical technique that permits simultaneous study of the employment durations of physicians who have left and physicians who have not.¹³⁻¹⁶ Commonly used by biostatisticians studying human lifetimes (where the event of interest is death), survival analysis can be used to study how long it takes for any event to occur, even when the event being studied is within the individual's control. In this case, because employment duration was measured in quarterly intervals, we used discrete-time survival analysis, which focuses not on employment duration directly, but on the conditional probability (called the hazard rate) that a physician leaves a center in any particular quarter, given that he or she worked continuously until that quarter.

TABLE 1. Number and Percentage of Physicians Overall (n = 2,654), With National Health Service Corps Obligation (n = 915), and Without Obligation (n = 1,739), by Predictor

Predictor	Obligation		No Obligation		Chi-square	P
		%		%		
Physician characteristics						
Sex						
Male	559	61.1	1014	58.3	0.1	0.763
Female	352	38.5	655	37.7		
Missing	4	0.4	70	4.0		
Race						
White	407	44.5	730	42.0	0.6	0.425
Asian	21	2.3	128	7.4	40.0	<0.001
Black	222	24.3	214	12.3	46.7	<0.001
Hispanic	149	16.3	228	13.1	1.7	0.196
Other	10	1.1	102	5.9	47.6	<0.001
Missing	106	11.6	337	19.4		
Specialty						
Specialist	110	12.0	292	16.8	12.5	<0.001
Primary care	804	87.9	1408	81.0		
Missing	1	0.1	39	2.2		
FTE status						
Part-time	68	7.4	704	40.5	377.4	<0.001
Full-time	846	92.5	1009	58.0		
Missing	1	0.1	26	1.5		
Center characteristics						
Expenses						
<\$2 million	318	34.7	504	29.0	9.3	0.002
\$2-5 million	362	39.6	696	40.0	0.1	0.818
>\$5 million	235	25.7	539	31.0	8.3	0.004
Visits						
0-22,000	245	26.8	409	23.5	3.4	0.065
22,001-40,000	250	27.3	430	24.7	2.1	0.147
40,001-60,000	187	20.4	375	21.6	0.5	0.499
>60,000	233	25.5	525	30.2	6.6	0.010
Staff FTEs						
1-35	261	28.5	383	22.0	13.6	<0.001
36-69	260	28.4	446	25.6	2.3	0.126
70-120	212	23.2	422	24.3	0.4	0.528
>120	182	19.9	488	28.1	21.8	<0.001
Productivity						
1-4,400	234	25.6	460	26.4	0.2	0.624
4,401-4,800	243	26.6	540	31.1	5.9	0.015
4,801-5,200	188	20.5	313	18.0	2.5	0.113
>5,200	250	27.3	426	24.5	2.5	0.114

(Continued)

TABLE 1 (Continued)

Predictor	Obligation		No Obligation		Chi-square	P
		%		%		
Federal grade						
A	363	39.7	695	40.0	0.0	0.883
B	430	47.0	722	41.6	7.3	0.007
C,D,E	119	13.0	320	18.4	13.1	<0.001
Rural/urban						
Rural	575	62.8	814	46.8	62.3	<0.001
Urban	340	37.2	925	53.2		
Location						
Migrant	288	31.5	427	24.6	14.4	<0.001
Community	627	68.5	1312	75.4		

FTE, full-time equivalent.

The hazard rate can be estimated just like any statistical quantity. If few physicians leave during the first few quarters on the job, early hazards (risks) are low. In contrast, if many physicians who remain until their fourth year leave in the quarter corresponding to their anniversary of hire, the fourth year (or 16th quarter) anniversary risk is high. Plots of risk versus years of work completed describe the quarter-to-quarter changes in the risk of leaving during the period of employment in a C/MHC.

By building hazard models, relations between hazard and various predictors can be explored. By using discrete-time hazard models instead of more familiar regression models (or logistic regression or even proportional hazards models), we were able not only to analyze appropriately censored and noncensored data simultaneously, but also to determine whether the effects of predictors remained constant across the physicians' careers or whether they varied with time. This allowed us to discover, for example, that the entire profile of risk with time for physicians with NHSC obligations differed from that of nonobligated physicians.

