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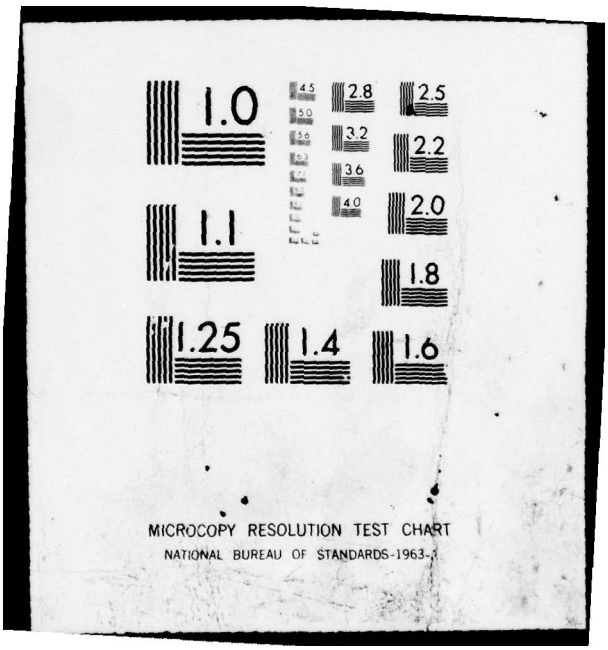
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THE ECONOMICS OF DENTAL LICENSING

By: Arlene Holen

November 1978

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THE ECONOMICS OF DENTAL LICENSING

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EXECUTIVE SUMMARY

Economists, with few exceptions, have viewed occupational licensing as a conspiracy of suppliers; they have focused attention almost exclusively on its costs, such as higher prices and restricted opportunities.

In this study an attempt is made to define and document benefits that might flow from the licensing of dentists. In addition, hypotheses about the determinants of licensing stringency are examined, and the effects of licensing on the distribution of dentists are investigated.

The benefits consumers might realize from the licensing of dentists are:

1. reduced risk of adverse outcomes

2. reduced costs of acquiring information

3. greater consumer satisfaction.

Whether these benefits are in fact realized by consumers is subjected to several empirical tests. These tests are based on state variations in licensing stringency. Regression analysis is used to distinguish the effects of licensing from other factors.

The first test examines how adverse outcomes of care vary with the stringency of licensing. It amounts to testing the soundness of criteria by which applicants for licensing are measured. The results suggest that licensing reduces the likelihood of adverse outcomes, and increases the quality of care.

A second test examines dental health, to see whether dental health is improved in states with stricter licensing. Increased quality of care may improve dental health; however restriction of entry may simultaneously reduce the availability of care. Using data on a sample of individual naval recruits, we found that more stringent licensing is associated with less

dental neglect, measured as untreated dental disease relative to total dental disease, treated and untreated. When neglect was measured as lack of all natural teeth, however, no statistical connection was found.

Another test examines the demand for dental care directly. If consumers perceive that licensing is beneficial, affecting dental care services favorably, they should demand more services at given prices when licensing standards are high. The results of this test suggest that consumers believe that the quality effect of licensing is beneficial.

Our investigation of the determinants of licensing stringency finds that licensing standards are higher in states where consumers may stand to gain more from licensing. Licensing standards also are higher where there are many licensing applicants. A relatively large pool of applicants may enable licensing boards to be more selective and to raise standards of quality.

Evidence for the widely held belief that supplier conspiracy explains licensing is reexamined. The association between licensing stringency and dentist earnings can be explained at least partially by higher quality in more stringent states, and also by the fact that stringent licensing may not only be a cause of high earnings but may also result from high earnings. Applicants are attracted to states where earnings are high, and licensing boards appear to impose higher standards in response to a large number of applicants.

The effects of licensing on the distribution of dentists are examined to see whether state licensing barriers promote unevenness in the availability of care across states. Differences between states in dentists per capita have diminished over the past twenty-five years, although without licensing barriers this equalization might have accelerated.

State licensing barriers are not associated with reduced dentist mobility or reduced levels of dentists per capita. The number of dentists per capita has increased more in stringent states over the past ten years. Applicants for licensing are highly sensitive to shifts in population, enabling licensing

boards in growing states to raise standards and at the same time grant more licenses.

Empirical results were not all statistically significant, but the directions of effect were consistent. The study concludes that dental licensing may have certain beneficial effects, and that variation in licensing stringency does not appear to create problems of unequal access to care. Since costs are not estimated, however, or full benefits, judgment as to whether consumers achieve higher levels of welfare because of licensing must await further research.

The recommendation is made that proposals to change licensing in dentistry ought not to ignore the risks of doing away with minimum standards of quality. Nor should policy proposals assume that a single, federal standard would be preferable to the current pattern of differences, which is responsive, at least in part, to local preferences and to the availability of applicants.

INTRODUCTION

Economists, with few exceptions, have viewed licensing as a conspiracy of suppliers; they have focused their attention almost exclusively on its costs, such as higher prices, and restricted opportunities.[1] It has been suggested that licensing may even reduce the quality of service available to consumers [9].

This study, in contrast, takes the view that it is unrealistic to ascribe so pervasive a phenomenon wholly to supplier conspiracy. Occupational licensing is extremely widespread in our economy,[2] and appears to be increasing.

If licensing came about because suppliers somehow managed to impose it on consumers, whose interests are less concentrated, one would expect consumers to resist. Instead, consumers often seem to welcome licensing, and frequently look to occupational regulation as a solution to problems. Moreover, government and insurance payment mechanisms rely on licensing credentials as evidence of minimum competence.

Licensing of dentists is under scrutiny as a possible source of manpower problems due to supply restriction; proposals have been made to substantially modify the authority of state licensing boards. Existing studies of dental licensing, however, have addressed only its negative aspects. They have either ignored questions of quality or have assumed the absence of any beneficial effects. A balanced view of policy action requires that attention be paid to risks of proposed changes.

In this study an attempt is made to define and document benefits that might flow from dental licensing. In addition, hypotheses about the determinants of licensing stringency are examined, and effects of licensing on the distribution of dentists are investigated. No attempt is made to provide a full

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[1] For discussion of these effects see [4, 5, 7, 8, 16, 18, 22, 23, 25, 27, 28, and 30].

[2] In 1970, there were about 500 separate occupations licensed by one or more states and over 2,000 regulated at the local level [1].

cost-benefit analysis of licensing; however, this work may provide a first step toward such an overall evaluation.

To understand the effects of dental licensing, we must understand the licensing mechanism and the market for dental care; these are discussed in the next sections.

LICENSING IN DENTISTRY

Medicine, dentistry, law, and pharmacy were among the first occupations to be licensed in the United States. Dentists were licensed in most states by 1900 [11]. Licensing boards were established by state dental practice acts, which also defined the practice of dentistry and prohibited unlicensed persons from working in the field [26].[1] Licensing boards are generally composed of practicing dentists; boards are responsible for the examination of candidates for licensing and for issuing and enforcing administrative regulations. State dental boards have the authority to revoke or suspend licenses in cases of serious wrongdoing. Board appointments and dental legislation are heavily influenced by state dental societies.

Although the degree of restrictiveness or level of difficulty of obtaining a license varies considerably between states, there are several common requirements. Candidates, with few exceptions, must have graduated from a school approved by the Council on Dental Education of the American Dental Association. They must pass the written examination of the National Board of Dental Examiners, or the state's equivalent written examination. In most cases, they must also pass the practical or clinical examination of the state in which they want to practice, and must provide their own patients for that examination. Provisions for recognition of out-of-state licenses and reciprocity agreements between states have increased in recent years; these provide exceptions to the requirement that candidates must pass a practical examination, but are still not widely in effect. Also, several groups of states have recently established simultaneous examination arrange-

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[1]For a more complete discussion of the institutional features of dental licensing, see [8] and [15].

ments; candidates passing such an examination are qualified for licensing in participating states.

Despite these recent modifications, state licensing still imposes an important control on the number of new dentists, in large part through the requirement that candidates pass a practical examination. The practical examination looms as an especially difficult barrier for graduates of out-of-state schools or non-recent graduates, those less familiar with prevailing academic standards.

It is much more difficult to obtain a license to practice dentistry in some states than in others. Some states do not recognize the certificate of the National Board of Dental Examiners, but recognize only their own written examinations. In 1975, fifteen percent of all licensing examinations resulted in failure; the range between states was from zero to fifty- five percent. The operative procedures included in the clinical examination vary substantially, both in number and level of difficulty. Some states also require the successful completion of a gold foil restoration, which is an extremely painstaking process; some states require candidates to pass an examination on the dental practice act or dental ethics. Even in states where licenses can be granted without examination to candidates with sufficient credentials, boards have the discretion to, and often do, refuse to grant licenses [8]. Application fees for licensing currently range from $25 to $150. There is variation as well in other licensing provisions. Important licensing provisions for 1969 are shown by state in table 1.

Dentists, once licensed and in practice, are then limited in their use of aides by the state dental practice act and regulations that relate to the functions that may be performed by dental hygienists and auxiliaries. These also vary across states.

