# The Financial Viability of Rural Primary Health Care Centers

ROGER FELDMAN, PHD, DAVID M. DEITZ, BA, AND EDWARD F. BROOKS, MBA

**Abstract:** Primary health care centers have been proposed to meet the health care needs of rural America. Some centers become financially "self-sufficient", receiving their entire budgets from direct patient or third-party payments; others shut down when external funding is withdrawn. An explanation for this difference is important, because funding agencies may not wish to subsidize centers whose financial futures appear bleak.

This study identifies the correlates of financial self-sufficiency. A survey conducted in late 1976 of 164 rural clinics provided 101 usable responses. Multiple regression analysis of the data shows that the longer a center has been in operation, the more self-sufficient it will become. Hospital control of the center and provision of laboratory tests increase self-sufficiency; outreach services and nonprofit status reduce it.

Two variables related to financial self-sufficiency are separately examined. Clinics with a faster growth rate of patient visits are more self-sufficient, and smaller clinics tend to grow faster. More self-sufficient clinics experience less difficulty in keeping professional staff. The presence of a state Area Health Education Center (AHEC) program also eases the problem of staff retention. (Am. J. Public Health 68:981–988, 1978.)

## *Introduction*

There is a substantial need for health care in rural America. Fifty-four million Americans live in rural areas or towns of less than 2,500 persons.[1] Furthermore, the demographic structures of the rural and urban U.S. populations are substantially different. In rural America 11.5 per cent of the population is at least 65 years old, compared to 9.3 per cent of urban Americans.[2] Old people have higher rates of illnesses than young people, and thus place a heavier demand on health care delivery systems.

Occupational injuries and accidents are more prevalent in rural America. Rural areas have an overall rate of disability and death from accidents 30 to 40 per cent higher than urban areas.[3] Farming has one of the highest rates of fatal accidents of all occupations.[4]

The rural poverty rate is higher than the urban rate. Based on a 1969 federal government poverty index, 17.0 per cent of the rural population, compared to 10.2 per cent of the urban population, have incomes below the poverty level.[5] From the positive relationship between poverty and illness[6] (6, p. 102, table 3-3) one can infer that rural America has a higher rate of poverty-related illness. A poignant example is the infant mortality rate which is one-third higher in rural America[3] (3, p. 37618). The higher rate of poverty-related illnesses indicates an increased need for health resources. The rural population infrequently obtains preventive and health maintenance services.[7]

Rural areas have problems which have prevented the delivery of needed health care. A severe shortage of physicians exists: the number of active doctors in metropolitan U.S. counties is approximately 156 per 100,000 population, compared to only 64/100,000 in rural U.S. counties;[8] the average age of rural doctors is older than that of urban doctors, and retirement and death are depleting the rural supply of physicians.[1]

The heavy reliance on solo practice, with its long hours and heavy workload, discourages many young doctors from locating in rural areas. A study of 73 Virginia physicians who left solo or dual primary care practice for other medical specialties revealed that 96 per cent might have remained in primary care *group* practice.[9] However, many rural areas do not have the population base to support a group practice, so this may not be a feasible alternative.

Another influence on physicians' choice of location is the depressed condition of rural economies and the resultant unattractiveness of the living environment. Health professionals may not want to live and raise a family in an area which lacks social and cultural amenities.

The diffuseness of the rural population hinders health care delivery. Rural people must travel long distances to receive health care. As a result, emergency treatment may be delayed, leading to the higher rates of fatalities and disabilities from accidents in rural areas. Jehlik and McNamara found a positive relationship between the distance which a farm family must travel to a physician and the number of days of home bed illness.[10]

Address reprint requests to Roger Feldman, Assistant Professor of Economics, Department of Economics, University of North Carolina, Gardner Hall 017 A, Chapel Hill, NC 27514. Author Dietz is a medical student, and author Brooks is Instructor in Health Administration, both at UNC. This paper, submitted to the Journal July 27, 1977, was revised and accepted for publication April 11, 1978.

**Primary Health Care Centers—A Potential Solution**

Primary health care centers have been proposed to meet the health care needs of rural areas. Such centers are ordinarily staffed by general and family practitioners, internists, and pediatricians. Non-physician providers (physician's assistants or nurse practitioners) may also staff these clinics.