The results reported here are based on a sequence of discrete time hazard models that linked the risk of leaving a C/MHC to physician and center characteristics.¹³ Because the employment patterns of NHSC physicians and nonobligated physicians differed so dramatically (as described

in the results section), separate but parallel analyses were conducted for these two groups. Initial models explored the relation between hazard and the physicians' age at hire, gender, race, specialty, and full-time status. Subsequent models examined the effects of center characteristics after controlling for physician characteristics. At each stage, we explored the main effects of each predictor and all possible interactions between predictors. Of all the interactions tested, that between the center's Federal grade and its annual expenses was the only one found. For each predictor, we examined issues of functional form by comparing models using variables expressed in linear and quadratic forms (for continuous variables) with models using variables expressed as a set of indicators. All comparisons highlighted in the text were significant at the 0.05 level (using two-tailed tests).

In addition to presenting parameter estimates and associated standard errors for our discrete-time hazard models, we summarize our analytic results using three related statistics: (a) fitted hazard functions for subgroups of physicians; (b) estimates of median employment duration, the number of years that pass before half of a given group of physicians leave their centers; and (c) cumulative survival rates, the percentage of a cohort of physicians that remains 1, 3, and 5 years after hire.

Before moving to a discussion of our results, we draw attention to an analytic dilemma we en-

countered and describe our approach to resolving it. Our sample, which includes all individuals employed during a prespecified measurement window, is known by economists as a stock sample.¹⁷ Half of the sample ($n = 1,372$) were hired before the measurement window began (that is, between January 1, 1986 and December 31, 1989) and half ($n = 1,292$) were hired afterward (on or after January 1, 1990). Use of the data for the 1,372 physicians hired before the measurement window began presented a serious challenge. These data could not be used to describe the career trajectories of all physicians hired before the measurement window began because, by design, our sample provided no data on their colleagues who entered the C/MHCs at the same time, but who left earlier, before the measurement window began. Yet we did not want to set these physicians aside because they provide information about the risk of leaving a C/MHC during those time periods that occur within the measurement window (ie, between the calendar dates January 1, 1990 and September 30, 1992), which happen to be the later time periods in physicians' C/MHC careers.

We resolved this dilemma by using the data for physicians hired before the measurement window to describe employment behavior during later careers, after the calendar time when these individuals entered the window. This approach resolves the potential selection bias problem because we allowed physicians to contribute to our estimates of risk only when they were an unbiased sample of the risk set for that time period. To understand how this works, consider a physician hired on January 1, 1986. When the measurement window opens on January 1, 1990, she is beginning her fourth year (or 17th quarter) on the job. We therefore used her data to describe the risk of leaving a center in that 17th quarter (or any subsequent quarter when she is still working). But we did not use her data to describe the risk of leaving a center during any earlier quarter (so as to prevent selection bias). Similarly, data from a physician hired on January 1, 1989 could be used to describe the risk of leaving a center in her fifth quarter (which began on January 1, 1990), but it could not be (and was not) used to estimate the risk of leaving in quarters one through four. By adopting this approach, we were able to analyze simultaneously the data from all 2,654 physicians in the sample, and we allowed them to contribute to the estimation of risk only during those time periods when they represented an unbiased sam-

ple of physicians known to be at risk of leaving a C/MHC.

Results

Who Works in Community and Migrant Health Centers?

Table 1 describes the physicians working at all C/MHCs between January 1, 1990 and September 30, 1992 and the centers in which they worked. The data are presented separately for the 915 physicians who began working in their C/MHCs to fulfill an NHSC obligation and the 1,739 physicians who were under no such obligation. We present descriptive statistics separately for these two groups both because they displayed somewhat different demographic profiles (as discussed here) and because analyses presented in the next section revealed that they had different career trajectories. Given the sample sizes, we had adequate statistical power to detect even small differences between the two groups of physicians. As a result, we draw attention to those differences that were not only statistically significant, but that were practically significant, as well.

Beyond a comparable gender distribution (approximately 60% male) and a shared propensity toward primary care (more than 80% of the physicians in both groups, although the fraction of NHSC physicians providing primary care was significantly higher), the two groups of physicians displayed some striking differences. Whereas more than 40.5% of nonobligated physicians worked in the C/MHCs part-time, that was true of only 7.4% of the NHSC physicians. On average, NHSC physicians were younger (sample means of 33.4 versus 39.6 years, t statistic = 18.6, $df = 2071$, $P < 0.0001$), and although whites and Hispanics were represented in equal proportions in both groups, the proportion of physicians who were black was twice as high among the obligated group as it was among the nonobligated group, and the proportion of physicians who were Asian was nearly one third as small.

