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MULTIVARIATE ANALYSIS OF HEALTH CARE SERVICES UTILIZATION AMONG OLDER TEXANS

SUSAN BROWN EVE
HIRAM J. FRIEDSAM
North Texas State University

INTRODUCTION

Health is a major concern of older Americans. (1) Factors which create barriers to the use of health care services deny older adults the chance to achieve and/or maintain their maximum health potential and thus their maximum independence, life satisfaction, and economic self-reliance. Identification of these barriers is prerequisite to social policy aimed at eliminating them and thus increasing the quality of life of older people.

The principle objective of this research was to identify those demographic, social, and economic factors which affect the use of health care services of older people. The three types of health care providers on which this research was focused were physicians, hospitals, and dentists.

Andersen and Newman (1973) developed a framework for the study of the individual characteristics which
determine the use of health care services of any given population. The framework consists of three basic components: predisposing variables, enabling variables, and illness variables. Predisposing variables exist prior to the onset of illness and are related to the probability of having access to the enabling variables. The predisposing variables include: demographic characteristics such as age, sex, marital status, and past illness; social structural characteristics, such as education, race, occupation, family size, ethnicity, religion, and residential mobility; and beliefs about health, illness, and service providers. The enabling variables provide the means for individuals to use health care services and include: family level variables such as income, health insurance, type of regular source of care, and access to a regular source of care; and community level variables such as ratios of health care providers and facilities to the population, the price of health care services, region of the country, and urban/rural residence. The most immediate stimulus to use of health care services is actual illness level, both as it is perceived by the individual and as it is evaluated by health care practitioners. (Andersen and Newman, 1973:106-111)

There is much literature on the use of health care services by adults eighteen years of age and older. However, there are very few studies which have examined the use of health care services among samples of older adults, 65 years of age or more. Of the studies available, most used relatively small samples from a limited geographic area. None of these studies used multivariate analysis procedures to try to assess the relative importance of the different predisposing, enabling, and illness level variables. A review of the existing studies of older adults, as well as some suggestive studies on adult populations eighteen years of age and older, indicated that many of the variables in the Andersen and Newman framework
influence use of health care services among older adults.

The available evidence suggests that the direction of these effects differs for the different types of health care services. The bulk of the research on health care utilization has focused on the two most utilized services, physicians and hospitals and, to a much smaller degree, use of dental services. This literature can only be reviewed very briefly. A more thorough review can be found in a recent article by Ward (1977).

**LITERATURE REVIEW**

Recent research indicated that, among older adults, use of physicians increases with age and that females visit physicians more than males do. (Andersen et. al., 1976; Berki and Kobashigawa, 1976; Galvin and Fan, 1975; Kronenfeld, 1978; Monterio, 1973; Motley, 1976; National Center for Health Statistics, 1974) Adults who have had experience with illness and, therefore, probably with the health care services in the past, are likely to have higher rates of utilization than those without a past history of illness. (Andersen and Newman, 1973; Ward, 1977) Older people who live alone have been found to be more likely to visit physicians than older people who do not live alone. (Salloway and Dillon, 1973)

In general, higher socioeconomic status has been found to be positively related to use of physicians' services because of factors such as greater financial resources and greater knowledge of the health care system. (Andersen et. al., 1976; Berki and Kobashigawa, 1976; Ward, 1977) Minority groups were found to underutilize physicians' services compared to Anglos. (Berkanovic and Reeder, 1973; Queseda and Heller, 1977; Torres-Gil, 1977) Use of health care services has also been found to increase following retirement. (Bond, 1976) Positive attitudes toward
health and health care providers have been found to be positively associated with physician utilization. (Andersen and Newman, 1973; Battistella, 1968; Fabrega and Roberts, 1972; Litman, 1971; McKinlay, 1972; Mechanic, 1979; Suchman, 1966; Torres-Gil, 1977)

Among the predisposing variables, health insurance has generally been among the strongest indicators of physician utilization, particularly for older adults. (Health Services and Mental Health Administration, 1972) Difficulty of obtaining transportation may also adversely affect use of physicians' services. (Ward, 1977)

Community variables limit the amount of health services that are readily available to a population and, therefore, place an ultimate limit on the amount of utilization which can occur. (Andersen and Newman, 1973; Kronenfeld, 1978; Wan and Soifer, 1974) Research has tended to indicate that, other things being equal (especially financial resources and level of need), those elderly who live in areas such as rural communities, that lack health care personnel and facilities, have the lowest rates of utilization. (National Center for Health Statistics, 1972)