The attractiveness of rural primary health care centers had led to government and philanthropic funding. Since 1970, for example, the Appalachian Regional Commission (ARC) has supported rural primary health care centers for up to five years with federal funds. Often this outside funding becomes an integral part of a health center's budget. When funding is withdrawn, some centers cannot maintain the level of their operations. A substantial number shut down entirely. However, other centers have become self-sufficient and have maintained their original operation after the initial financial backing is removed. Self-sufficiency means that a center receives its entire budget from funds generated by direct patient or third-party payments including Medicare and Medicaid. The following measure of the level of self-sufficiency* will be used in this paper:

$$\text{Level of self-sufficiency} = \frac{\%\ \text{DIRECT} + \%\ \text{MEDICARE} + \%\ \text{MEDICAID} + \%\ \text{THIRD-PARTY}}{100\%}$$

Why do some rural primary health care centers attain self-sufficiency while others continue to rely on external funds? This is an important question because those who distribute funds may be reluctant to subsidize centers whose financial futures appear bleak. If the correlates of self-sufficiency can be identified, centers incorporating these factors into their design should find initial funding easier to obtain because they are more likely to become financially viable.

## *Methods*

The exact number of rural health clinics is not known; the Appalachian Regional Commission estimates 500–700.[7] The Health Services Research Center (HSRC) of the University of North Carolina at Chapel Hill conducted a survey in August 1975 of rural primary health care centers throughout the United States. HSRC mailed letters to 727 organizations and individuals** requesting them to supply the names and addresses of all rural primary health care programs with which they were familiar. To encourage responses, HSRC did not define "rural" or "primary health care." Four hundred ninety-eight programs were identified, and 396 responded to a mail survey.

Since the factors influencing self-sufficiency change over time, 164 rural‡ respondents were surveyed in late November 1976 with a similar questionnaire.‡‡ Two follow-up mailings were sent to nonrespondents at three-week intervals. One hundred one usable surveys, representing a response rate of 61.6 per cent, were finally received. The 101 centers are located in 30 states.

Since the universe of clinics is not known, nothing can be said about response bias to the 1975 survey. However, the 101 respondents to the 1976 survey could be compared to the 164 rural clinics from which they were drawn. Standard "t-tests" revealed no significant differences between population means of the dependent variables used in this study. In addition both samples appear statistically to be drawn from the same local environment. Each serves an area of approximately 14,300 people. The largest city or town within a 30-minute drive from the clinic has a population of only 17,900. The nearest short-term general hospital with at least 50 beds is 30 miles away. Therefore, while we are hesitant about drawing inferences to all primary health care programs, these clinics appear to represent rural areas.

This study examines rural primary health care centers to identify the factors which influence self-sufficiency. Two additional factors related to self-sufficiency are examined separately: these are the annual percentage change in patient vists (output) and the ease with which a center is able to retain its professional staff. We believe that self-sufficiency, growth, and the ability to keep professional staff are inter-

*All sources of direct patient payments are given equal weight in the self-sufficiency index. Equal weights might be questioned because Medicaid funds are more politically labile than other funds. We conducted a partial correlaion analysis, holding self-sufficiency constant, between each source of funds and the clinic administrator's assessment of his current and anticipated future financial resources. Administrators who derived a larger per cent of funds from Medicaid did not judge their present position more inadequate, nor the future more insecure, than those who relied more on other sources of direct patient payments.

**The Appalachian Regional Commission, program directors in the ten DHEW regional offices, state and local government officials, health services research organizations.

‡In December 1971, the Economic Development Division of the U.S. Department of Agriculture prepared a study entitled "The Distribution of Federal Outlays among U.S. Counties" for the Committee on Government Operations of the United States Senate. The study classified all U.S. counties into six categories: 1) highly urban, 2) urban, 3) semi-isolated, 4) densely settled rural, 5) sparsely settled rural with urban population, and 6) sparsely settled rural with no urban population. The classification was based on an index of "urban orientation," a measure that included both the population density within the county and the percentage of the county's population living in areas of 2,500 or more persons. This study surveyed only centers in county categories 4, 5, and 6. For a more extensive description see reference 11, p. 12.

