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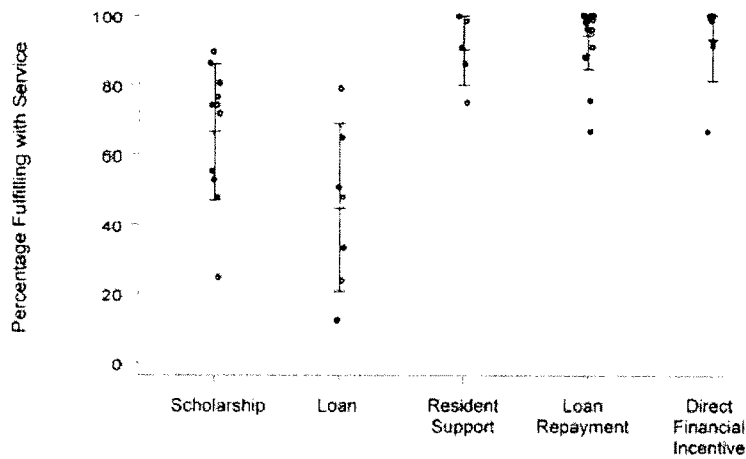


FIGURE 1. Percentage of recent physicians in each program (%) who fulfilled their obligations with service, grouped by program type.

Bars denote group means  $\pm$  standard deviations

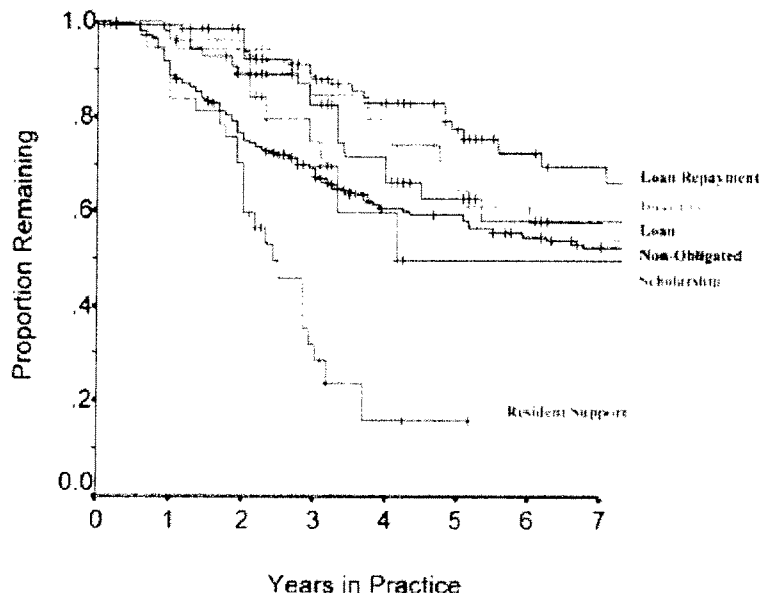


FIGURE 3. Retention of obligated physicians within their service practices: Kaplan-Meier estimations by type of program and compared with nonobligated physicians

# Outcomes of States' Scholarship, Loan Repayment, and Related Programs for Physicians

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**Context:** Many states attempt to entice young generalist physicians into rural and medically underserved areas with financial support-for-service programs—scholarships, service-option loans, loan repayment, direct financial incentives, and resident support programs—with little documentation of their effectiveness.

**Objective:** The objective of this study was to assess outcomes of states' support-for-service programs as a group and to compare outcomes of the 5 program types.

**Design:** We conducted a cross-sectional, primarily descriptive study.

**Participants:** We studied all 69 state programs operating in 1996 that provided financial support to medical students, residents, and practicing physicians in exchange for a period of service in underserved areas; federally funded initiatives were excluded. We also surveyed 434 generalist physicians who served in 29 of these state programs and a matched comparison group of 723 nonobligated young generalist physicians.

**Data Collection:** Information on eligible programs was collected by telephone, mail questionnaires, and from secondary sources. Obligated and nonobligated physicians were surveyed, with 80.3% and 72.8% response rates, respectively.

**Main Outcome Measures:** Levels of socioeconomic need of communities and patients served by physicians, programs' participant service completion and retention rates, and physicians' satisfaction levels.