Finally, need for services has usually been found to have the strongest direct effect on physician utilization. (Andersen and Anderson, 1976; Andersen, et. al., 1972; Berki and Kobashigawa, 1976; Bice et. al., 1972; Fillenbaum, 1979; Galvin and Fan, 1975; Kronenfeld, 1978; Wan and Soifer, 1974; Wolinsky, 1978)

Generally, hospital utilization has been found to be influenced in essentially the same ways by the predisposing, enabling, and illness level determinants. However, unlike physician utilization, use of hospitals is usually greater among males than among females.
(Andersen et. al., 1976; Motley, 1976; National Center for Health Statistics, 1974; Torres-Gil, 1977) Hospitalization rates are higher for minorities than for Anglos of both sexes. (National Center for Health Statistics, 1974) Attitudes toward hospitals may be especially likely to influence rates of utilization among members of older generations because of the poor quality of such institutions when these generations were younger. (Fabrega and Roberts, 1972; Phillips, 1970; Suchman, 1966; Torres-Gil, 1977) Also, because of the greater coverage of hospital, as compared to physician, expenses in the Medicaid and Medicare programs, hospital utilization is influenced more by the presence of these insurance programs than is physician utilization. (Health Services and Mental Health Administration, 1972; Lowenstein, 1971; Palmore and Jeffers, 1971; Pettengill, 1972)

Unlike hospitalization and physician utilization, use of dental services declines with age. (National Center for Health Statistics, 1974) Because most dental services are elective and because most dental expenses must be paid out-of-pocket, use of dental services is likely to be much more strongly influenced by social structure and income variables than is hospital or physician use. (Health Services Administration; National Center for Health Statistics, 1974; Kriesberg, 1963; Motley, 1976; Weeks, 1961)

**METHOD**

Sample

The data for this research were taken from interviews with 8,065 Texans, aged 65 years or older. The data were originally collected by the Center for Studies in Aging at North Texas State University as part of a needs assessment survey conducted by thirteen Area Agencies and Regional Offices on Aging in the state of Texas. These agencies were located in north-central Texas, south-central Texas, and parts
of east Texas. The sampling design was a proportionate quota sample within each of the thirteen areas based on age, sex, and ethnicity. As probability sampling techniques were not used, the aggregate data were treated as exploratory data and exploratory data analysis techniques were used. (Elder, et. al., 1976: 16-20)

Approximately 500 interviewers were recruited by the participating agencies. Nearly 75 percent of the interviewers were 60 years of age or over. In addition to these older interviewers, agency employees and local college students were also used. (Elder, et. al., 1976:2-21)

The original sample consisted of 8,065 Texans over the age of 60 years. With the data analysis procedure used (AID3), it was necessary to eliminate all cases which had missing data on any of the eighteen predictor variables or any of the dependent variables. This stringent requirement resulted in a loss of approximately 3,000 cases. Of the cases that remained, 44 percent are male and 56 percent are female. Ethnically, 80 percent of the sample are white; 15 percent, black, and 5 percent Mexican-American. Sixty percent of the sample are residents of urban areas and 40 percent of rural areas. Fifty-one percent of the sample are less than 70 years of age.

Measurement of Variables

As the research involves secondary analysis of data collected by other researchers for other purposes, only variables which had been measured in the original study could be included. Thus, two limitations of this research are as follows: (1) not all variables that it would have been desirable to include were measured and, therefore, available for inclusion; and (2) the variables that were measured were not always operationally defined as the researchers would have
liked. Given these limitations, nonetheless, acceptable measures of many of the variables in the Andersen and Newman framework were available.

Measures of the number of doctors' visits in the last six months and the number of dentists' visits in the past year were included. These variables are not truly measured at the interval level because the upper end of the scale is truncated as four or more visits are grouped together in one category. However, observation of the frequency distributions revealed that the majority of the cases was within the first four categories of both variables which do constitute a true interval scale. The frequency distribution of responses for doctors' visits is as follows: no visits, 31 percent; one visit, 23 percent; two visits, 14 percent, and no response, 1 percent. The frequency distribution for dentist visits is as follows: no visits, 72 percent; one visit, 15 percent; two visits, 6 percent; three visits, 2 percent; four or more visits, 3 percent; and, no response, 3 percent. As these variables so closely approximate interval variables, they will be treated as interval measures.