One controversial aspect of dental licensing is the soundness of criteria by which successful applicants are actually chosen. Some critics charge that there is frequent discrimination, directed particularly against graduates of out-of-state schools. Many view the gold foil requirement as a

TABLE 1

DENTAL LICENSING VARIABLES, BY STATE, 1969

State	Fail Rate (%)	Reciprocity	Simultaneous Exam	Gold Foil Requirement	Recognizes National Board Exam	Licensing Exam Fee ($)
Alabama	5	No	No	No	Yes	50
Alaska	56	Yes	No	Yes	Yes	25
Arizona	45	No	No	Yes	Yes	75
Arkansas	8	No	No	No	Yes	50
California	26	No	No	Yes	Yes	50
Colorado	17	No	No	Yes	Yes	50
Connecticut	6	No	No	No	Yes	50
Delaware	0	No	No	Yes	No	50
Dist. of Col.	5	No	Yes	No	Yes	40
Florida	35	No	No	Yes	No	50
Georgia	14	No	No	No	Yes	50
Hawaii	25	No	No	Yes	Yes	50
Idaho	22	No	No	Yes	Yes	75
Illinois	16	No	No	Yes	Yes	50
Indiana	2	Yes	No	Yes	Yes	25
Iowa	1	No	No	Yes	Yes	50
Kansas	0	Yes	Yes	Yes	Yes	55
Kentucky	2	Yes	No	Yes	Yes	50
Louisiana	0	No	No	No	Yes	50
Maine	4	No	Yes	Yes	Yes	50
Maryland	1	No	Yes	Yes	Yes	30
Massachusetts	5	No	Yes	Yes	Yes	40
Michigan	4	No	No	No	Yes	35
Minnesota	0	No	No	Yes	Yes	25
Mississippi	0	No	No	No	Yes	50
Missouri	3	Yes	Yes	Yes	Yes	40
Montana	18	No	No	Yes	No	25
Nebraska	0	No	No	Yes	Yes	50
Nevada	57	No	No	Yes	Yes	100
New Hampshire	3	Yes	Yes	Yes	Yes	50
New Jersey	19	No	No	No	Yes	50
New Mexico	26	No	No	Yes	No	50
New York	14	No	Yes	No	Yes	40
North Carolina	8	No	No	No	Yes	30
North Dakota	33	Yes	No	Yes	Yes	50
Ohio	6	Yes	No	No	Yes	50
Oklahoma	6	Yes	Yes	No	Yes	50
Oregon	17	No	No	Yes	Yes	50
Pennsylvania	0	Yes	Yes	No	Yes	25
Rhode Island	0	No	No	No	Yes	50
South Carolina	12	No	No	No	Yes	50
South Dakota	0	Yes	No	Yes	Yes	50
Tennessee	3	No	No	No	Yes	50
Texas	7	No	No	No	Yes	50
Utah	5	No	No	Yes	Yes	25
Vermont	14	No	No	Yes	Yes	25
Virginia	6	No	No	No	Yes	50
Washington	21	No	No	No	Yes	25
West Virginia	4	Yes	Yes	No	Yes	35
Wisconsin	5	No	No	No	Yes	25
Wyoming	29	No	No	Yes	Yes	50

TABLE 1 (continued)

Sources: **Fail rate: percent of state licensing examinations resulting in failure.** Facts About States for the Dentist Seeking a Location, 1971 (American Dental Association), p. 20, col. 5.

Reciprocity: whether the state has reciprocity arrangements with any other state. Facts, 1969; p. 19.

Simultaneous examination: whether the state participates in a simultaneous examination arrangement. Dr. Donald W. Johnson, Division of Dentistry (U.S. Dept. of H.E.W.).

Gold foil requirement: whether the clinical examination includes some class of gold foil restoration. Facts, 1969; pp. 15-18.

Recognizes National Board Examination: whether the state recognizes the certificate of the National Board of Dental Examiners. Facts, 1969; p. 13, col. 4.

Licensing examination fee: Facts, 1969; p. 14, col. 1.

restrictive device, since it is difficult to accomplish successfully on the practical examination and has little relevance to actual dental practice. Some recent developments in state licensing procedures attempt to change questionable practices: these include representation of consumers on licensing boards, examination grading procedures that minimize bias on the part of examiners, and simultaneous examination arrangements.

THE MARKET FOR DENTAL CARE

If there were no licensing, the market for dental care would be similar in many ways to other markets. The demand for dental care, like the demand for other commodities, depends on price, income, and consumer tastes. Consumers can be expected to demand fewer services, other things constant, when prices are higher. Higher income should lead to greater demand. Taste, or inclination to consume dental care services, may vary according to characteristics such as age, education, sex, race, and urban or rural residence.

In addition to these factors, which affect demand for many commodities, the demand for dental care depends on dental disease and abnormalities. Given price, income and the inclination to utilize dental care, the quantity demanded will depend on the individual need for care, which is determined by current and previous dental disease. Dental disease, in turn, depends on inherited traits, and preventive care as well as environmental conditions. Inherited traits and preventive care practiced by individuals should vary according to factors affecting demand that have already been mentioned: age, education, sex, race, urban or rural residence and income. The environmental condition most commonly associated with prevention of dental disease is fluoridation of the water supply. In the short run, fluoridation reduces tooth decay and therefore the demand for care [31]. But over the longer term, demand might increase; natural teeth that are retained longer are then subject to additional problems.

The demand for dental care is further influenced by governmental expenditures for dental care. Services financed at

public expense provide a subsidy to dental care consumption; this should increase the quantity demanded.

The supply of dental care, like that of other commodities, depends on price, the number of suppliers, and the price and availability of other inputs. The quantity supplied would generally be expected to increase with higher prices, other things constant. More dentists should provide more dental care services. Similarly, more dental auxiliaries should increase supply, and should be willing to work more hours at higher wages. The supply of dental care may be further influenced by governmental expenditures for dental care, where these expenditures function as a subsidy to dental schools or other institutional providers.

In principle, dental licensing can affect both the supply and demand sides of the market. On the supply side, licensing may restrict entry; this would reduce the number of dentists and thus the quantity of services supplied. Critics of licensing emphasize this effect. If the licensing process selected among applicants on a discriminatory or other non-quality-related basis, this could be its only effect.

The licensing process, however, appears to be aimed at selecting those applicants who are most likely to provide higher quality services. It may effectively exclude from the market the least promising candidates. The resulting changes in the quality distribution of providers and of services provided could then affect demand as well as supply, since important aspects of the product "dental care" would be altered.

This characterization of the market for dental care services can be written as a simultaneous model in the following equation form:

Quantity demanded per capita = f(Price,
Income per capita,
Demographic characteristics,
Flouridation
Percent urban,
Public dental care expenditures per capita,
Licensing restriction or quality as a result of licensing restriction)

Quantity supplied per capita = f(Price,
Licensing restriction or number of dentists per capita as a result of licensing restriction,
Number of dental auxiliaries per capita,
Wages of dental auxiliaries,
Public dental care expenditures per capita)

POSSIBLE BENEFITS AND TESTS

The benefits consumers might realize from the licensing of dentists are increments in utility that would flow from changes in the market for dental care, abstracting from the cost of any such changes.

The following list of possible benefits draws on the work of Kenneth Arrow [2], Keith Leffler [21], and Thomas G. Moore [25]:

1. Reduced Probability of Adverse Outcomes. Adverse outcomes of dental treatment can often be serious and irreversible; the recovery of damages is uncertain and involves considerable transaction cost. By requiring standards of competence, licensing may reduce the incidence of adverse results of treatment. This should increase the utility of risk-adverse consumers. Also in case of an adverse outcome, an administrative remedy enforced by the licensing authority can be a convenient alternative to normal legal channels for recovering damages or imposing sanctions.

2. Reduced Variability in Service Quality. Again, by establishing minimum standards of competence, licensing may reduce variability in the quality of services. Thus, costs of acquiring information might be reduced, with less search required to attain a given level of certainty as to quality. Assessing the quality of dental services or the capability of dentists may be difficult for many consumers. Licensing may substitute for individual search.[1]

[1] A number of economists, including Milton Friedman [16], have suggested that occupational certification might be preferable to licensing, since certification would furnish evidence that providers of services meet prescribed standards but would not restrict entry. Under certification, as opposed to licensing, the costs of restricting economic freedom could be avoided, but the benefits of providing information about quality could be retained.

3. Greater Consumer Satisfaction. Licensing implies that someone trustworthy and capable has evaluated the competence of the provider. People might feel better about consuming services when providers are licensed, even if these services are not actually higher in quality. Some people may gain satisfaction from knowing that others are consuming services performed by licensed providers.

The existence of the first two benefits can be addressed directly, by seeing whether licensing standards effectively exclude low quality services from the market. Whether consumer satisfaction is increased can only be examined by inference. To see if the potential benefits of licensing are realized, three basic tests were performed; these examined relationships between specific aspects or measures of licensing stringency and market outcomes.

The first test examines how the frequency of adverse outcomes of care varies with licensing stringency. It amounts

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Footnote continued from previous page.

Certification, however, is seldom used, although in some states psychologists and registered nurses are certified. Pennell and Stewart [26, p. 3] point out that "the tendency in occupational licensing has been to move toward a compulsory or mandatory licensing act...[beginning] with a permissive or voluntary statute which prohibits the use of a particular title rather than the practice itself." Voluntary, as opposed to statutory, certification is used in many occupations and occupational specialties, including specialties in medicine and dentistry. In this study we limited our attention to compulsory licensing, the most common form of occupational regulation.

to testing the soundness of criteria by which applicant for licensing are measured.

A hypothetical distribution of the competence of applicants to a state, reflecting potential quality of service, is sketched in figure 1. Suppose B represents a higher level of competence than A. States that require applicants to meet the standard of B may have fewer adverse outcomes following treatment than states that require only A. In states requiring A, the dark area represents licensing examination failures. In states requiring B, the dark area plus the striped area represents failures.