**Results:** Compared with young nonobligated generalists, physicians serving obligations to state programs practiced in demonstrably needier areas and cared for more patients insured under Medicaid and uninsured (48.5% vs. 28.5%,  $P < 0.001$ ). Service completion rates were uniformly high for loan repayment, direct incentive, and

resident-support programs (93% combined) but lower for student-targeting service-option loan (mean, 44.7%) and scholarship (mean, 66.5%) programs. State-obligated physicians were more satisfied than nonobligated physicians, and 9 of 10 indicated that they would enroll in their programs again. Obligated physicians also remained longer in their practices than nonobligated physicians ( $P = 0.03$ ), with respective group retention rates of 71% versus 61% at 4 years and 55% versus 52% at 8 years. Retention rates were highest for loan repayment, direct incentive, and loan programs.

**Conclusions:** States' support-for-service programs bring physicians to needy communities where a strong majority work happily and with at-risk patient populations; half stay over 8 years. Loan repayment and direct financial incentive programs demonstrate the broadest successes.

**Key Words:** physicians, health services access, rural health, primary care, student loans and scholarships, loan repayment, state health policy

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■ *It is one of the happy incidents of the federal system that a single courageous State may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.*—Louis Brandeis

*Supreme Court of the United States*  
New State Ice Co. v. Liebmann, 1932; *dissenting opinion*<sup>1</sup>

States and federal agencies frequently use service-requiring scholarships, loans, loan repayment, and related incentives to entice physicians into medically underserved settings.<sup>2–4</sup> As of 1996, 40 states offered 69 such physician-obligating programs, the federal National Health Service Corps (NHSC) and Indian Health Service (IHS)-sponsored scholarship and loan repayment initiatives,<sup>5</sup> and the NHSC and states jointly sponsored an additional 29 loan repayment programs. Service-requiring programs collectively wield a sizable workforce, estimated at 2900 physicians in 1996, half each under state and federal auspices.<sup>5</sup>

The 5 recognized program types—scholarships, service-option loans, loan repayment, direct financial incentives,

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and resident support<sup>5</sup>—share fundamental goals and an approach that links financial support to periods of service; however, these program variations differ in important ways. *Scholarship programs* obligate medical students early in their training and many years before they are to serve their obligations. Participants in scholarship programs are firmly expected to provide service, and hefty penalties are used to discourage participants from buying out their obligations should their career interests change. *Service-option loan programs* also target medical students but offer participants a choice of performing service or repaying program funds at standard interest rates.

*Loan repayment and direct financial incentive programs* commit physicians much later, near the completion of residency training when their service is to begin. They typically levy no or minimal penalties on physicians who fail to complete a period of service. With loan repayment programs, physicians receive assistance repaying traditional education loans they acquired years earlier as students, whereas financial incentive programs provide unrestricted funds.

The newest programs, the *resident support* type, respond to the growing financial pressures on residents<sup>6</sup> with assistance in the form of scholarships, loan repayment, and direct financial incentives. Service is required and begins 1 to 2 years after a commitment is signed, at the end of residency.

Over the decades much has been said, with little supporting evidence, about the outcomes of these programs as a group and the relative strengths of the individual program types. It is generally believed, for example, that physicians in support-for-service programs are less satisfied and remain in their practices briefer than physicians without obligations. Many observers believe that stiff penalties are required to curtail otherwise high buyout rates, especially in programs that obligate individuals years in advance of service.<sup>7</sup> Others worry, however, that high penalties trap some participants in ill-suited commitments who are then unhappy as they serve and unlikely to be retained.<sup>8–10</sup> Proponents of loan repayment and direct incentive programs believe satisfaction and retention are better when physicians sign commitments after their training when they know their career interests, job options, and families' needs.<sup>11</sup> Scholarship defenders counter that only captive scholarship recipients can be drawn to the most desperately underserved communities because they are so unattractive.<sup>12</sup>

Few studies have assessed the outcomes of support-for-service programs, like the rates at which their practitioners complete their obligations with service and their practitioners' satisfaction and retention. Programs do not often undertake self-evaluations and those that do seldom have comparative data on other programs.<sup>2,13</sup> States and federal agencies regularly add, drop, and modify their programs without firm evidence of their effectiveness.<sup>14–17</sup>

This study has 2 primary goals: 1) to assess outcomes of states' support-for-service programs as a group, and 2) to compare outcomes for the 5 program types. We assess program outcomes we believe are important to underserved communities, physicians, and policymakers: the levels of socioeconomic need of communities and patients served by participating physicians, participant service completion and retention rates, and satisfaction levels of participants and their families. We also test the assumptions that 1) higher buyout penalties increase the proportion of physicians who fulfill their obligations with service but at a cost of lower physician satisfaction and poorer retention, and 2) scholarship programs bring physicians into the neediest communities.