The centers that hired NHSC physicians also differed somewhat from those that hired nonobligated physicians. Obligated physicians were more likely to be working in migrant settings (31.5% versus 24.6%) and rural areas (62.8% versus 46.8%), which tend to be smaller, on average, both in terms of expenses and staff FTEs. Yet those

differentials were not so dramatic that there were not ample numbers of obligated physicians in large urban centers and ample numbers of nonobligated physicians in small rural centers, providing us with sufficient statistical power to detect the effects of these predictors on employment duration among both sets of physicians.

When Do Physicians Leave Community and Migrant Health Centers?

Figure 1 presents sample hazard functions (top panel) and sample survival functions (bottom panel) for two groups of physicians: those who began working in a C/MHC to fulfill an NHSC obligation (the darker lines) and those who began working in the center without such an obligation (the fainter line).

Examining the estimated median lifetimes (displayed on the survivor functions in the lower panel), a casual observer might conclude that these two groups had similar career trajectories because the median lengths of stay (3.0 years for

those without an obligation; 2.9 years for those with an obligation) were not significantly different. This impression is mistaken, however, because the risk profiles of the two groups of physicians were distinctly different. Those fulfilling NHSC obligations were at much lower risk of leaving the centers during each of the quarters that comprise the first 2 years on the job. After this period of time, however, those fulfilling NHSC obligations were at much greater risk of leaving, to the point that after 5 years, we estimate that only 16.8% of those who began because they were fulfilling a NHSC obligation remained at C/MHCs versus 35.6% of those who began with no such obligation. It seems clear that if one of the policy goals for C/MHCs and the NHSC is to retain physicians beyond their NHSC contractual obligation (that is, usually 2, 3, or 4 years), there is considerable room for improvement.

Further support for our hypothesis that NHSC physicians leave when their obligations are completed can be seen in the sample hazard functions displayed in the top panel. For both groups of physicians, we observed an "anniversary effect," indicating that the risk of leaving a center was highest in the quarter corresponding to a physician's annual employment anniversary at 1 year, 2 years, 3 years, and 4 years. The anniversary effect likely arises at the point when contractual agreements between centers and individuals expire because that is an opportunity for both parties to reconsider the value of extending the relationship. Centers may decide to terminate because they do not have the income to continue to pay the physician; because although they need a physician, this particular one is not working out; or for other reasons. For the physician, it provides a logical point at which to reassess career or lifestyle choices and to decide either to continue at the center for another year or to move to another position, perhaps in another community.

For those physicians fulfilling an NHSC obligation, the anniversary effect was decidedly more pronounced than it was for those with no such obligation. For them, the risk of leaving on the 2-year anniversary was 0.13; on the 3-year anniversary, it was 0.17; and on the 4-year anniversary, it was 0.41. The corresponding risks for nonobligated physicians were 0.09, 0.09, and 0.05, respectively. Although the data available to us did not indicate which physicians were fulfilling 2-year, 3-year, and 4-year obligations, we know that these are common obligations for those in the

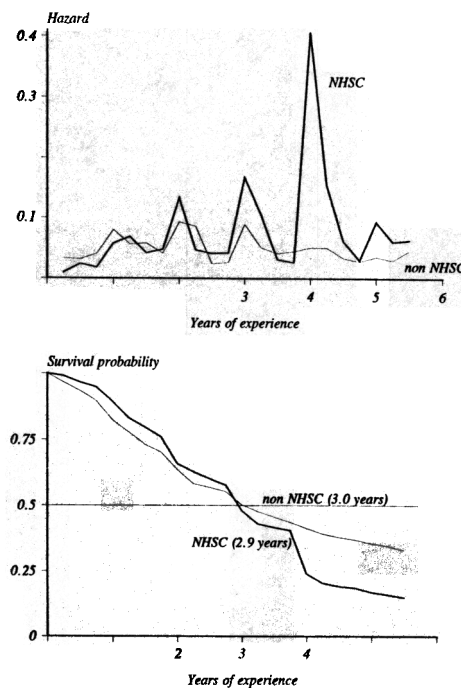


FIG. 1. Sample hazard and survivor functions for NHSC and non-NHSC physicians.

NHSC. The consistently elevated risk of leaving on annual anniversary dates for NHSC physicians in comparison to nonobligated physicians suggests the reasonable hypothesis that the obligated physicians were at the greatest risk of leaving at the end of their loan payback period.