‡‡The eight-page survey was mailed to each clinic, where it was usually (54 of 90 known cases) answered by an administrator or director, Information was requested in four areas: general information, staffing, patient visits, and finances. The general information section provided data on the clinic's environment used to test for nonresponse bias and to construct the PUBLIC TRANSPORTATION, HOSPITAL CONTROL, ADVANCE PROMOTION, OUTREACH SERVICES, and LABORATORY TESTS variables. Staffing questions dealt mainly with employment and utilization of non-physician providers. Patient visits in 1975 were taken from the 1975 survey. The VISIT TREND variable was computed by subtracting visits in 1975 from visits in 1976. The finances section measured BUDGET/POPULATION, NONPROFIT STATUS, and the sources of clinic funds from CURRENT SELF-SUFFICIENCY and FEDERAL SUPPORT. PRIOR SELF-SUFFICIENCY was taken from the 1975 survey.

**TABLE 1—Dependent Variable = CURRENT SELF-SUFFICIENCY[a]**

| Variable Name | # Cases | Mean[b] | Coefficient[c] |
|---|---|---|---|
| CURRENT SELF-SUFFICIENCY | 81 | .596 (.372) | |
| PRIOR SELF-SUFFICIENCY | 101 | .474 (.382) | .548 (48.37) |
| OUTREACH SERVICES | 101 | .307 (.464) | −.199 (10.05) |
| LABORATORY TESTS | 101 | .852 (.357) | .261 (11.22) |
| NONPROFIT STATUS | 96 | .927 (.261) | −.386 (10.81) |
| BUDGET/POPULATION | 79 | 44.166 (95.093) | −.001 (3.7) |
| HOSPITAL CONTROL | 99 | .071 (.258) | .225 (4.13) |
| AHEC | 101 | .337 (.475) | .078 (1.81) |
| VISIT TREND | 78 | .325 (.553) | .101 (3.47) |
| PER CAPITA INCOME | 101 | 2616.4 (634.8) | −.001 (3.7) |
| STAFF RETENTION | 98 | 2.357 (.736) | .058 (2.00) |
| AGE | 100 | 4.720 (6.535) | .009 (2.19) |
| ADVANCE PROMOTION | 96 | .844 (.365) | .104 (1.40) |
| CONSTANT | | | .594 |

$R^2$ = .738
std. error = .211
F = 12.17[d]

Degrees of Freedom
regression = 12
residual = 52

[a]The regression was done with the SPSS stepwise computer program using pairwise deletion of missing values. Listwise deletion showed similar results.
[b]The standard deviation is in parentheses.
[c]The F-statistic is in parentheses. For each variable the F-statistic significant at the 5 per cent level is approximately 3.95.
[d]For the regression equation with 12 and 50 degrees of freedom, the 1 per cent confidence level is F = 2.58.

related, and each is influenced by a number of independent variables. Appendix Table 1 shows the variables used in the analysis, and our explanations follow.

The ability to keep professional staff (STAFF RETENTION) should increase self-sufficiency. The level of self-sufficiency should rise over time as a result of "learning by experience." Therefore the number of years that the center has been open (AGE) should have a positive influence on the dependent variable. In addition, the acquired level of self-sufficiency should persist from period to period. This "habit effect" is measured by the lagged variable, PRIOR SELF-SUFFICIENCY.

OUTREACH SERVICES and LABORATORY TESTS reflect the mixture of services provided by the center. Daily provision of outreach services to patients in their homes, often located in nearly inaccessible areas, is a service unlikely to recover its full cost. On the other hand, the EKG proxy for tests and services should increase self-sufficiency.

Nonprofit ownership is both a measure of service orientation and management inefficiency. For many centers, self-sufficiency may be secondary to the ability to provide needed services. Service orientation should be less for the proprietary centers, since they are in business to generate net revenue on services. The proprietary centers may also be more efficient. Clarkson has argued that managers and workers are more productive when they have a profit incentive.[12] For either reason, NONPROFIT STATUS should lessen self-sufficiency.

Centers which are better known and accepted by their target area population should find it easier to be self-sufficient. The proxy used for this variable is conducting public relations activities before opening.

Area Health Education Centers (AHECs) are institutions which perform all the functions of a university health science center except basic education of medical students.[13] They cooperate with primary care centers to plan and develop effective health delivery systems. A state with an AHEC program should provide services which enhance the self-sufficiency of the primary care centers.