## METHODS

### Identifying Eligible State Programs

We identified all state support-for-service physician programs nationally as of 1996<sup>5</sup> by supplementing previous lists of relevant programs<sup>3,18,19</sup> with information from telephone calls to key contacts in every state and from available online sources and printed materials. Eligibility criteria for programs were that they 1) provided financial support to students, residents, and/or practicing physicians in 1996; 2) had a service requirement or option in defined medically needy settings located across a given state; and 3) received no direct federal support. Of the 69 identified eligible programs, 20 offered scholarships, 24 provided loan repayment incentives, 12 offered loans with service options, 7 offered direct financial incentives, and 6 offered support to residents.

### Program Data

We obtained basic descriptive information for all programs through initial and follow-up telephone contacts with program directors and from programs' web sites, brochures, reports, and copies of their enacting legislation. This information was verified and supplemented through an 8-page mailed questionnaire completed by 45 programs (65%). Forty-eight (86%) of the 56 programs old enough to have had more than 20 physicians eligible for placement in service sites provided estimates of the service completion rate for their obligated physicians over the previous 3 years. Programs were approached for survey and other data in no particular order other than we started with the few directors we knew and tended to recruit all programs within a particular state at the same time.

### Identifying State-Obligated and Comparison Group Physicians

Programs were asked to provide names and basic information on each physician who signed a first contract with them and/or had been placed in a first-service site in 1991 and 1996. These 2 years were selected because individuals who

committed to student programs in 1991 and loan repayment and direct incentive programs in 1996 would have begun serving their obligations in approximately 1996. Programs created after 1991 provided names of individuals contracted in their first year of operation; very large programs provided only a randomly selected subsample of names from 1991 and 1996, and smaller programs supplemented their samples with names of physicians obligated in proximate years (eg, 1992 and 1995). We elected not to request physician names from the last 12 eligible programs as a result of project time requirements. Of the 48 programs from which we requested physician data, 29 (60%) provided all data we needed to survey their obligated physicians. Programs from which we requested and received physician-specific information, programs from which we requested but did not receive this information, and programs from which this information was not requested were similar in size, physicians' contract terms, the types of geographic locations where their obligated practitioners served, and reported service completion rates.

We surveyed all 434 family physician, general internist, and general pediatrician participants (allopaths and osteopaths) identified by programs as then serving or having served their obligations. We excluded nongeneralists and physicians who defaulted or bought out their obligations without ever serving a day of their obligations. Programs reported no international medical graduates.

We constructed a comparison group of nonobligated generalists from the American Medical Association Physician Masterfile. A sampling frame of eligible subjects was constructed of all 8742 graduates of U.S. allopathic and osteopathic medical schools in 1988 and 1992 who 4 years after graduation were in clinical practice in the United States in family practice, general internal medicine, and general pediatrics. A stratified random sample of 723 of these physicians was selected, with oversampling of strata to match the state-obligated cohort in specialty distribution and geography, and to ensure diverse racial and ethnic representation.

### Physician Surveys

In 1998 and early 1999, we sent up to 4 questionnaire mailings to the state-obligated and comparison group physicians. Of the 434 obligated physicians surveyed, 23 proved to be ineligible or were never located, and there were 330 eligible respondents (80.3%). Response rates for obligated physicians were comparable across service program types, physician specialties, and racial-ethnic groups.

In the comparison sample of 723 physicians, 56 subjects proved ineligible or were never located and 468 eligible physicians responded (72.8%). Response rates for the comparison sample did not vary by subjects' rural/urban location, gender, or specialty; rates were somewhat lower for blacks (52.4%). We excluded 100 physicians from the comparison

group who indicated that they had or were serving a state or federal obligation.