(2)

Hospital visits within the past year are measured dichotomously by asking the respondents whether or not they have been admitted to a hospital within the past year. Dichotomous variables are true interval measures as their means can be interpreted as proportions when the variable codes are ones and zeros. The frequency distribution is within the acceptable 80/20 distribution limits so that it is acceptable for analysis as a dependent variable. (Sonquist, et. al., 1973) Specifically, the frequency distribution for hospital admissions is as follows: no visits, 72 percent; one or more visits, 27 percent; and, no response, 1 percent.

All the independent variables are measured at
either the nominal or ordinal levels. The predisposing variables include age, sex, education, ethnicity, residence, employment, marital status, and the number of people living in the household. The enabling variables measured include average monthly income, income from employment, SSI benefits, Social Security benefits, job pensions, difficulty of transportation, Medicare, Medicaid, and other insurance. The need variable included is a subjective evaluation of the general state of health.

Data Analysis Procedures

As no specific hypotheses were to be tested, a search procedure, known as "tree analysis," was used. "Tree analysis" was done using the AID3 (Automatic Interaction Detector) program, developed by the staff of the Institute for Social Research of the University of Michigan. (Sonquist, et. al., 1973) The procedure begins by searching the data set for the predictor variable that accounts for the greatest proportion of the variance in the dependent variable and then divides the data set dichotomously on that predictor. This procedure maximizes the difference of means between the two resulting subgroups. The procedure continues until there are no more variables on which the subgroups can be divided which explain an arbitrary, prespecified criterion amount of variance in the dependent variable. In this case, the default option of .6 percent of variance explained was adopted. The central focus of the procedure is on power in reducing error, that is, importance rather than significance. Testing the optimal model resulting from this procedure would require a fresh, independent set of data. Thus, no significance tests are provided as they are not appropriate.

RESULTS

In the data analysis reported below, the data are analyzed twice. First, the data are analyzed making
ASSUMPTIONS OF CAUSAL ORDER
SUMMARY OF AIDS ANALYSIS OF DOCTOR VISITS WITH NO FIGURE 1
no assumptions about the causal ordering of the variables. Second, the data are analyzed assuming the causal order implied by the Andersen and Newman framework. The predictor variables are ordered so that the predisposing variables are entered into the analysis first; the enabling variables, second; and the need variables, third.

The "trees" resulting from the analysis are presented in Figures 1 through 5. Within each box of the "tree," N represents the total number of respondents having the set of characteristics represented by the box. \( Y \) represents the mean number of doctor visits of those respondents, or the proportion of these respondents having a hospital admission or the mean number of dentist visits, whichever is appropriate. The "percent \( V \)" at each branching is the proportion of variance in the parent body explained by the split. Groups in the tree were split into further groups whenever the resulting split fulfilled two criteria: (1) the "Between Sum of Squares" produced by the split was at least .6 percent of the "Total Sums of Squares" for the total sample; and (2) the N in each of the resulting groups was greater than or equal to 25. Splits not meeting these criteria are likely to be either trivial and/or unstable.

**Doctor Visits**

The AID3 analysis of doctor visits, making no assumptions about causal order among the predictor variables, is summarized in Figure 1. The "tree" structure indicates that subjective evaluation of general health is a major factor out of the eighteen predictor variables which predict doctor visits among older people. Older people, who perceive themselves as being in good health, have an average of 1.02 doctor visits within the past six months while those who perceive themselves as in fair health have 1.76 visits, and those who perceive themselves in poor
Anderson and Newman's Assumptions of Causal Order

Summary of the Aids Analysis of Doctor Visits with

Figure 2
health, 2.60 visits. Once the variance due to general health is removed, no other variables are important in the prediction of doctor visits. The total sum of squares accounted for by this tree is 14.1 percent.

The AID3 analysis of doctor visits, assuming the causal order in the Andersen and Newman framework, is summarized in Figure 2. Among the predisposing variables, whether or not the respondent is employed is the major predictor of the mean number of doctor visits. However, employment accounts for only a very small amount of the total variance (2 percent). Among those respondents who are employed part-time or full-time, no other predisposing or enabling variables are important predictors of doctor visits. Subjective evaluation of health is the only variable which substantially influences doctor visits. Those working people who evaluate their health as fair or poor have twice as many doctor visits as those who evaluate their health as good.