Finally, we include the control variables VISIT TREND, HOSPITAL CONTROL over the health center, county PER CAPITA INCOME, and BUDGET/POPULATION.*

## *Results and Interpretations*

A linear ordinary least squares (OLS) regression of current self-sufficiency on the explanatory variables is shown in Table 1. Each independent variable has a direct effect on CURRENT SELF-SUFFICIENCY. It also has an indirect effect through the other dependent variables in the equation. We discuss the direct effects here.

*It might be argued that self-sufficiency depends on the size of a clinic's service area population. Clinics also have startup costs and other non-recurring expenses to be amortized. We experimentally used service area population and dummy variables for a new or renovated clinic building (proxies for startup costs) to explain self-sufficiency. The F-statistics of these variables were too small for them to be brought into the regression equation.

The STAFF RETENTION variable has a positive but statistically nonsignificant influence on self-sufficiency. Other factors equal, a clinic which has negligible difficulty retaining its professional staff will have a .116 higher level of self-sufficiency than a clinic which experiences severe difficulty retaining its professional staff.**

The longer a center has been in existence, the more likely it will achieve complete self-sufficiency. The AGE variable has a positive effect on the level of self-sufficiency but the F-statistic is not significant at the 5 per cent level. The average center (all independent variables except AGE set at their mean values) would become completely self-sufficient only after 50 years of operation through this effect alone.

The effect of prior self-sufficiency is significant and positive, as we predicted. This habit effect tends to wear out over time because only a fraction (.548) of prior self-sufficiency is passed on to the current year. After many years, if other independent variables do not change, self-sufficiency tends to be a constant level of .75.‡ Therefore public agencies funding rural primary care centers face a serious problem: in the absence of structural changes, long-run public support will be required to meet operating deficits.

Service mix influences self-sufficiency, as we predicted. The EKG proxy for tests and services has a significant positive effect. Programs which employ these inputs will experience a .261 higher level of self-sufficieency, all other things equal. The OUTREACH SERVICES dummy variable negatively influences self-sufficiency. The average clinic which does not provide daily outreach services will be 37 per cent more self-sufficient than one which does.

Nonprofit clinics are markedly less self-sufficient than for-profit centers. Holding all other factors equal, a for-profit center will be .386 more self-sufficient.

The HOSPITAL CONTROL variable indicates that, *ceteris paribus*, those health centers ultimately controlled by a hospital will be more self-sufficient than a center controlled by other sources. We speculate that hospitals provide stable and experienced management for the center. They may also facilitate patient referral for conditions which can be treated better at the hospital and, ultimately, they may subsidize the center as an alternative to a hospital outpatient clinic.

If the people in a center's target area are unaware of its program, then it will have problems reaching total self-sufficiency. This is shown by the positive coefficient of ADVANCE PROMOTION. However, the variable is not significant at the 5 per cent level, so any interpretation should be made with caution. The lack of a state AHEC program is also a drain (not significant statistically) on CURRENT SELF-SUFFICIENCY.

Among the control variables there is a negative relationship between PER CAPITA INCOME and self-sufficiency. Higher income people may use other sources of care, either within the area or by traveling longer distances if necessary. The coefficient of VISIT TREND indicates that faster-growing centers will be more self-sufficient. Although economic theory does not provide a clear explanation for this effect, perhaps unmeasured factors such as management skill are responsible for both rapid growth and self-sufficiency.

The independent variables of interest in the equation for VISIT TREND are PRIOR VISITS and PRIOR VISITS$^2$/100,000 (patient vists in the last fiscal year squared and scaled by $10^{-5}$). We are interested in the relation between size and rate of growth. The squared term allows the relation to be nonlinear.

The association of large size with rapid growth may be reason to infer that larger clinics are more efficient than small clinics, hence they "survive" better. However, the association between size and growth is not convincing unless other variables are controlled. Table 2 shows a linear OLS regression of VISIT TREND on size and other variables.