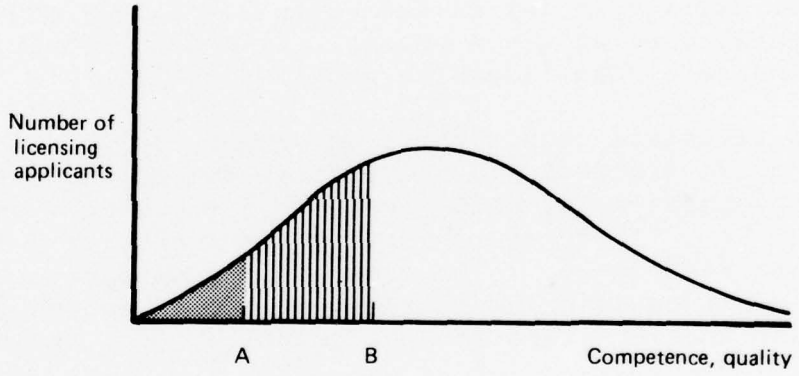

FIG. 1: MINIMUM STANDARDS OF APPLICANT QUALITY

If adverse outcomes are in fact relatively less frequent in stricter states, we would conclude that restriction of entry to practice does result in higher effective standards in these states, and that corresponding consumer benefits -- reduced risk and increased certainty as to quality -- are realized. If stricter states do not have fewer adverse outcomes, we would

conclude that strictness in licensing does not mean the same thing as higher standards and consumers do not benefit.

A second test examines dental health. If dental health is improved in states with stricter licensing, we would conclude that licensing is beneficial to consumers, even allowing for restriction of entry. Improvement in dental health might be realized directly through increased quality of care; however, the improvement may also be realized through an increase in the amount of services consumed. This increase could result if consumers believe that the product "dental care" is favorably altered because of licensing, and, for whatever reason, they consume more of it and have better dental health as a result.

A final test investigates the demand for dental care directly. One way to define benefits due to licensing is the willingness of consumers to pay for it. If licensing increases consumer utility in any of the above ways, they should demand more dental care at given prices. Evidence of increased demand would indicate that licensing provides benefits to consumers.

To illustate such a shift in demand, suppose that curves D_1 and S_1 in figure 2 are the initial demand and supply curves. These intersect at A, so Q_1 services are produced and consumed at price P_1 . If demand shifts to the right, with increased licensing stringency, to D_2 , and supply shifts to the left, to S_2 , the new equilibrium is reached at B. The new price, P_2 , is higher than P_1 , and the new quantity, Q_2 , is lower than Q_1.[1]

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[1]If supply shifted less, or not at all, it would of course be possible for Q_2 to be greater than Q_1 .

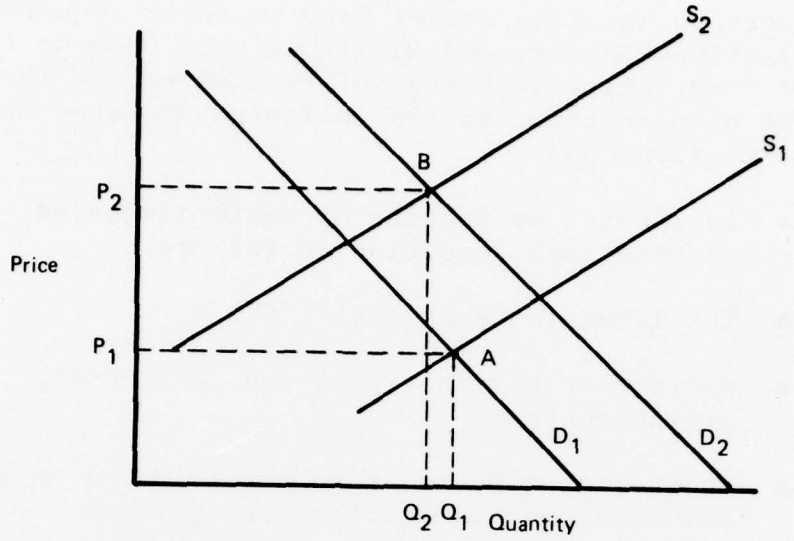

FIG. 2: DEMAND AND SUPPLY SHIFTS WITH LICENSING

Even if we observe such a shift in demand, we cannot conclude that consumers achieve higher levels of welfare with licensing. Nor can we evaluate optimal levels of licensing restrictiveness. The tests described indicate whether licensing benefits consumers in the sense that they would be willing to pay some positive price for these benefits. We cannot tell how much they would be willing to pay.

MEASURES OF LICENSING STRINGENCY

To measure the effects of licensing it would be ideal to observe parallel situations in which the only difference was the presence or absence of licensing. There are no places in this country, however, where the complete absence of dental licensing can be observed. But we can analyze the effects of licensing by measuring variations in the stringency of the licensing rules that are applied.

As described earlier, states vary in their requirements, fees, examination content, and willingness to endorse the credentials of other states. Using information on how these vary by state, we have constructed the following measures of licensing restrictiveness:

- Fail rate, or percent of state licensing examinations resulting in failure
- The licensing examination fee
- Whether or not the state has reciprocity arrangements
- Whether or not the state participates in a simultaneous examination arrangement
- Whether or not the state recognizes the certificate of the National Board of Dental Examiners (NBDE)
- Whether or not a gold foil restoration is required as part of the practical examination.

Higher fail rates and higher examination fees are more restrictive than lower fail rates and fees. The last four measures are dummy variables reflecting more or less restriction. Reciprocal arrangements, simultaneous examinations, and recognition of the NBDE certificate are all less, rather than more, restrictive. Requirement of a gold foil restoration is more restrictive.

The concept of licensing stringency should, in principle, include not only how difficult it is to become licensed, but also how difficult it is to retain the license once granted. Disciplinary actions against dentists can involve license

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[1]Higher fees may deter applicants but may also be indicative of more careful testing procedures. This was pointed out by Bud Crawford, of the American Association of Dental Examiners. Fees are used to pay for the administration of examinations, and are controlled by the state legislature.

revocation, suspension or restriction, or mandated continuing education.[1] Such actions, however, although believed to be increasing in frequency are not recorded systematically.

These separate dimensions of licensing restrictiveness are not independent of one another. States that have high fail rates tend not to have reciprocity arrangements but have high examination fees; nonrestrictive states tend to be less stringent according to several of the licensing measures (see table 1). Because of this collinearity, or tendency of each measure to obsecure the apparent effects of others, we have not always used the measures together.

The fail rate was selected as the single best measure of stringency, with higher fail rates taken to indicate tighter screening of applicants. Although higher fail rates might reflect lower quality applicants, rather than higher standards, we found that the opposite relation holds.[2] According to imputed measures of quality, licensing applicants self-select on the basis of anticipated examination difficulty. Those with higher manual aptitude scores tend to apply to states with higher fail rates. Thus, variation in applicant quality between states, if anything, causes the fail rate to be a conservative measure of stringency.[3]

[1]Studies of disciplinary actions against physicians find the imposition of sanctions to be quite rare, and more frequently related to drug or alcohol abuse, unethical behavior, or advertising infractions than to incompetence or malpractice [6]. Illinois, one of the few states reporting disciplinary actions of their licensing boards, in 1976 suspended or revoked the licenses of seven dentists, five for the use of unlicensed help. A number of states now require continuing education for relicensure, or dental society membership, but these requirements were not in effect before 1970.

[2]Measures of academic and manualability of licensing applicants were imputed by combining respective DAT scores by dental school with confidential data on state licensing applications by school of graduation.

[3]A recent study by the American Dental Association's Division of Educational Measurement shows that, for 1552 candidates for the Northeast Regional Board in 1972, DAT manual scores were not predictive of examination performance.

The fail rate was also selected as the best measure because the ranking of states by fail rate has been quite stable over time. If current licensing standards departed substantially from those in the recent past, there would be little reason to expect the quality of services rendered by existing stock of dentists to reflect the newer standards.

These measures of licensing stringency are used, first, to see how adverse outcomes vary with licensing.

THE EFFECT OF LICENSING ON ADVERSE OUTCOMES

Quality of care, or the relative frequency of adverse outcomes is measured here by malpractice insurance premiums for dentists. Insurance companies set dental premium rates by state according to the expected incidence of claims, and size of awards, including settlements out of court.[1] Thus, rates for malpractice insurance "average" the cost of adverse outcomes over all those providing dental care in the state. Malpractice premiums thus provide a measure of adverse outcomes that reflects both the incidence of claims and the size of awards.

Many factors influence malpractice costs, however, in addition to quality. These factors include access to legal services, the willingness to engage in litigation, and local rules of evidence, such as application of community or national standards of care.[2] In using malpractice insurance premiums as a measure of adverse outcomes in regression analysis, it is necessary to take these other factors into account. We do this

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[1] In addition to experience rating by state, insurance companies have begun to set separate rates for oral surgeons.

[2] Studies of medical malpractice have given more attention to causal factors other than quality; for example [17] and [20]. In [24, chap. 5] the connection between licensing and malpractice incidence is made explicitly.

implicitly, by using malpractice insurance premium rates for physicians as a control variable.

In addition to reflecting malpractice claim tendencies in a state for a given quality of practice, physician malpractice premiums should reflect other causal factors underlying health care quality, such as demographic and economic characteristics. Thus, holding physician malpractice premiums constant, dental licensing variables should have a negative effect on dental malpractice premiums if licensing stringency reduces the frequency of poor quality care.

Data on malpractice insurance premiums were obtained from the Insurance Services Office, an independent organization which gathers actuarial data from insurance companies nationwide. No single insurer does business in every state. The figures used are recommended rates for a given level of coverage.[1] Annual malpractice insurance premiums for 1970 are shown in table 2 for dentists and for physicians in general practice. Premium rates have since risen sharply.

Table 3 presents regression estimates of how licensing stringency, measured in several ways, affects adverse outcomes, measured by dental malpractice insurance premiums. The explanatory variables of interest are the measures of licensing stringency. Malpractice insurance premiums for physicians are used to take into account important factors besides licensing in a state that might affect dental malpractice cost.