In the physician questionnaires, participants of state programs reported details of the first practice in which they served their obligations. On parallel questionnaire items, comparison group physicians described the first practice after residency in which they worked 9 months or longer. Both groups reported their incomes, satisfaction, their families' experiences, and their patients' insurance types. Nearly all questionnaire items had been used in earlier studies<sup>9,20,21</sup> and were pilot-tested again for applicability to this study with 30 obligated and nonobligated physicians in North Carolina.

We appended 1990 U.S. Census data characterizing the towns and cities where physicians worked.<sup>22</sup> County data on local physician-to-population numbers were appended for 1994 from the Area Resource File.<sup>23</sup>

### Analyses

We compared obligated and nonobligated physicians on a variety of outcomes, including satisfaction and retention rates. We also compared programs of each of the 5 types individually and with the other 4 program types as a group. We used chi-squared tests, independent sample 2-tailed *t* tests, and 1-way analysis of variance (ANOVA) to compare groups on normally distributed variables. The Kruskal-Wallis test was used to compare groups on 4 nonnormally distributed variables: physician income, town population, town per capita income, and county primary care physician-to-population ratios. Bivariate comparisons were followed with linear and logistic regression models (with log transformations of non-normally distributed variables) to adjust for key potentially confounding or explanatory variables. Life tables were used to describe proportions of physician groups remaining in their practices for specified numbers of years. Kaplan-Meier plots and Cox proportional hazards models were used to compare estimates of retention for various physician groups over time.

We also assessed relationships between programs' buy-out costs and the various program outcomes with chi-squared and 2-tailed *t* tests. We further used multiple and logistic regression to test the relationships between buyout costs and the various outcomes for confounding by varying service obligation terms across programs and/or respondents' actual obligation periods. No confounding was found and we do not report these models.

Comparisons of obligated and nonobligated physicians were weighted to adjust for strata sampling fractions and response rates and run on the SUDAAN statistical software program (Research Triangle Institute, Research Triangle Park, NC). Analyses involving only obligated physicians were run on the SPSS statistical program (release 11.5.0; SPSS Inc., Chicago, IL) and not weighted. A level of statistical significance of  $P \leq 0.05$  was used throughout.

## RESULTS

### State Programs

In 1996, the 69 eligible programs were relatively new and small, with a median age of just 6 years and median workforce of 11 physicians. Sixty-four programs were funded with state revenues, 2 had only private support, and 3 were self-supporting using buyout funds from earlier participants; 9 programs also used community matching funds. Forty-seven programs were based in state offices of rural health or other state agencies, 18 within individual medical schools, and 4 within private organizations.

Programs supported physicians with an average of \$14,000 for each year of obligated service with no significant differences across the 5 types of programs ( $P = 0.55$ ). Average minimum service obligation terms did vary across program types, from 12 months in resident support programs, 18 months in scholarship programs, 19 months in service-option loan programs, 29 months in loan repayment programs, and 36 months in direct financial incentive programs ( $P = 0.003$ ).

### Physicians and Their Practices

Physicians obligated to state programs, compared with physicians without obligations, were more often male (63% vs. 53%,  $P < 0.05$ ), more often married (84% vs. 75%,  $P < 0.05$ ), slightly older (33 vs. 32 years on average,  $P < 0.001$ ), but no more or less likely to be black or Hispanic (8.5% vs. 6.2%,  $P = 0.10$ ). Obligated physicians were much more likely than nonobligated generalist physicians to be family physicians (72% vs. 38%,  $P < 0.001$ ) and more often owned the practices where they worked (36% vs. 27%,  $P < 0.05$ ), but earned comparable salaries (median, \$89,735 vs. \$89,622,  $P = 0.2$ ).

Comparing physicians obligated to the 5 types of programs, we found no differences in gender, marital status, ethnicity, or income. Loan program participants, however, were less likely to be family physicians than participants of other programs (54% vs. 75%,  $P = 0.02$ ), and physicians in incentive programs more often owned their practices (49% vs. 16%,  $P = 0.01$ ).

Although minimum service obligation durations varied across programs of the 5 types, the average number of years this study's respondents were actually obligated to their programs did not differ for those in 4 of the types (range, 3.13–3.48 years,  $P = 0.31$ ) but was shorter for participants of resident-support programs (2.72 years,  $P = 0.02$ ).