Although only 45 per cent of the variation in VISIT TREND is explained by the combined effects of the independent variables, one can still draw conclusions from the individual variables. The coefficients of PRIOR VISITS and PRIOR VISITS$^2$/100,000 reveal a U-shaped relation between size and growth. VISIT TREND is at a minimum value of 1.36 per cent when the clinic reaches an annual output of 28,571 visits.‡‡ The sample mean of PRIOR VISITS is 10,502, much less than the number of vists at the minimum point of VISIT TREND. Thus, over the observed range of sizes, smaller clinics are growing faster. The fact that smaller clinics grow more quickly than larger clinics may be explained by market saturation. In two areas of equal population, a clinic which currently serves fewer people can expand more rapidly than a larger clinic.

Among the other variables, PUBLIC RELATIONS has a positive, though not significant, effect on VISIT TREND. Clinics which provide outreach services grow faster, and those controlled by hospitals grow slower, than the average.

Our third equation explains the difficulty which clinics experience in keeping professional staff. The statistical method employed had to be specially selected to suit the somewhat unusual problem confronted here. The dependent variable, STAFF RETENTION, represents a subjective assessment of staffing problems which takes three discrete values: severe difficulty in keeping professional staff, moderate difficulty, and negligible difficulty. We employed probit anal-

**When we say "other factors equal" or discuss an "average clinic," we mean that all variables assume their sample average values. The average level of current self-sufficiency is .596. We can calculate how the level changes as one or more independent variables are manipulated. In this example, STAFF RETENTION goes from 1 (severe difficulty) to 3 (negligible difficulty). The difference of 2 units is multiplied by the coefficient of STAFF RETENTION in the CURRENT SELF-SUFFICIENCY REGRESSION (.058 in Table 1) to produce a gain of .116. Other calculations are left to the reader.

‡We set CURRENT SELF-SUFFICIENCY = PRIOR SELF-SUFFICIENCY and solve the equation, holding other variables at their mean values. AGE cannot be held constant but, as shown above, the passage of time by itself works very slowly to increase self-sufficiency.

‡‡To find the output at which VISIT TREND is minimized, set the first derivative of the equation with respect to PRIOR VISITS equal to zero and solve for PRIOR VISITS. This value, when substituted back into the equation, permits solution for the minimum growth rate of 1.36 per cent.

**TABLE 2—Dependent Variable = VISIT TREND**

| Variable Name | # Cases | Mean[a] | Coefficient[b] |
|---|---|---|---|
| VISIT TREND | 78 | .325 (.553) | |
| BUDGET TREND | 63 | .333 (.810) | .254 (8.41) |
| PRIOR VISITS | 79 | 10501.6 (10970) | −.00004 (6.99) |
| OUTREACH SERVICES | 101 | .307 (.464) | .231 (2.01) |
| STAFF RETENTION | 98 | 2.357 (.736) | −.266 (7.21) |
| PER CAPITA INCOME | 101 | 2616.4 (634.8) | .0001 (0.97) |
| PRIOR VISITS$^2$/100,000 | 79 | 2291.0 (5349.2) | .00007 (4.43) |
| PUBLIC TRANSPORTATION | 100 | .400 (.492) | .170 (1.48) |
| FEDERAL SUPPORT | 81 | 29.247 (35.849) | .0079 (4.35) |
| CURRENT SELF-SUFFICIENCY | 81 | .596 (.372) | .905 (5.40) |
| PRIOR SELF/SUFFICIENCY | 101 | .474 (.382) | −.403 (2.79) |
| HOSPITAL CONTROL | 99 | .071 (.258) | −.410 (2.12) |
| BUDGET/POPULATION | 79 | 44.166 (95.093) | −.0011 (1.91) |
| PUBLIC RELATIONS | 95 | .484 (.502) | .144 (0.91) |
| CONSTANT | | | .318 |

$R^2$ = .451
std. error = .470
F = 2.60[c]

Degrees of Freedom
regression = 13
residual = 41

[a]The standard deviation is in parentheses.
[b]The F-statistic is in parentheses. For each variable the F-statistic significant at the 5 per cent level is approximately 3.98.
[c]For the regression equation with 13 and 41 degrees of freedom, the 1 per cent confidence level is F = 2.62.

ysis to estimate the STAFF RETENTION equation.* This technique estimates an equation from which it is possible to calculate the probability that an observation will fall into each category of STAFF RETENTION, given the values of variables that affect the probability. Current self-sufficiency should attract staff, since a clinic that meets operating costs from patient revenues can offer secure salaries. Lacking self-sufficiency, perhaps a clinic can survive on federal grants (FEDERAL SUPPORT). And if the professionals pay attention not only to current self-sufficiency, but also to its direction of change (is the clinic on the "ups?"), then staffing problems should increase as PRIOR SELF-SUFFICIENCY rises.** A clinic with a full-time administrator should be well-run, and therefore attractive to physicians.