The major difference among the regressions in table 3 is in the way licensing stringency is described. In equation 1 all six measures of dental licensing are included; in equation 2, only one - the 1969 fail rate. Equation 3 uses the average of fail rates between 1965 and 1969 for each state. As explained above, we have not always included the whole set of licensing parameters since they tend to be collinear. Alaska is omitted from these regressions because of gaps in information.

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[1]These more closely represent actual claims experience than would state-approved charges, to the extent these might differ.

TABLE 2

ANNUAL MALPRACTICE INSURANCE PREMIUMS, BY STATE, 1970
($)

State	Dentists	Physicians, general practitioners
Alabama	25	49
Alaska	missing	missing
Arizona	45	146
Arkansas	25	89
California	150	278
Colorado	45	126
Connecticut	36	84
Delaware	45	62
Dist. of Col.	50	73
Florida	40	165
Georgia	40	66
Hawaii	35	72
Idaho	25	57
Illinois	45	71
Indiana	25	62
Iowa	60	62
Kansas	45	57
Kentucky	30	72
Louisiana	40	67
Maine	25	44
Maryland	68	56
Massachusetts	43	48
Michigan	30	153
Minnesota	25	77
Mississippi	20	40
Missouri	40	64
Montana	25	109
Nebraska	25	51
Nevada	30	146
New Hampshire	25	25
New Jersey	39	130
New Mexico	40	104
New York	72	180
North Carolina	15	35
North Dakota	15	40
Ohio	80	102
Oklahoma	48	99
Oregon	35	79
Pennsylvania	60	69
Rhode Island	34	37
South Carolina	30	31
South Dakota	15	42
Tennessee	25	57
Texas	30	60
Utah	25	92
Vermont	35	38
Virginia	30	54
Washington	50	98
West Virginia	20	57
Wisconsin	25	65
Wyoming	16	40

Source: Dr. Graham Boyd, Insurance Services Office.

TABLE 3

THE EFFECT OF LICENSING ON ADVERSE OUTCOMES

Dependent variable: Annual malpractice insurance premium for dentists, 1970 ($)

(1)

Explanatory variable	Coefficient	t-value
Constant	-2.23	
Fail rate, 1969 (%)	- .50	-1.96
Reciprocity	-2.17	- .36
Simultaneous examination	9.58	1.60
Gold foil requirement	4.31	.89
National Board examination	9.14	1.05
Licensing examination fee ($)	.05	.25
Annual malpractice insurance premium for physicians in general practice, 1970 ($)	.39	7.03

Corrected R^2 = .50
Omits Alaska

(2)

Explanatory variable	Coefficient	t-value
Constant	13.31	
Fail rate, 1969 (%)	-.52	-2.63
Annual malpractice insurance premium for physicians in general practice, 1970 ($)	.38	7.09

Corrected R^2 = .50
Omits Alaska

TABLE 3 (continued)

(3)

Explanatory variable	Coefficient	t-value
Constant	13.37	
Fail rate, average of 1965-1969 (%)	-.39	-1.48
Annual malpractice insurance premium for physicians in general practice, 1970 ($)	.37	6.08

Corrected R^2 = .45
Omits Alaska

Sources: Annual malpractice insurance premiums: see table 2.
Dental licensing variables, 1969: see table 1.
Fail rates, 1965-1969: David DeMarais, Council on Dental Education, American Dental Association.

The results in table 3 suggest that licensing improves the quality of dental care, although high levels of statistical significance are not generally attained. The coefficients of licensing variables, in most cases, have signs consistent with this effect. Licensing measures indicating stringency (for example, the fail rate) have negative signs, meaning that they are associated with lower malpractice insurance rates. Measures indicating leniency (for example, the dummy for simultaneous examination) have positive signs, meaning they are associated with higher malpractice rates. The exceptions, in equation 1, are the variables for reciprocity, gold foil requirement, and examination fee; these have very low t-values. Results similar to those in equation 3 were obtained using average fall rates for 1960-1969. Physician malpractice rates are consistently and very strongly associated with dental malpractice rates, as expected, since important underlying factors affect both in the same way.

Further Evidence on Adverse Outcomes

A good test of how well licensing examinations sort out applicants may be how well they predict professional behavior in the future. To test the connection drawn between the screening of applicants for licensing and the quality of services rendered by dentists in a state, we examined two aspects of the behavior of dentists after they were licensed: their participation in continuing education and the effect of continuing education on dental malpractice rates.

Table 4 shows a regression estimating how licensing stringency affects the percentage of dentists who take continuing education courses, allowing for differences in age and in the availability of such courses.

A dentist's inclination to attend professional courses might be affected by his age (older dentists may feel less favorable toward learning in a classroom) and by the convenience or availability of such courses, which are often provided by dental schools. We measure the availability of courses by the number of dental students per practicing den-

TABLE 4

THE EFFECT OF LICENSING ON CONTINUING EDUCATION

Dependent variable: Percent of dentists reporting continuing education courses (1966-1969)

Explanatory variable	(4) Coefficient	t-value
Constant	422.95	
Fail rate, average of 1960-1966 (%)	.50	3.30
Reciprocity	-2.11	-.56
Gold foil requirement	4.76	1.53
National Board examination	-1.40	-.37
Licensing examination fee ($)	-.15	-1.48
Median age of dentists	-16.70	-.87
$(\text{Median age})^2$	.18	.87
Number of dental students in state per practicing dentist	.32	.04

Corrected R^2 = .40
Omits Georgia

Sources: Percent of dentists reporting continuing education courses: percent of active, civilian dentists who completed one or more continuing education course during the year; dentists were surveyed between 1966 and 1969. The National Survey of Dentists' Practice Characteristics (Cycle II) compiled by the Manpower Analysis Branch, Division of Dentistry (U.S. Dept. of H.E.W.)

Fail rates, 1960-1966: David DeMarais, Council on Dental Education, American Dental Association.

Licensing variables, 1966: Facts, 1966, pp. 18-23.

Dentists' age: The National Survey of Dentists' Practice Characteristics.

Number of dental students in state per practicing dentist: number of students attending dental school in the state, 1970-71, Annual Report on Dental Education 1970-71, Council on Dental Education, American Dental Association, divided by number of dentists in state in 1970, Facts, 1971.

tist. Data on participation of dentists in continuing education are drawn from a survey made between 1966 and 1969. At that time, continuing education courses were not required in any state as a condition of license renewal or dental society membership [10].

The fail rate in this regression has a positive and significant coefficient; this suggests that higher fail rates represent higher standards of applicant screening. Thus, states that pass a smaller percentage of applicants in the licensing examination tend to select those who are more likely to participate in further professional education.[1]

The effect of continuing education on dental malpractice premiums is investigated in the regression shown in table 5. As would be expected from the regressions already shown, greater participation in continuing education is associated with lower malpractice premiums, thus with fewer adverse outcomes. This result, however, is not statistically significant.

THE EFFECT OF LICENSING ON DENTAL HEALTH

The second test is designed to see how dental health varies with licensing. Even if licensing improves the quality of care as suggested by the first test, it also restricts the availability of care. Its net effect on health is therefore uncertain.

In order to determine whether dental health is improved by stricter licensing, it was necessary to find special data sets from which to derive measures of dental health by state. Neither the Health Examination nor the Health Interview Surveys of the National Center for Health Statistics tabulates epidemiologic data by state.

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[1]This result is consistent with principles of personnel selection. Although predicting future occupational performances from performance on an examination may be an uncertain process, a higher fail rate increases the "level of accuracy in predicting that applicants will show certain desired job behavior outcomes" [12, p. 152].

TABLE 5

THE EFFECT OF CONTINUING EDUCATION ON ADVERSE OUTCOMES

Dependent variable: Annual malpractice insurance premium for dentists, 1970 ($)

(5)

Explanatory variable	Coefficient	t-value
Constant	23.92	
Percent of dentists reporting continuing education courses	-.29	-1.15
Annual malpractice insurance premium for physicians in general practice, 1970 ($)	.34	6.15

Corrected R^2 = .44
Omits Alaska and Georgia

Sources: Annual malpractice insurance premiums: see table 2.
Percent of dentists reporting continuing education courses: see table 4.

One data set was obtained from a study of 477 naval recruits screened at the Naval Training Center in San Diego in 1968 [29]. This study recorded the dental health status of each recruit (including the numbers of decayed, missing, and filled teeth, and measures of periodontal disease and oral hygiene) and the time of last dental visit. The age, education, and home state of each individual were noted as well. The recruits came from forty-one states. These data allow estimation of the effect of licensing stringency on measures of dental health for individuals in these forty-one states.[1]

Another data set was obtained from the Health Interview Survey, indicating the percent of the population edentulous (without any natural teeth). Loss of all one's natural teeth is in most cases the worst possible state of dental health. It is not uncommon; in 1971, eleven percent of the total U.S. population and thirty percent of the population over fifty-five were edentulous [13]. Unpublished data were obtained for twenty-two metropolitan areas (SMSAs), located in fifteen states, in 1971. These data allow estimation of the effect of licensing stringency on the percent of the population that was edentulous in these fifteen states.

Dental Neglect

To analyze the effect of licensing on the current dental health of the population, we use two separate indicators. One is the amount of untreated or currently existing dental disease, relative to the amount of dental disease, both treated and untreated, experienced by the individual over his lifetime. We measure, for each individual, the ratio of decayed teeth to the sum of decayed, missing, and filled teeth.[2] The other is

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[1]The most heavily represented states were California (95), Texas (55), Iowa (23), Washington (22), and Minnesota (21).

[2]The number of decayed, missing, and filled teeth for an individual is an epidemiologic measure used by the Health Examination Survey of the National Center for Health Statistics. The specific measure used here was suggested by Harris J. Keene, Professor of Dental Oncology, University of Texas (Dental Branch, Houston).

the prevalence of edentulousness in the population.