Who Leaves Community and Migrant Health Centers?

To understand which physicians are at greatest risk of leaving C/MHCs, we explored the relation between risk and each of the physician and center characteristics displayed in Table 1. Table 2 presents separately for NHSC and nonobligated physicians the results of fitting this series of main effects models, exploring the effect of each covariate individually without controlling for any other covariates. We present models separately because the overall pattern of risk shown in Figure 1 differs dramatically for the two groups and because, as we shall demonstrate, the predictors associated with physicians' decisions to stay or leave differ across the two groups. Indeed, with the exception of physician age at entry (which is associated with risk of leaving for both groups of physicians), no other predictor was found to be associated with the risk for both obligated and nonobligated physicians.

Not all physicians are equally likely to leave (or stay in) C/MHCs. Although we found no statistically significant difference in risk between men and women or between primary care providers and specialists, we did find effects of age at entry, race, and part-time versus full-time status. Among both NHSC and nonobligated physicians, the younger a physician was at entry, the greater the risk of leaving. The odds that a physician who was 30 at hire would leave, for example, were an estimated 1.22 times higher than they were for a physician who was 40 at hire. We found no differences in the risk of leaving among white, black, and Hispanic physicians, but among nonobligated physicians, the odds that an Asian physician would leave were approximately half as high as the odds that a non-Asian physician would leave. Among physicians fulfilling an NHSC obligation, there was a large and statistically significant effect of FTE status. The odds that a physician working part-time would leave were approximately one fourth the odds that a physician working full-time would leave. In interpreting this finding, however, we note that only 7.4% of the

NHSC physicians worked part-time ($n = 68$), and no similar effect was found among nonobligated physicians, for whom part-time work was far more common (40.5%). This finding, therefore, may reflect nothing more than the extended time necessary to fulfill a contractual NHSC obligation if the rate of repayment was prorated on a part-time basis.

Table 2 also shows that physicians appeared more likely to leave certain types of centers, although the effects of center characteristics differed for obligated and nonobligated physicians. Among physicians in the NHSC, the effects of center characteristics were generally modest. Physicians were less likely to leave centers that were in urban areas or that had fairly large staffs (more than 120 FTEs). Among the larger group of physicians who were not fulfilling an NHSC obligation, center size and productivity were significantly associated with retention. The general nature of the effect revealed that physicians were at lower risk of leaving the more productive centers and centers with moderate to high numbers of visits per year than smaller, less productive centers. Overall, there appeared to be no statistically significant effect of either center expenses or Federal grade (although for both these variables, there was a weak effect for NHSC physicians at the $P < 0.10$ level).

Each of the effects just described are simple main effects, estimated without controlling for the other identified effects. Although it is reasonable to ask whether center characteristics were associated with the risk of leaving regardless of physician characteristics, if it turns out that certain sorts of physicians gravitate toward certain types of centers, we might have been mistakenly highlighting a center effect that was simply an artifact of different demographic distributions. Similarly, we might have been overlooking the effects of other center characteristics because they would emerge only (a) after statistically controlling for the effects of individual characteristics or for particular subgroups of physicians (as would happen if the predictors interacted statistically in the prediction of risk); or (b) during particular periods of physicians careers (as would happen if they interacted with time.) To test these possibilities and to identify predictors that were clearly associated with physician retention, we fit a sequence of discrete-time hazard models to these data, separately for NHSC and nonobligated physicians. The parameter estimates and standard errors

TABLE 2. Results of Fitting Sample Discrete-Time Hazard Models Predicting the Risk of Leaving a Community and Migrant Health Center on the Basis of Individual Predictors, Separately for Physicians With and Without a National Health Service Corps Obligation