The probit equation of STAFF RETENTION on other variables is shown in Table 3. Positive coefficients indicate higher predicted values which imply less difficulty in keeping staff. The presence of a state AHEC program is a positive aid in keeping staff (not statistically significant). Current and lagged self-sufficiency, federal grants, income, and public transportation also have the predicted effects. Growth *per se* appears to be a disruptive experience, since clinics with a large value of VISIT TREND have more trouble keeping staff. In addition, lack of outreach programs makes it difficult to keep staff.

The presence of a full-time administrator, contrary to our expectations, creates staffing problems. We consider several possible explanations. Abernathy, *et al.*, point to conflicts between administrators and physicians[15] which may explain our finding. Also, it is likely that National Health Service Corps physicians, who are obligated to serve in rural areas,[13] are more prevalent at centers with full-time administrators. NHSC physicians frequently leave the rural area after their obligation is met. The ADMINISTRATIVE EMPLOYEE variable may reflect this extraneous influence.

The quantitative significance of independent variables is shown by Table 4, in which we conduct several hypothetical experiments. The probability that STAFF RETENTION falls into each category is calculated for hypothetical values of independent variables.

The presence of an AHEC "buys" the clinic as much staff retention as a 10-point gain in self-sufficiency. If the AHEC were taken away, the probability of experiencing severe retention problems rises by 65 per cent. A cutoff in federal funding would more than quadruple the probability of falling into category 1, and it would cut by 56 per cent the chances of having no significant staff retention problems.

## *Conclusions*

Self-sufficiency is achieved by a "snowballing process," influenced by past self-sufficiency, among other factors. This suggests that the organization which initially sub-

*Probit estimates of a categorical variable are unbiased if the model has only one equation. Our model has three equations. Appropriate econometric techniques for this problem have not been devised so we take the simplest solution: ordinary least squares for the continuous variables, and probit for the STAFF RETENTION equation.

**Let STAFF RETENTION = $a_0 + a_1$ CURRENT SELF-SUFFICIENCY + $a_2$ (CURRENT − PRIOR SELF-SUFFICIENCY). Then STAFF RETENTION = $a_0 + (a_1 + a_2)$ CURRENT SELF-SUFFICIENCY − $a_2$ PRIOR SELF-SUFFICIENCY.

**TABLE 3—Dependent Variable = STAFF RETENTION[a]**

| Variable Name | # Cases | Mean[b] | Coefficient[c] |
|---|---|---|---|
| STAFF RETENTION | 98 | 2.357 (.732) | |
| FEDERAL SUPPORT | 79 | 29.844 (32.11) | .015 (2.156) |
| PER CAPITA INCOME | 98 | 2617.5 (626.49) | .00075 (3.36) |
| ADMINISTRATIVE EMPLOYEE | 95 | .779 (.409) | −.806 (2.34) |
| PUBLIC TRANSPORTATION | 97 | .402 (.488) | .427 (1.64) |
| CURRENT SELF-SUFFICIENCY | 79 | .588 (.331) | 2.074 (2.88) |
| AHEC | 98 | .347 (.476) | .276 (1.02) |
| VISIT TREND | 76 | .334 (.486) | −.644 (2.39) |
| PRIOR SELF-SUFFICIENCY | 98 | .460 (.377) | −4.27 (1.02) |
| OUTREACH SERVICES | 98 | .316 (.465) | .404 (1.31) |
| CONSTANT | | | −1.29 |

Chi-squared = 29.336
Degrees of freedom = 9
Probability < .01

$R^2$ = .334
Per cent predicted correctly = 57

[a]The regression was done with a multivariate probit program[14] with missing independent variables set at the mean value.
[b]The standard deviation is in parentheses.
[c]The asymptotic Z-statistic is in parentheses. For each variable the Z-statistic significant at the 5 per cent level is 1.96.

sidizes a center should closely observe the level of self-sufficiency from year to year. If the level continually increases, then the funding organization should gradually phase itself out of the picture. If, after a reasonable length of time, it appears that a center will not become self-sufficient, then the funding organization should reconsider its support. The present practice of funding a project only during its early years may be responsible for the dissolution of many centers which are potentially self-sufficient. Furthermore, the AGE variable illustrates the positive influence of the number of years of operation on the level of self-sufficiency.