The ratio of decayed, to the sum of decayed, missing, and filled teeth, is constructed from the data on naval recruits. In this measure, the number of missing teeth is not included in the numerator, to avoid ambiguity. Missing teeth, particularly in young adults, can result from accidents or therapeutic extractions,[1] as well as from untreated disease. Some ambiguity remains with the inclusion of missing teeth in the denominator.

The neglect measure takes disease as given.[2] Stricter licensing may affect the level of untreated disease by influencing the quality or quantity of dental care services. If quality is improved with stricter licensing, the amount of neglect, or decay, may be reduced because it is less likely to be overlooked by the dentist. On the other hand, stricter licensing may reduce the quantity of care by restricting the supply of dentists, leading to more dental neglect. Even with restriction in supply, however, if consumers are aware of quality or other improvements in "dental care" brought about by licensing, they may increase the quantity of care that they demand; this would mitigate any negative influence of licensing on quantity.

Table 6 shows the results of three regressions estimating the effect of licensing restriction on dental neglect. Dental neglect is expressed as a function of the individual's characteristics that could be expected to affect the consumption of dental care, as well as characteristics of the individual's

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[1] Removal of impacted wisdom teeth or removal of teeth associated with orthodontic treatment.

[2] To the extent that licensing may affect the level of disease, through preventive care, use of this measure leads to conservative results.

TABLE 6

THE EFFECT OF LICENSING ON DENTAL NEGLECT

Dependent variable: Number of decayed teeth ÷ sum of decayed, missing, and filled teeth

Sample:	All recruits		Recruits with dental visit within the year		Recruits with no dental visit within the year	
	(6)		(7)		(8)	
Explanatory variable	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Constant	.94		.83		1.18	
Age	.01	.93	.02	1.12	-.02	-.62
Education	-.06	-3.63	-.06	-3.09	-.04	-1.49
Public dental care expenditures per capita ($)	-.04	-1.24	.005	.18	-.12	-1.86
Income per capita ($)	.00003	.49	-.00002	-.26	.0001	1.28
Fail rate, 1960 (%)	-.002	-1.79	-.002	-1.32	-.002	-1.01
	Corrected R^2=.05 n=477		Corrected R^2=.05 n=293		Corrected R^2=.06 n=184	

Source: Data on individuals from 1968 survey of naval recruits, see text.

Public dental care expenditures per capita: expenditures by state for dentists' services in 1969. Personal Health Care Expenditures by State, Volume II, Barbara S. Cooper, Nancy L. Worthington and Paula A. Piro (U.S. Dept. of H.E.W.), p. 22.

Income per capita: personal income per capita by state, 1960. Statistical Abstract, 1972, p. 319.

Fail rate: see table 4.

home state that could be expected to have an important independent bearing on the supply or demand for dental care. The individual characteristics are age and education; the statewide characteristics are dental care expenditures per capita, state income per capita, and the fail rate on the dental licensing examination.

The three equations in table 6 differ only in the selection of observations. Equation 6 was estimated on the full sample of 477 naval recruits, equation 7 on the 293 recruits who made at least one dental visit within the year prior to screening, and equation 8 on the remaining recruits, those with no dental visit within the year. The sample was divided in this way in order to distinguish any differential effects of licensing for those who use dentists' service routinely and those who do not. Licensing may affect both the quality of treatment and the likelihood of receiving it. Thus, better dental health may result for those receiving regular care, but not for others.[1]

The fail rate has a negative and close to significant coefficient in equation 6, indicating that more stringent licensing is associated with less dental neglect. Its magnitude is the same in all three equations. Similar results were obtained using average fail rates for 1960-1966, and using other measures of licensing stringency.

Education has the expected, negative effect on dental neglect. In these equations, the education variable may also be

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[1]The division of the sample into these two groups was investigated in a separate regression. A dummy variable was used as the dependent variable, indicating whether the individual had at least one dental visit within the last year. Independent variables were the same as for equation 6 but also included the number of decayed, missing, and filled teeth. Age was found to have a negative and significant effect on the likelihood of a recent visit, consistent with health survey findings in this age range. Also, as expected, education was found to have a significant positive effect, as was the number of decayed, missing and filled teeth. The fail rate had a positive, insignificant effect.

describing effects of other socioeconomic characteristics of individuals which are not accounted for explicitly.

The estimated effect of public expenditures is interesting.[1] Although it may seem obvious that dental care provided at public expense should reduce the level of dental neglect, the extent to which public care may substitute for private care is not obvious, nor is it obvious that public expenditures for dental care will produce measurable improvements in dental health status. The results for equation 8 indicate that subsidized dental care does not merely take the place of private care. Greater public dental care expenditures per capita are associated with reduced dental neglect for the sample population. Equation 8 suggests that, in particular, individuals not receiving regular care benefit more than other groups from public programs.

Equations similar to those in table 6 were also estimated for an analagous measure of treated dental disease: the ratio of filled teeth to the sum of decayed, missing and filled teeth. Corresponding results were obtained; more restrictive licensing is positively associated with improved dental health.

Stringent licensing may both reduce the number of dentists in a state and increase their quality. The three regressions shown in table 7 separate these effects of licensing by substituting dentists per capita and the percent of dentists reporting continuing education for the fail rate as measures of licensing stringency.[2]

The results in table 7 indicate that dental neglect is less prevalent where more dentists take continuing education courses. This is true for the sample of all individuals, equation 9, and for the sample of those receiving regular care, equation 10. The result does not hold, however, for the group of individuals who did not have a visit within the year, equa-

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[1]The figures for public dental care expenditures comprise mainly Medicaid funds.

[2]These regressions omit observations for one state where information on continuing education was not available.

TABLE 7

THE EFFECT OF LICENSING ON DENTAL NEGLECT,
THROUGH QUALITY AND QUANTITY OF DENTISTS

Dependent variable: Number of decayed teeth ÷ sum of decayed, missing, and filled teeth

Sample:	All recruits		Recruits with dental visit within the year		Recruits with no dental visit within the year	
	(9)		(10)		(11)	
Explanatory variable	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Constant	1.17		1.08		1.10	
Age	.01	.79	.02	1.13	-.01	-.47
Education	-.06	-3.62	-.07	-3.10	-.03	-1.32
Public dental care expenditures per capita ($)	-.04	-1.32	.01	.46	-.14	-2.32
Income per capita ($)	.00003	.55	.00002	.39	.00004	.36
Dentists/000 population	-.06	-.52	-.17	-1.22	.17	.77
Percent of dentists reporting continuing education courses	-.004	-2.09	-.006	-2.78	.002	.52
	Corrected R^2=.06 n=465		Corrected R^2=.07 n=286		Corrected R^2=.0 n=179	

Sources: Through income per capita, see table 6.

Dentists/000 population: for 1960, Facts, 1961, p. 6.

Percent of dentists reporting continuing education courses: see table 4.

tion 11. Those not receiving regular care would not have had the opportunity to benefit directly from higher quality care. Again, public dental care expenditures per capita appear to be important in reducing neglect among those who had not visited a dentist in the preceding year. The number of dentists per thousand population is not significant in these equations (but has a t-value of -1.22 in equation 10). Other results are similar to those in table 6.

We may conclude from this analysis that dental health, as measured by neglected and treated disease in individuals, is better in states with stricter licensing. This is true even allowing for restriction of entry. To the extent that more stringent licensing selects higher quality applicants - as measured by higher participation in continuing education (see table 4) - licensing is associated with less dental neglect. To the extent that more stringent licensing may simply reduce the number of dentists, dental neglect is not increased significantly.

Percent Edentulous

In contrast to findings consistent with the hypothesis that licensing has favorable effects on the quality of care and on dental neglect, analysis of the relation between licensing and edentulousness in the population did not yield significant results. The two regressions shown in table 8 are typical of a number that were tried; the inclusion or exclusion of selected variables and the use of other measures of licensing stringency made little difference.

Since our data on percent of the population edentulous are for metropolitan areas, control variables were also obtained for metropolitan areas, where these were available. The licensing variables are for respective states in which the metropolitan areas are located.

In equation 12, edentulousness is estimated as a function of economic, demographic, and environmental factors of the metropolitan area which might independently affect dental health, as well as public dental care expenditures per capita in the

TABLE 8

THE EFFECT OF LICENSING ON PERCENT OF POPULATION EDENTULOUS

Dependent variable: Percent of population edentulous in SMSA, 1971

	(12)		(13)	
Explanatory variable	Coefficient	t-value	Coefficient	t-value
Constant	22.0		-33.4	
Percent of population over 65	1.14	3.38	1.23	3.79
Median income ($)	.0005	.34	.002	1.44
Median years of schooling	-2.31	-1.38	2.40	1.07
Number of years since water fluoridated	-.01	-.15	.04	.58
Public dental care expenditures per capita ($)	-.70	-2.08		
Fail rate, 1969 (%)	.02	.22	.01	.17
Gold foil requirement			-2.19	-1.81
Dental school in SMSA			-2.30	-1.10
Dentists/000 population			-12.23	-2.25
	Corrected R^2 = .34		Corrected R^2 = .42	

Sources: Percent of population edentulous: Ethel Black, Health Interview Survey, National Center for Health Statistics.

Percent of population over 65: in SMSA, 1970 Census, state volumes, tables 192 and 193.

Median income: in SMSA, for persons 14 and over, 1970 Census state volumes, table 192.

Median years of schooling: in SMSA, for persons 14 and over, 1970 Census, state volumes, table 148.

Number of years since water fluoridated: in SMSA, prior to 1971 Cora Leukhart, Communicable Disease Center.

Public dental care expenditures per capita: see table 4.

Fail rate, gold foil requirement: see table 1.

Dental school in SMSA: Dental Education 1974/75. (Council on Dental Education, American Dental Association).