Predictor	Obligation (n = 915)		No Obligation (n = 1,739)	
	Estimate	SE	Estimate	SE
Physician characteristics				
Sex				
Male	0.16	0.11	-0.04	0.09
Start age	-0.02*	0.01	-0.02§	0.01
Race				
White	0.73	0.62	-0.15	0.20
Asian	0.85	0.73	-0.67†	0.27
Black	0.54	0.63	0.31	0.22
Hispanic	0.44	0.63	0.05	0.22
Specialty				
Primary care	-0.11	0.15	-0.03	0.11
FTE status				
Full-time	1.42‡	0.28	-0.02	0.09
Center characteristics				
Expenses				
\$2-5 million	0.01	0.12	-0.14	0.11
>\$5 million	-0.21	0.13	-0.09	0.11
Log (cost)	-0.10	0.06	-0.06	0.05
Visits				
22,001-40,000	-0.11	0.14	-0.30†	0.13
40,001-60,000	0.00	0.15	-0.28†	0.13
>60,000	-0.19	0.14	-0.08	0.12
Log (visits)	0.02	0.06	-0.14†	0.05
Staff FTEs				
70-120	0.18	0.12	-0.20*	0.11
>120	-0.42†	0.14	0.05	0.10
Log (staff)	0.09	0.11	-0.05	0.05
Productivity				
4,801-5,200	-0.04	0.14	-0.36‡	0.12
>5,200	-0.12	0.12	-0.21*	0.11
Federal grade				
C,D,E	0.28*	0.14	0.17	0.11
Rural/urban				
Urban	0.29‡	0.11	0.14	0.09
Location				
Migrant	0.02	0.11	0.15	0.10
% self-pay				
continuous	0.002	0.00	0.002	0.00

FTE, full-time equivalent.

* $P < 0.10$.

† $P < 0.05$.

‡ $P < 0.01$.

§ $P < 0.001$.

TABLE 3. Results of Fitting a Multivariate Discrete-Time Hazard Model Predicting the Risk of Leaving a Community and Migrant Health Center on the Basis of the Predictors Shown, Separately for Physicians With and Without a National Health Service Corps Obligation

Predictor	Obligation (n = 915)		No Obligation (n = 1,739)	
	Estimate	SE	Estimate	SE
Physician characteristics				
Sex				
Male	-0.014	0.128	0.127	0.121
Start age	0.050*	0.027	-0.005	0.011
Age × time	-0.007‡	0.002	-0.003†	0.001
Race				
Asian	1.123	0.842	-0.618†	0.313
White	1.016	0.749	-0.281	0.222
Hispanic	0.686	0.759	0.017	0.250
Black	0.728	0.754	0.174	0.247
Specialty				
Primary care	-0.206	0.189	See notes	
FTE status				
Full-time	1.625§	0.336	See notes	
Center characteristics				
Expenses				
\$2-5 million			-0.222	0.156
>\$5 million			-0.011	0.163
Productivity				
4,401-4,800			0.306†	0.149
4,801-5,200			-0.144	0.184
>5,200			-0.171	0.169
Federal grade				
C,D,E			0.357	0.221
Grade × expense (\$2 million)			0.521	0.423
Grade × expense (>\$5 million)			-1.176‡	0.395
Chi-squared statistic (baseline)	6715.2		10182.3	
Chi-squared statistic (this model)	2070.0		2633.5	

FTE, full-time equivalent.

Note: To conserve space, we have not presented the 22 parameter estimates and associated standard errors for the baseline hazard functions in these models. They are available on request from the authors. For the models for nonobligated physicians (which involve interactions with time), we have similarly not presented all interactions with time terms. These, too, are available on request from the authors. To facilitate interpretation of these models, we instead present the cumulative survival rates for various types of physicians in Tables 4 and 5.

*P < 0.10.

†P < 0.05.

‡P < 0.01.

§P < 0.001.

from these models are summarized in Table 3. The estimated cumulative survival rates based on these fitted models are presented in Tables 4 and 5.

First, consider the model for physicians who were members of the NHSC. Their stay-or-leave decisions seemed to be based entirely on personal considerations. The model for these

physicians did not include center characteristics because none was significantly associated with the risk of leaving after controlling statistically for the effects of individual characteristics. Beyond the clear anniversary effects shown in Figure 1, only two additional effects persisted through the multivariate analysis—those of part-time versus full-time status and physician age at hire. Controlling for gender, age at hire, race, and specialty, NHSC physicians working part-time were far less likely to leave than those working full-time. This effect was evident in the estimated cumulative survival rates presented in Table 4. Although the estimated proportion of part-time physicians remaining after 1 year was only slightly larger than the estimated proportion of full-time physicians, by the end of year 5, most full-time physicians left their centers, whereas the majority of part-time physicians remained. The only other effect was that of age at hire: those who were somewhat older at initial hire were more likely to leave. But, as we note this effect, we hasten to add that it reversed with time. This reversal is the reason that the effect went undetected earlier in our simple main effects model. Controlling for these personal characteristics, no association could be found between any center characteristic for which data were available and the stay-or-leave decisions of NHSC physicians.