On the other hand, steps can be taken to increase self-sufficiency. Centers can provide tests and services along with primary health care. Public relations activities are also important. The presence of such activities early in a center's development speeds the attainment of self-sufficiency. Furthermore, the distribution of informational brochures positively influences self-sufficiency through its positive effect on VISIT TREND.

Characteristics of a clinic's service area determine, in part, the difficulty of keeping professional staff. Nothing can be done to change these characteristics in the short run. But an AHEC program makes a contribution to STAFF RETENTION.

In general we have stressed the need for organizational change. This does not imply that federal aid cannot be used to finance service-oriented rural health programs. Our research suggests that self-sufficiency, growth, and a stable staff can be achieved within a program that provides needed health services to rural America.

**TABLE 4—Probability (STAFF RETENTION = 1, 2, or 3)**

| | 1 Severe difficulty in keeping professional staff | 2 Moderate difficulty | 3 Negligible difficulty |
|---|---|---|---|
| Given: | | | |
| Sample mean | .102 | .386 | .512 |
| AHEC present | .0735 | .3433 | .5832 |
| AHEC absent | .121 | .4069 | .4721 |
| No FEDERAL SUPPORT | .3372 | .4567 | .2061 |
| 10-point gain in CURRENT SELF-SUFFICIENCY | .0735 | .3433 | .5832 |

## REFERENCES


1. Guillozet, Noel. "Rural Medicine: Making It Now, And The Problems Ahead." *California Medicine*, 118, No.4 (April 1973), 91-93.
2. Margin, Edward D. "The Federal Initiative In Rural Health." *Public Health Reports*, 90, No. 4 (July/August 1975), 291-297.
3. Harris, Fred. "America's Rural Health Crisis." *The Congressional Record*, 117, part 29 (October 27, 1971), 37618-37621.
4. Bayh, Birch. "The Crisis In Rural Health Care in America." *The Congressional Record*, 117, part 16 (June 22, 1971), 21228-21230.
5. U.S. Congress, Appendix to hearings before the Subcommittee on Family Farms and Rural Development, *Health Services for Rural Areas In The United States*. 93rd Congress, 2nd sess., Oct. 1, 2, and 3, 1974, p. 20.
6. Kosa, John et. al., ed. *Poverty and Health*. Cambridge, Mass.: Harvard University Press, 1969, p. 102, table 3-3).
7. Lane, Nancy M. Testimony before the United States Senate Committee on Finance, (July 21, 1977).
8. Madison, Donald L. "The Physician Distribution Problem In Rural Areas." Statement to the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce, U.S. House of Representatives (May 21, 1974), Reprinted as a Working Paper in Community Medicine by the Division of Community Medicine, Department of Family Medicine, University of North Carolina at Chapel Hill School of Medicine.
9. Crawford, Ronald L. and Regina C. McCormack. "Reasons Physicians Leave Primary Practice." *Journal of Medical Education*, 46, No. 4 (April 1971), 263-265.
10. Jehlik, Paul J. and Robert L. McNamara. "The Relation of Distance To The Differential Use of Certain Health Personnel And To The Extent of Bed Illness." *Rural Sociology*, 17 No. 1-4 (1952), 261-265.
11. Reiheld, Robert E. Statement of the American Medical Association before the Subcommittee on Rural Development, Committee on Agriculture, U.S. House of Representatives. Reprinted in *The Ohio State Medical Journal*, 71, No. 1 (Jan. 1975), 44-46.
12. Clarkson, Kenneth W. "Some Implications of Property Rights in Hospital Management." *Journal of Law and Economics*, 15, No. 2 (October 1972), 363-384.
13. Carnegie Council on Policy Studies in Higher Education. *Progress and Problems In Medical and Dental Education*. San Francisco: Jossey-Bass, 1976.
14. McKelvey, Richard D. and William Zavoina. "A Statistical Model for the Analysis of Ordinal Level Dependent Variables." *Journal of Mathematical Sociology*, 4 (1975), 103-120.
15. Abernathy *et. al.*, eds. *The Management of Health Care*, 1974.
16. *Distribution of Physicians in the United States, 1973*, Center for Health Services Research and Development, American Medical Association, Chicago, 1974, pp. 180-333.