Dentists/000 population: number of dentists in SMSA in employed, civilian labor force, table 171; SMSA population, table 192, 1970 Census, state volumes.

state and the state licensing examination fail rate. The age of the population should be important, since the number of teeth lost is cumulative and the rate of loss is higher among older people. The number of years since fluoride was introduced into the metropolitan water supply is included as an important environmental condition.

The fail rate is not significant in equation 12. Age is important, however; the percent of the population over sixty-five has the expected positive sign and is significant. Public dental care expenditures per capita are also significant, with the expected negative sign. Greater expenditures on public care are, again, associated with better dental health. Public expenditures, however, are as likely to represent a greater need for dental care among the non-edentulous population as they are to represent a cause of better dental health.

In equation 13, age is again significant, as is dentists per thousand population. More dentists available in a state are associated with a lower percentage of edentulous population. As in the case of public expenditures, however, it is hard to tell whether this represents cause or effect. The gold foil requirement comes close to significance, raising the possibility that competence in this restorative procedure may help avoid tooth loss among patients. In this equation, a city dental school dummy is used in place of public dental care expenditures, since dental schools are major providers of public care and a metropolitan variable should be preferable. The dental school dummy does have the expected negative sign, but is not statistically significant.

Our failure to find a statistical connection between licensing and edentulousness may, of course, be caused by the lack of an actual connection between the two. It may, however, be caused by factors which reduce the power of the statistical experiment. For example, many city residents may have lived in other states for long periods of time, receiving dental care under licensing conditions different from those of their current state of residence. Lack of data prevents the investigation of this possibility. Also, data were available for only a limited number of states; the number of cities in the

sample was quite small. Dental health status, as measured by edentulousness, appears to be unaffected by licensing restrictions.

THE EFFECT OF LICENSING ON DEMAND FOR CARE

Evidence presented above suggests that licensing may indeed lead to better dental health. The relative frequency of poor quality care appears to be lower in states with stricter licensing, and dental health status, as measured by neglect of dental disease, appears to be improved.

If dental licensing increases the quality of care and reduces the necessity for search, we should find evidence of increased demand in states with more stringent licensing. We therefore investigated how licensing shifts demand for dental care. Increased demand due to licensing would provide further evidence that consumers perceive benefits associated with licensing, and the changes that licensing brings about in the market.

The test for increased demand involved estimating equations derived from the simultaneous model of supply and demand presented earlier. Quantity demanded per capita was expressed as a function of the price of dental services, income, demographic characteristics, fluoridation, percent urban, public expenditures for dental care per capita, and either licensing restrictiveness or increases in quality resulting from licensing restriction. In estimates of the demand relationship, a positive coefficient for licensing or quality would show that demand has shifted to the right. Quantity supplied per capita was expressed as a function of the price of services, licensing restriction, or number of dentists per capita, the number of dental auxiliaries per capita, the wages of dental auxiliaries, and public expenditures for dental care per capita.

We estimated these equations using two-stage least squares, in two ways. In one, the fail rate was used to indicate licensing stringency in both the demand and supply equations. In the other, the percent of dentists reporting continuing education was used in the demand equation to indi-

cate quality due to licensing restriction and the number of dentists per capita was used in the supply equation to indicate the effect of licensing restriction.

When the fail rate was used for both the demand and supply relationships, there was strong evidence that the demand curve was misspecified; price had a positive sign in the demand equation. Better statistical results were obtained with the second method, where quality variable was used in place of licensing. Results for the second method of estimation are shown in table 9.

Quantity, the dependent variable in both equations, is measured by the number of visits per capita. The percent of dentists reporting continuing education is used to measure the quality of services available. Price is measured as the average composite fee for five services, and enters as an endogenous variable. In order to reduce simultaneity bias, the method of two-stage least squares is used. Price is predicted as a function of the exogenous variables in both the demand and supply equations. Public dental care expenditures per capita is included in both the demand and supply equations; as mentioned earlier, the data used mainly reflect Medicaid payments, which are received as health care subsidies to consumers. Having found no direct measure of public payments to dental schools or other institutions for the provision of dental services, we assumed that such payments to suppliers would be positively correlated with the measure of public expenditures that we did have.

Estimates of both the demand and supply equations are shown in table 9. The positive and significant coefficient on the percent of dentists reporting continuing education indicates that the demand curve does shift to the right as the quality of services increases. Consumers evidently perceive that the quality effect of licensing is beneficial. Since quality is not purely a function of licensing, however, the size of this coefficient overstates the effect of licensing on demand.

TABLE 9

A SIMULTANEOUS MODEL OF THE DEMAND FOR AND SUPPLY OF DENTAL VISITS

(14)

Demand

Dependent variable: Annual visits per capita, 1967

Explanatory variable	Coefficient	t-value
Constant	3.26	
Price of dental services ($, endogenous)	-.004	-1.60
Income per capita ($)	.0007	3.60
Median age	-.01	-.49
Percent high school graduates	.01	1.72
Percent using fluoridated water	.0008	.45
Public dental care expenditures per capita ($)	.02	.58
Males/00 females	-.02	-1.14
Percent black	-.005	-.99
Percent urban	.006	.82
Percent of dentists reporting continuing education courses	.01	2.13

Omits Alaska, Delaware, and Georgia

(15)

Supply

Dependent variable: Annual visits per capita, 1967

Explanatory variable	Coefficient	t-value
Constant	-.39	
Price of dental services ($, endogenous)	.0003	.88
Public dental care expenditures per capita ($)	.03	1.47
Dentists/000 population	2.02	8.49
Dental auxiliaries per capita	.25	2.51
Average monthly salary of dental assistants	.001	1.11

Omits Alaska, Delaware, and Georgia

TABLE 9 (continued)

Sources: Annual visits per capita: mean number of visits per week reported by dentists, National Survey of Dentists' Practice Characteristics, multiplied by 52, multiplied by the number of licensed dentists per state, same source, divided by 1967 population, Statistical Abstract, 1971, p. 12.

Price of dental services: average composite fee for dental prophylaxis, amalgam filling (two-surface), single extraction, acrylic jacket crown, and complete upper denture, from 1971 Survey of Dental Practice, Journal of the American Dental Association, June 1972, p. 1382.

Median age: for 1970, Statistical Abstract, 1972, p. 31.

Percent high school graduates: for 1970, persons 25 and over, Statistical Abstract, 1975, p. 121.

Percent using fluoridated water: in 1964, Statistical Abstract, 1965, p. 174.

Public dental care expenditures per capita: for 1969, see table 6.

Males/00 females, percent black: for 1970, Statistical Abstract, 1972, pp. 25 and 28.

Percent urban: for 1970, Statistical Abstract, 1975. p. 20.

Percent of dentists reporting continuing education courses: see table 4.

Dentists/000 population: for 1970, number of dentists, Facts, 1971, divided by population in thousands, Statistical Abstract, 1975, p. 12.

Dental auxiliaries per capita: sum of full and part time auxiliaries, National Survey of Dentists' Practice Characteristics, divided by population, Statistical Abstract, 1975, p. 12.

Average monthly salary of dental assistants: for full time assistants in 1975, regional data, American Dental Association.

Although estimates of supply effects are not at issue for the hypothesis being tested here, the supply equation is shown for its general interest. The positive effect of dentists per thousand population on visits to the dentist is overstated. The dependent variable, visits per capita, was constructed from survey responses about visits reported per dentist and data about the number of dentists per capita. Thus, measurement error in the number of dentists may increase the apparent association between dentists and visits.

The results in table 9 corroborate our findings for adverse outcomes and dental health; more stringent licensing standards may be beneficial to consumers.

DETERMINANTS OF LICENSING

The analysis presented above suggests that higher licensing standards may improve both the quality of dental care and dental health. Moreover, consumers, on average, appear willing to pay higher prices when standards of quality are higher.

The widely held belief that supplier conspiracy explains licensing is not inconsistent with the idea that benefits to consumers can also flow from licensing. Our findings on benefits, however, suggested that it would be worthwhile to explore alternatives.

In this section, we reexamine evidence for the hypothesis that supplier conspiracy explains licensing. We consider two alternative explanations as well: consumers want licensing because they benefit from higher standards; and licensing boards adjust their standards in response to changes in the number of applicants.

Three major explanations for variation in licensing stringency are:

1. High standards are imposed in response to political pressures from consumers who benefit from the standards.

2. High standards are imposed by licensing boards when a large number of applicants allows boards to raise standards and at the same time pass some predetermined number.

3. High standards are imposed in response to political pressure from dentists who want to increase their earnings (supplier conspiracy).

CONSUMER BENEFITS

We have found that licensing may improve the quality of care and dental health. But some groups may benefit more than others.[1] If so, and if those who benefit are not the same proportion of the population in all states, consumer pressure

[1]This section draws heavily on Keith Leffler's analysis of physician licensing [21].

for licensing should be stronger in states where those who do benefit from licensing are concentrated.

For example, since people with larger incomes may want higher quality standards, wealthier states might impose more stringent licensing. On the other hand, states with relatively higher proportions of population over sixty-five years of age might impose less stringent licensing: older people tend to incur less risk from poor quality care since more of them are edentulous. Also, since a higher proportion of older people have retired from the labor force, they may have lower opportunity costs of searching for dentists who provide the desired quality of care. Search itself may be easier for older people who are edentulous; complete dentures are more standardized than other types of dental restorations.

More highly educated consumers might demand higher quality services, but the association between education and search is hard to predict. On the one hand, better educated people should be more efficient searchers, with less to gain than others from the help of a licensing agency; on the other hand, if they place a high value on market information, they will have more to gain from such help and may demand licensing as a substitute for their own search effort.

Recent migrants undoubtedly have relatively higher search costs because of their lack of community-based information. Thus, they should have more to gain from licensing.