### Service Completion Rates

The 5 types of programs differed greatly in how often their physicians completed their obligations with service rather than buying out or defaulting ( $P < 0.001$ ) (Fig. 1). Service-option loan programs reported the lowest average service completion rates (44.7%) followed by scholarship programs (66.5%). The 30 programs of the remaining 3 types, programs that committed physicians after training or as residents, reported uniformly high service rates (entire group mean, 93%; 92% after omitting the 5 of these 30 programs without a minimum service period).

Program directors reported obligation default rates, the proportion of obligated physicians who failed to provide either service or repay program funds, of 5.2% on average for all programs combined with no significant differences across program types ( $P = 0.78$ ). In contrast, the percentage of physicians who bought out-of-service commitments differed greatly across the 5 program types, greatest in service-option loan programs (49.2%) and scholarship programs (27.2%).

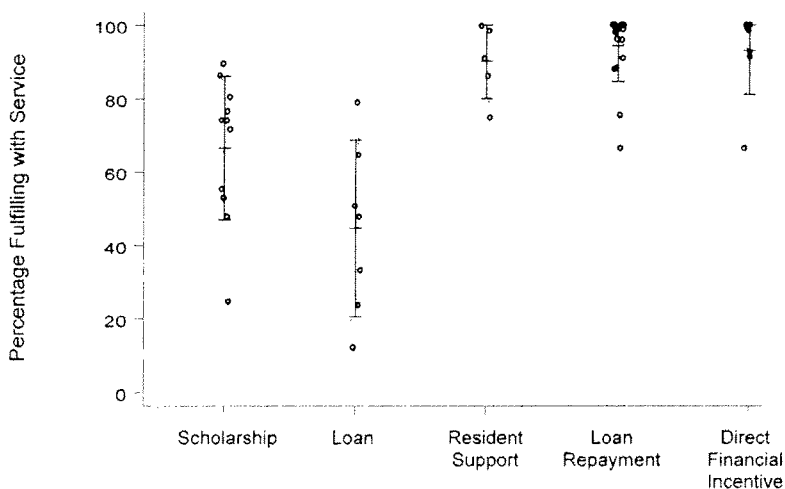


FIGURE 1. Percentage of recent physicians in each program (°) who fulfilled their obligations with service, grouped by program type.

Bars denote group means +/- standard deviations

Programs of the remaining 3 types reported comparable low buyout rates (2.3% combined). Thus, the high buyout rates of student programs account for their low service completion rates.

The costs that loan repayment, direct incentive, and resident support programs levy on physicians who buyout of obligations had no relationship with programs' service completion rates. Only among student programs, scholarships and service-option loans, were penalties and service completion rates related; specifically, rates averaged 80.3% for the 4 student programs that charged penalties of 3 times the amount of support provided compared with 48.6% for the 12 programs that charged less ( $P = 0.02$ ).

### Communities and Patients Served by Physicians

Physicians serving in state programs of all types combined, compared with the nonobligated physicians, worked in counties that were far more often rural and had lower primary care physician-to-population ratios, in cities and towns that were much smaller and poorer, and they reported more of their patients were uninsured or covered under Medicaid (Table 1). Even in analyses run separately for rural and urban-situated physicians and in multivariate models adjusting for physicians' rural versus urban location, specialty, and demographics, obligated physicians were still found to work in needier communities and with needier patients by all measures.

We explored whether county physician-to-population ratios were lower for obligated physicians simply because states with a greater need for physicians (and thus lower ratios) more often sponsored support-for-service programs.<sup>24</sup> We confirmed that, indeed, obligated physicians worked in counties with primary care physician-to-population ratios lower than their state's median county ratios more often than nonobligated physicians (37% vs. 11%,  $P < 0.001$ ).

Among obligated physicians and weighing findings on all 5 measures of community need (Table 1), those serving in direct financial incentive programs worked in the neediest settings. Contrary to popular belief, the towns and counties where scholarship participants worked demonstrated no greater need than where participants of other programs worked.

### Physician and Family Satisfaction

Physicians serving state obligations were more often satisfied with their work and practices and more often felt a sense of belonging to their communities than nonobligated physicians (Fig. 2). Obligated and nonobligated physicians gave comparable estimations of the satisfaction and needs-fulfillment of their spouses and children.