Among the other physicians working at C/MHCs, however, both personal and center characteristics were associated with stay-or-leave decisions. For these physicians, we found effects not only for age at hire, race, specialty, and part-time/full-time status, but also for the center characteristics of annual expenses, productivity, and Federal grade. We found that physicians who were older at hire were somewhat less likely to leave, as were physicians who are Asian (in comparison to those from all other racial and ethnic groups). In general, primary care physicians and part-time physicians were less likely to leave as well, but because the effect of these two predictors varied with time, there were actually some time periods when the specific risk for these two groups reversed. The estimated cumulative survival rates presented in Table 4 reveal the complex effects of part-time status. Although the survival rates for the full-time physicians were initially higher than the survival rates for the part-time physicians, by the end of the third year, this effect had reversed, and a greater proportion of part-time than full-time physicians remained. This effect was not nearly as dramatic as it was for the NHSC physicians.

Two clear center characteristic findings emerged. First, physicians in centers with moderate productivity levels—between 4,401 and 4,800

TABLE 4. Estimated 1-, 3-, and 5-Year Cumulative Survival Rates for Both Full-time and Part-time Physicians Who Are 30, 35, or 40 Years Old at Beginning of Employment*

	Time Status	Age at Start (yr)	Year 2	Year 3	Year 5
NHSC physicians	Full-time	30	0.899	0.463	0.111
		35	0.848	0.399	0.101
		40	0.870	0.484	0.215
	Part-time	30	0.979	0.853	0.614
		35	0.967	0.827	0.603
		40	0.972	0.862	0.724
Non-NHSC physicians	Full-time	30	0.828	0.417	0.254
		35	0.838	0.461	0.313
		40	0.848	0.504	0.372
	Part-time	30	0.717	0.431	0.283
		35	0.732	0.470	0.340
		40	0.745	0.507	0.396

NHSC, National Health Service Corps.

*Estimated survival rates are for white, male, primary care physicians in Federal grade A/B centers with 2 to 5 million dollars in annual expenses and 4,401 to 4,800 visits/staff (productivity).

TABLE 5. Estimated 1-, 3-, and 5-Year Cumulative Survival Rates for Non-National Health Service Corps Physicians at Centers With Different Levels of Productivity (Annual Visits per Staff), Annual Expenses, and Federal Grade*

Productivity	Annual Expenses	Federal Grade	Year 1	Year 3	Year 5
1-4,400	\$2-5 million	A,B	0.885	0.601	0.480
		C,D,E	0.901	0.648	0.536
	>\$5 million	A,B	0.860	0.535	0.406
4,401-4,800	\$2-5 million	C,D,E	0.935	0.755	0.667
		A,B	0.848	0.504	0.372
	>\$5 million	A,B	0.870	0.558	0.431
4,801-5,200	\$2-5 million	C,D,E	0.817	0.432	0.298
		A,B	0.913	0.684	0.579
	>\$5 million	A,B	0.899	0.642	0.528
		C,D,E	0.914	0.686	0.582
		A,B	0.877	0.580	0.457
		C,D,E	0.943	0.783	0.704

*Estimated survival rates are for white, male, full-time, primary care physicians who are 40 years old when starting work.

visits per physician per year—were more likely to leave than were physicians in either less or more productive centers. The estimated cumulative survival rates presented in Table 5 illustrate this effect. Consider physicians in grade A or B centers with \$2 million to \$5 million in annual expenditures. The estimated cumulative 5-year survival rate for physicians in moderate productivity centers was only 37.2%. In contrast, the estimated 5-year survival rates for physicians in lower and higher productivity centers were 48% and 52.8%, respectively. Note that the figures in Table 5 are for white, male, full-time primary care physicians with no NHSC obligation and who were 40 years old when they started at a center. Though not presented here, similar patterns with center characteristics were found for physicians with other characteristics (eg, other ages, part-time, female, physicians of other races, and with an NHSC obligation).

Second, among physicians in high expense centers (annual expenditures in excess of \$5 million), those in low-grade centers (levels C, D, and E) were 25% to 28% more likely to stay than their counterparts in higher grade centers. Again, this effect can be seen in Table 5. For example, of physicians working in low productivity centers, the estimated 5-year cumulative survival rate was 66.7%, whereas it was only 40.6% (a difference of

21.6 percentage points) in centers with comparable productivity levels and budgets but higher Federal grades.