People might also vary in their desire for licensing stringency according to their taste for government regulation or occupational regulation in particular.

These hypothesized relations are examined in equation 16 of table 10, showing estimates of the effects of these population characteristics on licensing stringency. Licensing is measured by the 1969 fail rate. Tastes for regulation are measured by voting patterns (percent of votes for McGovern in 1972) and by the number of occupations licensed in the state.

TABLE 10

DETERMINANTS OF LICENSING

Dependent variable: Fail rate, 1969 (%)

Explanatory variable	(16) Coefficient	t-value	(17) Coefficient	t-value
Constant	-40.12		-110.05	
Income per capita ($)	-.0007	-.19	.0006	.18
Percent over 65	-1.30	-1.11	-1.35	-1.14
Percent high school graduates	-.05	-.17	.13	.49
Percent votes for McGovern	.08	.41	.10	.48
Number of occupations licensed	.08	1.48	.05	1.02
Males/00 females	.31	.51	1.11	2.12
Percent black	-.20	-1.12	-.09	-.51
Percent recent migrants	1.19	3.26		
Licensing applicants per dentist			169.39	3.20
	Corrected R^2 = .57 Omits Florida		Corrected R^2 = .56 Omits Florida	

Sources: Fail rate: See table 1.

Income per capita, percent high school graduates, males/00 females, percent black: see table 9.

Percent over 65: for 1970, persons 65 and over, Statistical Abstract, 1972, p. 31, divided by population, Statistical Abstract, 1975, p. 12, multiplied by 100.

Percent votes for McGovern: Statistical Abstract, 1975, p. 438.

Number of occupations licensed: number of selected occupations licensed in the state. Occupational Licensing and the Supply of Non-Professional Manpower, Manpower Research Monograph #11, 1969 (U.S. Dept. of Labor).

Percent recent migrants: percent of 1970 population 5 and over who moved into the state or between counties within the state, 1965-1970, 1970 Census, Subject Report, Mobility for States and the Nation, table 44.

Licensing applicants per dentist: total number of examinations in 1969, Facts, 1971, p. 20, divided by number of dentists, Facts, 1971, p. 6.

Recent migrants are measured as the percent of population either moving into the state, or moving between counties within the state, between 1965 and 1970. In addition to the characteristics discussed above, the equation includes the ratio of males to females and percent black. Including these additional variables made little difference in the results, as did omitting selected variables. A substantial portion of the variability in fail rates is explained by the regression. The corrected R^2 is .57. Thus, licensing can be explained partially by variables representing the concentration of benefits.

RESPONSE OF LICENSING BOARDS TO THE AVAILABILITY OF APPLICANTS

Equation 16 estimates stringency as a function of measures of presumed consumer benefits from licensing. With one modification, this equation can be used to see whether licensing stringency is also affected by the response of licensing boards to greater availability of applicants for licensing.

The effect of recent migrants in equation 16 seems overly strong. Although recent migrants may have much to gain from higher licensing standards, it does not seem likely that they should play so influential a role in determining state licensing policy.

If licensing boards to some extent predetermine how many applicants will pass the test, this could account for the apparent effect of recent migrants. If some target number of passes is used, as has been claimed,[1] then the higher the volume of applicants, the higher will be the fail rate. Relatively high numbers of applicants for licensing should correspond with our measure of recent migrants if dentists try to settle in the same places as other people.

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[1]Members of State Boards of Dental Examiners confirm that some target number of passes is used. Thirty-five percent of respondents to a questionnaire said they believed arbitrary limitations are placed on the number of new licenses issued each year; an additional thirty-five percent believed that probably to be true [19, pp. 391-392].

To test this explanation -- both the idea of targeting and the correspondence of recent migrants in a state with would-be dentists -- we substituted, as an explanatory variable for recent migrants, the number of licensing applicants in the state per year relative to the number of dentists in the state. The results of this substitution, shown in equation 17 of table 10, are clearly comparable. We conclude that licensing stringency can also be explained by the behavior of licensing boards in response to applicant volume.

Targeting by licensing boards may be aimed at increasing the earnings of existing dentists. This is consistent with the supplier-conspiracy hypothesis. But targeting can also be explained by the response of examiners to the uncertainty of predicting future performance on the job from an occupational test. Raising minimum standards for passing candidates increases the probability that some good applicants will be rejected. If the pool of applicants is very small, high standards impose the risk that only few applicants of any quality would pass. If the pool is large enough to ensure the passing of a number in some way deemed sufficient or adequate to meet state needs, however, licensing boards can afford to set high standards. A large pool of applicants may simply enable licensing boards to be more selective, encouraging higher standards and higher fail rates.[1] Thus, even if boards do set some target number of passes, their behavior may not necessarily indicate the existence of a supplier conspiracy.

SUPPLIER CONSPIRACY

Dentist earnings and prices of dental services are higher in states with more stringent licensing. This observation has been documented in a number of studies and presented as evidence that licensing is used by suppliers in some states to restrict market entry and create monopoly rents [5, 7, 18, 23,

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[1] Alex Maurizi [22] offers a variant of the supplier conspiracy explanation for a positive association between fail rates and application rates. He argues that high application rates accompany "excess demand" conditions under which suppliers have more to gain from restricting entry.

28]. The positive association between licensing fail rates and dentist earnings has been explained simply as a matter of entry restriction.

This interpretation is reasonable, since restricting supply should increase price. But it overlooks, first, the possibility that higher licensing fail rates may not only exclude more potential suppliers, but may also increase quality. This simple interpretation also overlooks the possibility that higher dentist earnings may encourage a larger pool of licensing applicants and thereby encourage the imposition of higher licensing standards. Either of these situations would cast some doubt on the simple conspiracy explanation, by providing an alternative reason for the positive association between fail rates and earnings.

We have shown that more stringent licensing seems to increase the quality of dentists and the care they provide. Thus, higher quality may partly account for the association between fail rates and earnings. In this section, we investigate the second possibility, which amounts to seeing whether reverse causation, i.e., high earnings leading to high fail rates may also play a role. Equation 17 of table 10 shows that fail rates tend to be higher where there are more licensing applicants relative to the number of dentists. It is likely that licensing applicants are attracted to states where earnings are higher to begin with; thus, higher earnings may lead to higher fail rates.[1]

Although annual data on fail rates by state were available, state data on dentist earnings are available only for selected years. Consequently, it was not possible to perform a systematic analysis of leads and lags in fail rates and earnings. Instead, earnings for four separate years (1952, 1958, 1967, and 1970) were examined, along with fail rates in the same year, the previous year, and the following year. A consistent pattern indicating causation was not apparent.

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[1] Information on dentist earnings by state has been published by the American Dental Association until recently [15].

Our supposition that earnings may also determine fail rates is based on the high statistical significance of the coefficient for licensing applicants per dentist in equation 17, and the likelihood that the number of licensing applicants per dentist will be high where the earnings of existing dentists are high. To investigate how the number of applicants for licensing responds to variations in dentist earnings required estimation of a simultaneous model. This was necessary because the assumption that licensing applicants are sensitive to good economic prospects also suggests that they should be sensitive to the probability of failing the licensing examination.[1] But the fail rate itself is affected by licensing applicants per dentist.

To estimate these relations, we used the following simultaneous model:

Licensing applicants per dentist = f(Dentist earnings,
Fail rate,
Other licensing stringency measures,
Percent of population who moved to state within five years)

Fail rate = f(Licensing applicants per dentist,
Measures of consumer demand for licensing).

The number of licensing applicants per dentist depends on dentist earnings as reported in the previous survey, the fail rate, other licensing stringency measures (since these also might serve as deterrents to applicants) and finally on the percent of population who moved to the state within five years. The latter variable reflects the recent overall attraction of the state to new migrants, which should also reflect the general attraction of the state to dentists.

The equation showing determination of the fail rate is similar to those in table 10. This equation does not make an independent contribution to the analysis presented earlier, but is a necessary part of the model.

[1]Fail rates by state are published annually [15].

Estimates, using two-stage least squares, are shown in equations 18 and 19 of table 11. Equation 18, explaining licensing applicants per dentist, indicates that applicants are attracted by high earnings, and deterred by high expected fail rates or high probabilities of failing the examination, although coefficients are not statistically significant. The strongest finding in equation 18 is for percent new state residents. The coefficient of .007 here translates into a 3.5 percent increase in licensing applicants per dentist for each one percent increase in new state residents. In making decisions as to location, dentists appear to be highly sensitive to population growth, and to the same underlying conditions that induce migration among the general population.

Applicants are also attracted to states that recognize the certificate of the National Board of Dental Examiners. Such recognition means a reduced examination burden for most applicants. The positive sign for the examination fee is surprising, although higher fees, as explained earlier, may indicate more careful testing procedures.

We conclude from these results that the positive association between fail rates and dentist earnings cannot be entirely explained by simple supplier conspiracy. Not only is higher quality of service important in explaining higher earnings, but reverse causality -- the effect of higher earnings on fail rates -- may also help account for it. Supplier influence on the licensing process however, may also play a role in the way this reverse causation occurs by influencing the number of target passes set by licensing boards. These findings on the determinants of licensing question, but do not rule out, the explanation of supplier conspiracy.