In virtually all ways tested, satisfaction was comparable for physicians and families participating in the 5 types of programs, the only exception being that scholarship program participants more often than others felt restricted by the practice sites available to them (36.6% vs. 19.3%;  $P < 0.01$ ).

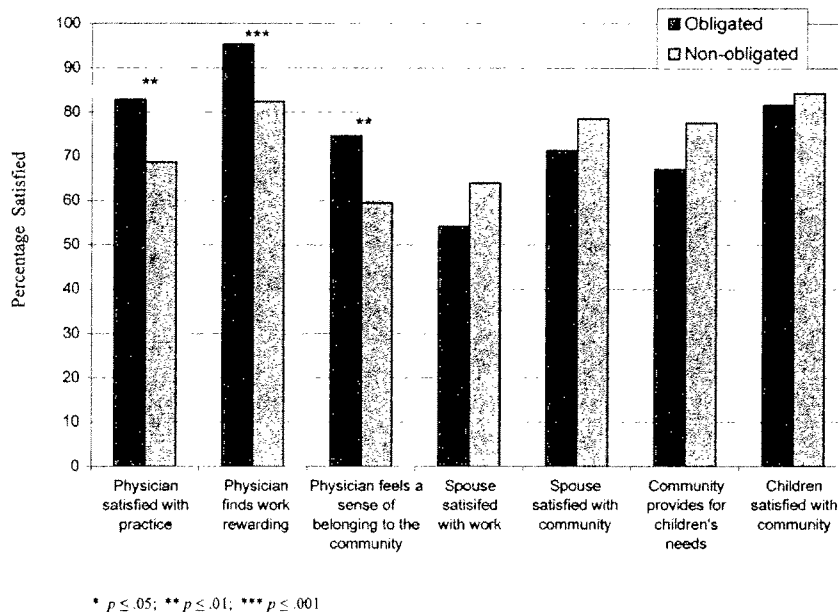
**TABLE 1.** Comparison of Community and Patient Characteristics of State-Obligated and Nonobligated Physicians; Physicians Serving in the 5 Types of Service Programs; and Physicians Obligated to Programs Using Different Types of Site-Eligibility Criteria

	Community and Patient Characteristics					
	(n Physicians/ Programs)	Rural (Nonmetropolitan) County (%)	Median Town/City Population	Median Town/City per Capita Income (\$)	Median County Primary Care Physician-to- Population Ratio	Mean Patients Covered by Medicaid or Uninsured (%)
Obligated vs. nonobligated						
Obligated, all types	(330/29)	68.4 <sup>‡</sup>	5094 <sup>‡</sup>	10,813 <sup>‡</sup>	78.5 <sup>‡</sup>	48.5 <sup>‡</sup>
Nonobligated	(368/NA)	11.6	56,129	14,090	118.1	28.5
Comparisons of 5 program types						
Scholarship	(30/5)	86.2*	3541	10,302	82	40.5
Service-option loan	(56/3)	50.0 <sup>‡</sup>	7284	12,082 <sup>‡</sup>	76	43.3
Resident support	(38/3)	51.4*	4062 <sup>‡</sup>	10,958	57 <sup>‡</sup>	50.8
Loan repayment	(138/14)	73.3	5422*	10,681	91 <sup>‡</sup>	48.0
Direct financial incentive	(68/4)	75.4	4410	9911 <sup>‡</sup>	64	55.5 <sup>‡</sup>

\* $P \leq 0.05$ ;

<sup>‡</sup> $P \leq 0.01$ ;

<sup>‡</sup> $P \leq 0.001$ ; 2-tailed *t*-test, chi-square, and Kruskal-Wallis comparisons of nonobligated versus obligated physicians, and comparisons of physicians in each program type versus obligated physicians in all four other types of programs.



**FIGURE 2.** Satisfaction and needs fulfillment of physicians and their families serving in all state programs combined ( $n = 330$ ) compared with nonobligated physicians ( $n = 368$ )

A remarkable 90.2% of obligated physicians indicated that they likely would enroll in their program if they had it to do all over again, including 64.2% who indicated that they definitely would do so. Differences across programs were found only for physicians in scholarship compared with loan repayment programs in which 47% versus 71% of physicians indicated that they would definitely sign up again ( $P = 0.01$ ).