## ACKNOWLEDGMENT

This project was partially supported by Grant Number HS 01971 to the Health Services Research Center of the University of North Carolina from the National Center for Health Services Research, Health Resources Administration, DHEW.

**APPENDIX TABLE 1—Variables Used in Analysis**

| VARIABLE NAME | EXPLANATION |
|---|---|
| CURRENT SELF-SUFFICIENCY | The level of self-sufficiency in year t where t is the most recently completed fiscal year. |
| PRIOR SELF-SUFFICIENCY | The level of self-sufficiency in fiscal year t-1. |
| OUTREACH SERVICES | Dummy variable which equals 1 if the center provides daily outreach services and 0 if it does not. |
| LABORATORY TESTS | A dummy variable which is a proxy for tests and services offered by the center (1 if the center has an EKG machine, 0 if not). |
| NONPROFIT STATUS | A dummy variable which equals 1 if the center has nonprofit status and 0 if it does not. |
| ADMINISTRATIVE EMPLOYEE | A dummy variable which equals 1 if the center has an employee whose *main* function is administration and 0 if it has no such person. |
| PUBLIC TRANSPORTATION | A dummy variable which equals 1 if there is public transportation available in the area where the center is located and 0 if there is no public transportation. |
| BUDGET POPULATION | The ratio of the center's current year budget to its service population. |
| HOSPITAL CONTROL | A dummy variable which equals 1 if a hospital has ultimate control over the health center and 0 if any other organization or person has ultimate control. |
| VISIT TREND | The percentage change in output (patient visits) from fiscal year t-1 to fiscal year t: $\text{VISIT TREND} = \frac{(\text{output}_t - \text{output}_{t-1})}{\text{output}_{t-1}}$ |
| PER CAPITA INCOME | The annual per capita income for the county in which the program is located.[15] |
| STAFF RETENTION | The ability of a clinic to keep its professional staff: 1 = severe difficulty in keeping professional staff, 2 = moderate difficulty, 3 = negligible difficulty. |
| AGE | The number of years that the center has been open. |
| ADVANCE PROMOTION | A dummy variable which equals 1 if the center conducted public relations activities before it opened and 0 if it did not conduct public relations activities. |
| BUDGET TREND | The percentage change in the budget from fiscal year t−1 to fiscal year t: BUDGET TREND = $(\text{budget}_t - \text{budget}_{t-1})/\text{budget}_{t-1}$. |
| PRIOR VISITS | The number of patient visits in fiscal year t−1. |
| PRIOR VISITS²/100,000 | Prior visits, squared and scaled by $10^{-5}$. |
| PUBLIC RELATIONS | A dummy variable which equals 1 if the center distributes public relations brochures and 0 if it does not. |
| FEDERAL SUPPORT | The percentage of a center's current budget which is provided by federal contracts or grants. |
| AHEC | Dummy variable which equals 1 if the state where center is located has Area Health Education Center (AHEC) program and 0 if it does not. |

## Bad Science and Social Penalties

*Bad science, especially in the environment and health area, may well impose socioeconomic penalties hardly envisioned. Health effects data, for example, are used as a basis and as a rationale (often emotional) for far-reaching decisions on the control of technology. All too often published partial findings are taken uncritically at face value, misinterpreted and misused; their qualifications are disgarded and their uncertainties forgotten. This can lead to technological fixes that do more harm than good. . . .*

*This plea to be more critical in the reporting and acceptance of science as a basis for important decisions is not meant to inhibit innovative work, withhold information from the public, or delay action needed in the public interest. Any reports that suggest a public health problem should be quickly examined to determine if immediate action is needed to prevent existing or imminent harm. (Fortunately, this determination can often be made on the basis of previous experiences.) Then such reports should be used to spur and guide any needed additional research.*

*The present spate of "doomsday" items, if taken at face value, could cumulatively produce either socioeconomic dislocations with little or no net health benefit, or public derision and counterreaction that would inhibit environmental improvement.*

*Comer C.* Science *200:1225, 1978*