TABLE 11

A SIMULTANEOUS MODEL OF LICENSING APPLICANTS AND THE FAIL RATE

(18)

Dependent variable: Licensing applicants per dentist, 1969

Explanatory variable	Coefficient	t-value
Constant	-.11	
Fail rate, 1969 (%, endogenous)	-.001	-1.37
Mean income of dentists, 1967 ($)	.000003	1.26
Reciprocity	-.0002	-.03
Simultaneous examination	.001	.13
Gold foil requirement	-.005	-.70
National Board examination	.03	1.91
Licensing examination fee ($)	.0006	1.58
Percent new state residents	.007	3.84

Omits Florida

(19)

Dependent variable: Fail rate, 1969 (%)

Explanatory variable	Coefficient	t-value
Constant	-82.47	
Licensing applicants per dentist, 1969 (endogenous)	183.74	1.38
Income per capita ($)	.0004	.11
Percent over 65	-1.26	-1.06
Percent high school graduates	-.01	-.04
Percent votes for McGovern	.14	.68
Number of occupations licensed	.06	1.20
Males/00 females	.79	1.11
Percent black	-.16	-.90
Percent recent migrants	.32	.44

Omits Florida

TABLE 11 (continued)

Sources: Licensing applicants per dentist: see table 10.

Licensing variables: see table 1.

Mean income of dentists: Facts, 1969, p. 9.

Percent new state residents: number of people moving into the state, 1965-1970, 1970 Census, Subject Report, Mobility for States and the Nation, table 44, divided by 1970 population, Statistical Abstract, 1975, p. 12, multiplied by 100.

Variables for equation (19), see table 10.

EFFECTS OF LICENSING ON THE DISTRIBUTION OF DENTISTS

National health policy has aimed toward equalizing access to health services. In order to determine whether state licensing barriers promote unevenness in the availability of care, we examine its effects on migration of dentists and on the number of dentists per capita. If state licensing barriers promote unevenness in the distribution of dentists and therefore in the availability of care across states, this would support the view that a national scheme of licensing might be preferable.

THE EFFECT OF LICENSING ON THE MIGRATION OF DENTISTS

Dentists do not often move from one state to another. Studies of location decisions of dental graduates show that they are likely to establish practice in the same geographic area in which they lived prior to dental school [14]. Data from the Censuses of 1950 and 1970 show that dentists migrate between states less frequently than physicians [7, 18].

Those who move, however, appear to choose a location based on their market prospects. As was shown in equation 18, table 11, the number of applicants is relatively high in states where the earnings of existing dentists are high (mean income), where the likelihood of failing the licensing examination is low, and where the population is growing (percent new state residents). In the discussion of equation 18 we noted the very strong attraction of growing states to licensing applicants.

In equation 20, table 12, we estimated the effect on dentist migration of variables measuring licensing stringency and population growth. The number of dentists per capita is held constant. Migration is measured by the number of net in-migrants, 1971-1975, as a percent of the number of dentists. New graduates and dentists of retirement age are excluded.

The results show that net state-to-state migration of dentists is positively and significantly associated with increases in population. Among the licensing variables, the fail rate itself has little effect,[1] only the recognition of a si-

[1] Similar results are obtained using as an independent variable the fail rate for graduates of out-of-state schools.

TABLE 12

THE EFFECT OF LICENSING ON THE MIGRATION OF DENTISTS

Dependent variable: Net in-migration of dentists, 1971-1975, as a percent of number of dentists

(20)

Explanatory variable	Coefficient	t-value
Constant	-3.45	
Percent increase in population, 1970-75	.76	4.94
Dentists/000 population	-1.88	-.38
Fail rate, average of 1970-1975 (%)	.01	.18
Reciprocity	-1.32	-.82
Simultaneous examination	4.38	2.81
Gold foil requirement	-.73	-.55
National Board examination	1.09	.44
Licensing examination fee ($)	-.01	-.14

Corrected R^2 = .53

Sources: Net in-migration of dentists, 1971-1975, as a percent of number of dentists: net gain in number of dentists due to migration, excluding new graduates and dentists over 68, Economic Research and Statistics Supplement 2 to House of Delegates, American Dental Association, divided by number of dentists in 1970, Facts, 1971, p. 6, multiplied by 100.

Percent increase in population, 1970-1975: Statistical Abstract, 1976, and 1975, p. 12.

Dentists/000 population: for 1970, as above.

Fail rates: See table 3.

Dental licensing variables, 1970: Facts, 1970, pp. 13-19, and Dr. Donald W. Johnson, Division of Dentistry (U.S. Dept. of H.E.W.).

multaneous examination is significant. The fail rate does not appear to independently restrict dentist mobility.

THE EFFECT OF LICENSING ON DENTISTS PER CAPITA

Although the number of dentists per capita is by itself a dubious measure of efficiency of resource allocation, since it ignores both differences in demand and in costs of supply, it is commonly used to indicate the availability of care. The number of dentists per capita shows substantial variation between regions within states as well as between states.[1]

An increase in the disparity in dentists per capita between states, however, might be a matter of concern, and might indicate an increase in the importance of licensing barriers. In this section we examine differences in dentists per capita over the past twenty-five years, and estimate the effect on dentists per capita of variables measuring licensing stringency.

Using data for 1952, 1960, and 1976, we found a steady decrease in the variance of dentists per capita between states, as well as a steady increase in average levels of dentists per capita. The coefficient of variation of dentists per capita decreased from .36 to .24 over the last 25 years. Thus, differences between states in dentists per capita have narrowed.

It may be, of course, that if state licensing had not been a barrier, the trend toward equalization in dentists per capita would have proceeded even faster. Until recently there have been relatively more licensing applicants to states with fewer dentists. Although equalization might have accelerated without licensing barriers, licensing did not prevent equalization.

In equation 21, table 13, we estimate the number of dentists per thousand population in 1970 as a function of variables measuring licensing stringency and the number of

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[1]In New York State, for example, the St. Lawrence region had less than half the dentists per capita than New York City in

TABLE 13

THE EFFECT OF LICENSING ON
DENTISTS PER CAPITA

Dependent variable: Dentists/000 population, 1970.
(21)

Explanatory variable	Coefficient	t-value
Constant	.05	
Fail rate, average of 1960-1969	.002	3.89
Reciprocity	-.01	-.56
Gold foil requirement	-.01	-.75
National Board examination	.02	1.57
Licensing examination fee ($)	.0001	.32
Dentists/000 population, 1960	.85	27.21

Corrected R^2 = .95

Sources: Dentists/000 population: for 1970 see table 12, for 1960 see table 7.

Fail rates: See table 3.

Dental licensing variables, 1966: Facts, 1966, pp. 18-23.

dentists per capita in 1960. The number of dentists per thousand in 1960 closely predicts the number in 1970. The fail rate also has a positive and significant effect. As was shown earlier (equation 17, table 10), high fail rates accompany high numbers of licensing applicants. Thus, high fail rates are associated with increased rather than decreased numbers of dentists per capita. A positive and close to significant effect was also found for the fail rate when the number of dentists per capita in 1960 was omitted from the regression. Thus, our conclusion holds for levels as well as changes in dentists per capita; high licensing standards do not appear to be an independent cause of reduced numbers of dentists in a state.

State licensing barriers do not appear to independently create differences in access to care, either through restricting dentist mobility or increasing differences in dentists per capita.

These findings help to explain our earlier results on the favorable effect of licensing on dental health. Even allowing for restriction of entry, we found that stricter licensing is associated with less dental neglect. It appears that states with more stringent licensing can have higher standards of quality, without making a corresponding sacrifice of numbers.

Findings in this section trace the circumstances under which a strict quality-quantity tradeoff is avoided. The number of licensing applicants, migrants as well as recent graduates, is highly sensitive to general shifts in population. Growth in population leads to much more than a proportional increase in applicants for licensing. Thus, licensing boards in growing states can be more selective, raising their standards, while at the same time passing relatively more new dentists than other states.

CONCLUSIONS

The basic question addressed in this study is whether licensing in dentistry provides benefits to consumers. Benefits may take a number of forms. We have examined the quality of care provided and the health status of the population to see if consumers are better off with more stringent licensing, and we have examined how the level of demand varies as a function of differences in licensing. In addition, the study investigates the causes and consequences of variation between states in licensing restrictiveness.

Empirical results were not all statistically significant, but the directions of effect were consistent. Licensing may have certain beneficial effects.

The licensing process in dentistry appears to increase the quality of services. Higher licensing standards reduce the probability of adverse outcomes; this gives rise to benefits through reduced risk and lower costs of acquiring information about quality. Dental health status, according to one measure, is better in states with stricter licensing. Thus, even allowing for restriction of entry, licensing appears to be beneficial. Further evidence that licensing may benefit consumers is provided by their willingness to pay higher prices when standards are higher.

Whether consumers achieve higher levels of welfare because of licensing must await further research. Costs and full benefits are not estimated in this study.

Variation between states in licensing stringency is partially explained by population characteristics and by the response of licensing boards to the availability of applicants. The simple explanation that licensing is due to supplier conspiracy is found to be questionable.

Differences in state licensing requirements do not appear to create differences in access to care.

Proposals to change licensing in dentistry should not

ignore the risks of doing away with minimum standards of quality. Nor should policy proposals assume that a single, federal standard would be preferable to the current pattern of differences, which is responsive, at least in part, to local preferences and to the availability of applicants.

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With few exceptions, occupational licensing has been viewed by economists as a conspiracy of suppliers; they have focused attention almost exclusively on its costs, such as higher prices and restricted opportunities to practice.

In this study, an attempt is made to define and test for benefits that might flow from dental licensing. In addition, hypotheses about the determinants of licensing stringency are examined and effects of licensing on the distribution of dentists are investigated.

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The benefits consumers might realize from the licensing of dentists are:

1. reduced risk of adverse outcomes,
2. reduced costs of acquiring information,
3. greater satisfaction.

Whether these benefits are in fact realized by consumers is subjected to several empirical tests. These tests are based on variation between states in the stringency of licensing. Regression analysis is used to distinguish the effects of licensing from other factors.

The study concludes that dental licensing may have certain beneficial effects, and that variation in licensing strengency does not appear to create problems of unequal access to care. Since costs are not estimated, however, or even all benefits, judgment as to whether consumers achieve higher levels of welfare because of licensing must await further research.