We explored the relationships between the buyout costs that programs levied and physicians' satisfaction, again finding associations only for medical student-targeted programs. When service-option loan and scholarship programs charged more than simple principal plus interest to buyout, most measures of physician satisfaction were lower, including fewer participants reporting, in retrospect, a definite willing-

ness to commit to their programs again (36% vs. 65%,  $P = 0.04$ ).

**Retention**

Obligated physicians remained longer in their service practices than nonobligated physicians remained in their first jobs after training (hazard ratio [HR] for leaving, 0.70; 95% confidence interval [CI], 0.51–0.96;  $P = 0.029$ ) (Table 2). Respective group retention rates from life tables at 2 years were 92% versus 77%, at 4 years 71% versus 61%, at 6 years 59% versus 55%, and at 8 years 55% versus 52%. Retention tended to be better for obligated physicians than nonobligated physicians even after adjusting for group differences in physicians' specialties and demographics, although the differ-

**TABLE 2.** Comparison of the Retention of State-Obligated versus Nonobligated Physicians

	Hazard Ratio	P Value	95% Confidence Interval
Model 1 (unadjusted)			
Obligated vs. nonobligated	0.70	0.029	(0.51–0.96)
Model 2 (adjusted)			
Obligated vs. nonobligated	0.75	0.080	(0.53–1.03)
Family physician vs. internist	0.91	0.688	(0.58–1.43)
Pediatrician vs. internist	0.80	0.533	(0.40–1.61)
Male vs. female	0.76	0.190	(0.50–1.15)
Married vs. unmarried	0.75	0.270	(0.46–1.25)
Age when physicians began serving obligations	1.01	0.675	(0.95–1.08)

ence fell under the threshold of statistical significance ( $P = 0.08$ ).

Among the 5 types of service-requiring programs, the longest group retention was seen for loan repayment recipients, 66% of whom remained in their service sites 8 years after starting work there, with a hazard ratio of departure compared with all other programs = 0.46 (95% CI, 0.30–0.70;  $P < 0.001$ ) (Fig. 3). Retention was shortest for resident support programs (HR, 6.72; 95% CI, 4.05–11.12;  $P < 0.002$ ). Scholarship participants demonstrated the second shortest retention (HR relative to service-option loan, loan repayment and direct incentive programs, 1.96; 95% CI, 0.97–3.97;  $P = 0.061$ ).

Programs' buyout penalties were associated with retention, but once again only in scholarship and service-option loan programs, wherein penalties above simple principal plus interest were associated with lower odds of retention at 4 years (odds ratio, 12.4;  $P = 0.012$ ).

## DISCUSSION

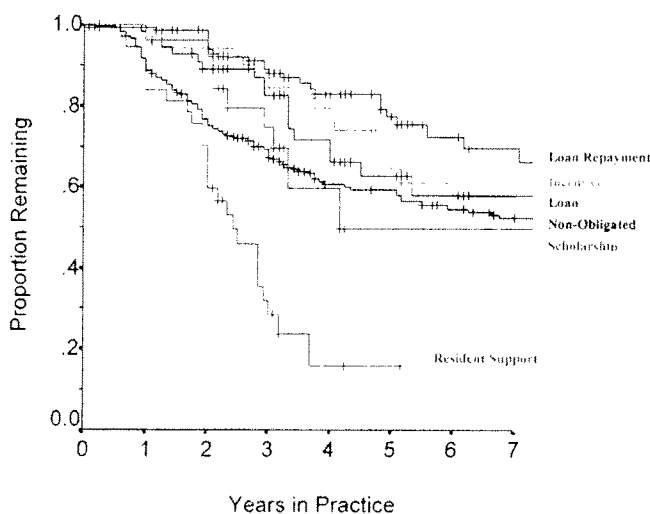
Outcomes for states' support-for-service programs as a group were generally quite positive. Programs as a whole placed physicians in small and needy rural towns and counties, where physicians estimated that almost half of their patients were covered by Medicaid or were without health insurance. Physicians who served in these state programs were generally more satisfied with their work and communities and remained in their service sites longer than nonobligated "mainstream" generalists. We do not believe that the jobs and communities where these physicians served were inherently more pleasing; rather, we suspect that the benev-

olence of individuals who commit to and then fulfill service requirements predisposes them to find particular satisfaction from work that they believe in.<sup>25,26</sup>