Among those people who are not working, an enabling variable, transportation, also influences the average number of doctor visits, although not in the expected direction. Those people who have some difficulty or very much difficulty with transportation have, on the average, more doctor visits than those who have no difficulty with transportation. Furthermore, transportation interacts with subjective evaluation of health. Those respondents who have difficulty with transportation and have poor health have fewer visits (2.58) that those who have no difficulty with transportation but who are in good health (2.65), although the difference is very small (.07) and may be idiosyncratic to these data.

The most striking observation from Figure 2 is that, even after controlling for all the predisposing and enabling variables, subjective evaluation of health still explains the largest proportion (10 percent) of
the total variation in the entire sample. The percentage of the total sum of squares explained by this tree is 13.4 percent.

Hospital Admissions

The AID3 analysis of the proportions of the sample with hospital admissions within the past year, imposing no causal order, is summarized in Figure 3. The major predictive variable is subjective evaluation of health, explaining 8 percent of the variance. Three times as many respondents with poor health had hospital admissions within the past year as those with good health. As with doctor visits, once health status is controlled, no other variables are influential in the prediction of hospital admissions.

The AID3 analysis of the proportions of the sample with hospital admissions within the past year, imposing the causal order in Andersen and Newman's framework on the variables, is summarized in Figure 4. Imposition of causal order on the variables produces results similar to those obtained using causally ordered predictors with doctor visits. Among the predisposing variables, only employment (working/not working) is influential in predicting hospital admissions, albeit, weakly. Among the employed respondents, no other variables are predictive of hospital admissions. Among the unemployed, a greater proportion of those who have difficulty with transportation have had hospital admissions within the last year compared with those who have no difficulty with transportation.

Within each group, a greater proportion of those in poor health are likely to be hospitalized than are those in fair or good health. Again, subjective evaluation of health explains more of the variance than any other variable. However, whether health is poor or fair-to-good, those respondents who have
FIGURE 4
SUMMARY OF THE AID3 ANALYSIS OF
PROPORTIONS OF SAMPLE WITH HOSPITAL
ADMISSIONS WITHIN THE PAST YEAR WITH
ANDERSEN AND NEWMAN'S ASSUMPTIONS
OF CAUSAL ORDER

Total Group
N=5120
\( \bar{y} = .273 \)

Working
N=977
\( \bar{y} = .184 \)
Percent \( V = .9 \) Percent

Not Working
N=4143
\( \bar{y} = .294 \)

Transportation
Not Difficult
N=2478
\( \bar{y} = .245 \)
Percent \( V = 1.5 \) Percent

Transportation Somewhat, Very Difficult
N=1665
\( \bar{y} = .368 \)

Fair, Good Health
N=2108
\( \bar{y} = .207 \)
Percent \( V = 2.0 \) Percent

Poor Health
N=370
\( \bar{y} = .459 \)
Percent \( V = 2.1 \) Percent

Fair, Good Health
N=1022
\( \bar{y} = .279 \)

Poor Health
N=643
\( \bar{y} = .512 \)

N=Number of respondents
\( \bar{y} = \) Mean number of doctor visits
Percent \( V = \) Percent of Total Sum of Squares of "Parent" group explained by this split.
Percentage of Total Sum of Squares accounted for by this tree=6.5 Percent.
difficulty with transportation are more likely to have been hospitalized compared with those who have no difficulty with transportation. This interaction of transportation and health indicates that older people with poor health are also likely to have other problems as well, such as transportation, which limit their ability to take advantage of services available to them. The percentage of the total sum of squares accounted for by the tree is 6.5 percent.

**Dentist Visits**

The AID3 analysis of dentist visits with no assumptions of causal order is summarized in Figure 5. Education is the variable which is most predictive of mean number of dentist visits. Those respondents with at least some education beyond high school have, on the average, more dentist visits within the last year than those with a high school education or less. Education accounts for 5 percent of the total sum of squares. Among the less educated respondents, income has no additional influence, while among the more educated, those with average monthly income of $500 or more have, on the average, more dentist visits than those with less income. The AID3 results, in which Andersen and Newman's assumptions of causal order were imposed on the data, are exactly the same as in Figure 5. Thus, regardless of the assumptions of causal order, once education and income are controlled, none of the other predictor variables have an influence on average number of dentist visits.