Discussion

The median tenure in Community and Migrant Health Centers for primary care physicians was approximately 3 years regardless of whether or not the physician had an obligation to the National Health Service Corps. Most physicians who stopped working in C/MHCs did so on or about their anniversary date, probably because it coincided with the end of their contract, but the "anniversary effect" was particularly strong for physicians with NHSC obligations. At the end of 5 years, a little more than one third of physicians who started without an NHSC obligation but only approximately one sixth of NHSC physicians (36% compared with 17%, respectively) were still working in centers. The data revealed other significant differences between NHSC and other physicians working in CHCs.

We believe the analysis presented here has three primary benefits. First, it demonstrates the value of discrete-time survival analysis in addressing questions related to the tenure of primary care physicians in C/MHCs. These techniques provided a method for including data from

physicians whose CHC careers either began before or ended after the measurement window.

Second, the study measured primary care physician tenure at C/MHCs and showed the median length of service to be approximately 3 years for both NHSC physicians and non-NHSC physicians, although career trajectories for the two groups differed dramatically. In addition, the results give center directors a yardstick against which to compare their own center's performance. If their physicians already stay an average of 5 years, for example, they know, first, that they are already 2 years beyond the general experience of other centers—perhaps because physicians consider their center to be a good place to practice—and second, that a goal of extending their physicians' service an additional year may not be reasonable. Conversely, for center directors whose physicians stay an average of 3 years or less, to add a fourth year to the normal 3-year term may provide a realistic target, knowing that nationally at least half of center physicians already stay that long. This modest goal may be attainable if directors can increase physician satisfaction with working there.

And third, the data available to us provides some help in trying to explain differences in the propensity to stay or leave employment in C/MHCs and provides guidance to those who would go further. Several personal characteristics of physicians (eg, age at hire) and several center characteristics (eg, size, location, productivity, and federal grade) appeared to have associations with physician stay-or-leave decisions; although the associations were relatively small, they provide some strategies for center leaders who want to attempt to increase physicians' tenure at their centers.

Physicians who were older at the time of hire were more likely to leave than younger physicians; with time, however, the effect reversed. If we assume that physicians have at least a general picture of the kind of clinical careers they want and that those with an NHSC obligation must spend 3 or 4 years in a Community Health Center before beginning to embark on those careers, then those who are older when they arrive at a CHC would want to get on with building their eventual practice. Those who are younger, conversely, may be persuaded to stay longer. This insight may be useful to center directors trying to increase the stability of their clinical staffs. If younger physicians can afford to remain an extra

year or two at the CHC before continuing their careers, then perhaps the center directors can find ways to encourage them to stay.

If those leaders can accomplish that goal, their centers will benefit, just as successful businesses have benefited from "the loyalty effect."¹⁸ Reducing the need to recruit new physicians would not only reduce expenditures associated with turnover (for recruitment, orientation, and practice building), but also would increase the opportunities for continuity of care for their patients and, perhaps, build patient loyalty at a time when even some community health center patients (eg, Medicaid eligible patients in managed care states) are a prize for a variety of provider organizations. In an era in which primary care physicians are in short supply, the best hope that center executives have to add to the stability of their physician staff may be to extend the length of time that the physicians who are already there remain at the center.

The results reported here provide a basis for thinking that may be an attainable goal. They offer some insight into physician careers and identify some areas for further exploration. For example, for physicians with an NHSC obligation, the data showed that only personal characteristics had a statistical relationship to their decisions. Yet, for their non-NHSC colleagues, characteristics of the centers in which they worked also played a role. Thus, if center directors could find ways to bring center characteristics to bear on NHSC physician decisions in a positive direction, they may be able to extend physician tenure and to achieve tangible benefits for their centers.

To provide center directors who want to extend the CHC careers of their primary care physicians with empirically based guidance that can help them in that effort requires more detailed person-level physician data than were available in the Bureau Common Reporting Requirements database. More specifically, it requires data from the decision processes themselves. What would be particularly useful are survey data that permit comparisons of physicians' career aspirations, their experience at their respective centers, and other factors among physicians who made different decisions about continuing to practice in C/MHCs on such matters as their career aspirations and family plans, as well as factors that, by affecting their satisfaction with working in centers, might affect their decisions to stay. In a related study, we conducted a national survey of representative samples of C/MHC physicians, some still practic-

ing in a center and others who had already left. In a subsequent report, we will build on the results presented here with data from that survey in an effort to help center directors set realistic goals for extending the length of service of their primary care physicians.

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