Loan repayment and direct financial incentive programs enjoyed the greatest successes among the various program types, confirming the wisdom of recruiting physicians at the end of their training.<sup>11</sup> Financial buyout penalties were generally not used or needed in these programs, because their service completion rates were excellent without financial threats. Several program directors spoke of how much easier loan repayment and financial incentive programs are to administer than student-targeted programs, in which program staff must monitor participants during their training and deal with the many who buy out.<sup>10,27</sup> Direct financial incentive programs demonstrated an interesting niche among the program types, supporting physicians who often owned their practices, often in particularly needy settings.

Despite positive outcomes for programs overall, this study confirmed some commonly held concerns about scholarship programs. Very high penalties do seem to cut buyout rates by one third,<sup>7</sup> but penalties of any amount were associated with lower physician satisfaction and shorter retention. Contrary to claims,<sup>12</sup> state scholarship program participants did not work in demonstrably needier settings than participants of other programs. Studies of the NHSC Scholarship Program have similarly found that its participants do not serve in needier settings than those in the NHSC Loan Repayment Program.<sup>11,27</sup> The Congressional Government Accounting Office (GAO) and NHSC further similarly concluded that the NHSC Loan Repayment Program achieved better outcomes—higher service-completion rates, greater satisfaction, and longer retention—than the NHSC Scholarship Program, and also at a lower cost.<sup>11,15,28</sup>

The affordable buyout terms of student service-option loan programs allowed half of their participants to opt out of service, but the half who did serve were satisfied and long retained. Service-option loans could play an important complementary role to programs that target graduates, appealing to aspiring medical students who might otherwise choose not to pursue a medical career rather than assume the typical \$100,000+ debt in traditional education loans. To embrace loan programs with service options, states must accept that it is not fatally undesirable for some participants to satisfy their loan contracts financially rather than with service. Indeed, most medical students fund their education with traditional loans, like the Health Education Assistance Loans (HEAL), where there is no option or enticement for service.<sup>6</sup> Concerns that too many physicians buyout of loan-for-service programs leaving too few available for shortage communities can be addressed quite readily by making more awards up front, costing programs nothing more because nearly all who opt not to serve repay their loans with interest.



**FIGURE 3.** Retention of obligated physicians within their service practices: Kaplan-Meier estimations by type of program and compared with nonobligated physicians



## Limitations and Unanswered Questions

Some of this study's data were self-reported and thus vulnerable to reporting inaccuracies. Directors provided figures on their programs' default and buyout rates and likely used a variety of methods to determine these rates. We are unaware, however, of any systematic inaccuracies likely to have biased our principal findings.

Some directors of scholarship and service-option loan programs who otherwise cooperated with our study would not provide the physician-specific information we needed to survey their participants, citing federal confidentiality protections of administrative data collected on students.<sup>29</sup> Given the demonstrated similarities between participating and nonparticipating programs, most importantly in the service completion rates of their participants, we do not suspect that the lower participation rates of student programs biased our outcomes. However, if less successful student programs withheld participants' names to hide their weaknesses, then loan repayment and direct incentive programs could actually be relatively even *more* successful than we judged (ie, bias, if present, was toward the null).

We had wanted to assess program costs and cost-effectiveness but program directors could not provide complete or comparable cost data. We also did not assess the experiences of physicians who signed up with these programs but chose not to serve.

We had no validated criteria on which to judge how often state-obligated physicians work in the very neediest settings, because states have not substantiated their site eligibility criteria and current federal criteria are inadequate.<sup>30,31</sup> Nonetheless, because some state programs use very broad site eligibility criteria, it is very likely that some obligated physicians do not work in the neediest areas.<sup>5,32</sup>

## CONCLUSIONS AND RECOMMENDATIONS

As a whole, states' support-for-service programs bring physicians to needy communities where they find satisfying work caring for at-risk patient populations and remain for many years. Of all program types, the loan repayment and direct financial incentive forms, which target physicians after training, show the broadest successes. The successes of these state programs warrant their continued support and perhaps expansion to remedy the continuing maldistribution of physicians.

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