**DISCUSSION**

In summary, subjective evaluation of health is the most important variable in the prediction of the use of physicians and of hospitals, while education and income are the most important variables in the prediction of use of dentists. The data seem to indicate that the use of doctors and hospitals is determined primarily by need for those services, while use of dental services
NO ASSUMPTIONS OF CAUSAL ORDER
SUMMARY OF THE AIDS ANALYSIS OF DENTIST VISITS WITH
FIGURE 5
is determined not by need for the services but by a combination of education (perhaps reflecting knowledge of the importance of dental care) and income with which to purchase these elective services. But is this interpretation correct? Are the elderly receiving all the care they need from hospitals and physicians without regard to socioeconomic status? There are five methodological issues relevant to the interpretation of these results.

First, the percent of the variance in the use of services explained by the model is very small, less than 15 percent in the case of doctor visits and less than 10 percent in the case of hospital and dental services. What factors explain the other 85 to 90 percent of the variance in the use of these services? Utilization data in the past has focused primarily on whether or nor a relationship existed between the predictor variables and utilization of services, not the variance explained. Is research which explains so little of the variation in the behavior under investigation really adequate for making policy decisions about health care service for the elderly? The most obvious source of unexplained variance in the dependent variables are predictor variables which have been left out of the analysis, including the predisposing belief variables, the enabling community variables, and measures of objective health. A second source of the unexplained variance may be the relatively crude level of measurement of the predictor as well as dependent variables. Perhaps more variance would be explained if there were finer distinctions in the categories of those variables.

A second related issue is that no distinctions are made in the use of health care services for different purposes. Andersen and Newman indicate that predictors of use of services may vary with the purpose of use; that is, whether use is for prevention, treatment, maintenance, or custodial care. (Andersen
and Newman, 1973) In this study, doctor, dentist, and hospital visits were not distinguished by purpose.

Third, an assumption of the framework used is that subjective evaluation of health precedes the use of medical services. With cross-sectional data, this assumption may not be warranted, particularly for older adults whose illnesses tend to be chronic with an insidious onset. Thus, an older adult may subjectively evaluate his health as good when, in fact, he has a chronic illness, such as hypertension, of which he is unaware or which he does not perceive as serious because its effects may not be outwardly visible. On the other hand, if an older adult is told by his doctor that he is seriously ill and/or if he is being treated for an illness by a physician, then the older adult may be more likely to evaluate his health negatively. Thus, use of medical services may produce a negative evaluation of health. The findings on transportation and use of physicians and hospitals may also result from an incorrect assumption about the causal order of the variables. It may be that illness produces problems with transportation as well as influencing the use of hospitals and doctors, so that those people who are in the poorest health will not only use physicians and hospitals the most but will also have the greatest problems with transportation. This issue of direction of causality can only be resolved with longitudinal data.

Fourth, these data only address the issue of quantity of services used, not quality, as does most of the health care services literature. Only the occurrence of a doctor, hospital, or dental visit is measured, not, for example, the appropriateness or adequacy of the diagnostic and/or treatment procedures used.

Finally, the delivery of health care services is conceptualized as an event in this research rather than a process. As a consequence, process variables
such as doctor-patient communication and patient compliance with treatment are not measured. It may be that the quality of medical care received as well as the quality of the delivery process may explain some of the variation in use of services.

These five methodological problems are not unique to these particular studies but are a problem with the health care utilization studies generally. In conclusion, this research suggests that the quality of health care utilization research could be improved by: refining the level of measurement; including measures of as many of the predictor variables included in the Andersen and Newman framework as possible; differentiating between the use of services for different purposes; using longitudinal designs which establish the direction of causality; and including measures of the quality of diagnosis and treatment as well as of the process of diagnosis and treatment. Such improvements would provide more adequate information to be used in the development of health care policy for the older adult.

NOTES

1. This article is a revised version of a paper presented at the 31st Annual Meeting of the Gerontological Society in Dallas, Texas, November 16-20, 1978. This study was supported under the auspices of a multidisciplinary grant from the Administration on Aging and a grant from the Faculty Research Funds of North Texas State University. Collection was supported by a grant from the Texas Governor's Committee on Aging and a grant from the Faculty Research Funds of North Texas State University.


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