Toward a Model for Improved Targeting of Aged at Risk of Institutionalization

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A national sample of institutionalized and noninstitutionalized aged was created by merging the 1977 National Nursing Home Survey and its counterpart, the National Health Interview Survey for the same year. A weighted logistic regression analysis was conducted to identify factors that might be useful in calculating home- and community-based long-term care clients' risk of institutionalization. A model containing patient characteristics, nursing home bed supply, and a climate variable correctly classified 98.2 percent of cases residing in nursing homes or the community. Physical dependency, mental disorder and degenerative disease, lack of spouse, being white, poverty, old age, unoccupied nursing home beds, and climate all appear to be determinants of institutional residency among the aged.

While few topics concerning health care of the aged have received more attention than the desire to prevent nursing home institutionalization, little success has been achieved in meeting that goal (Weissert 1985b). The corollary issue, an inability to predict institutionalization prospec-

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tively, has profound implications for community care because most such care is based on the assumption that providing it will obviate the need for institutionalization. Paramount among the reasons for such lack of success is the failure of most efforts to focus on that small subgroup of the elderly actually at risk of institutionalization and, more particularly, that even smaller subgroup that is likely, once it enters a nursing home, to stay there. Were such persons to be identified, efforts could then be made to reduce their risk of institutionalization.

The purposes of this article are multifold. First, we review the results of previous studies. Then we propose a model of the determinants of institutionalization, which includes patient and community characteristics. Finally, we provide a formula for the translation of this model into risk estimates for individual client applications. These risk estimates can then be used as one element in a process of practitioner judgment, which should lead to more effective implementation of program purposes. The model offered is substantially consistent with findings that have emerged—with slight variation from study to study—in the work of researchers who have pursued the determinants of institutionalization by studying a number of smaller or less representative data sets over the past decade or more. Nonetheless, the reader should be aware that the model is based on cross-sectional data and, as such, may be less accurate in prospective applications than results presented here suggest.

DETERMINANTS OF INSTITUTIONALIZATION: RESULTS FROM OTHER RESEARCH

Factors associated with institutionalization have been the subject of well-designed research efforts by a number of capable investigators over the past two decades. Some of the studies are cross-sectional in design and, therefore, are actually comparisons between noninstitutionalized and institutionalized elderly at a particular time. Other studies use a longitudinal design and are able to assess which factors cause some functionally impaired, at-risk, noninstitutionalized elderly—rather than all—to become institutionalized. The overriding concern in all of these studies is to determine what characteristics put a person at high risk for institutionalization. Reviewed here are the statistically significant results of studies, using either cross-sectional or longitudinal design, that also used multivariate techniques of analysis; bivariate results are not reported because they tell us little about the independent effects of variables. Studies related to special populations, such as resi-

dents of continuing care retirement communities (Cohen, Tell, and Wallack 1988) or other protected environments (e.g., Morris, Gutkin, Ruchlin, et al. 1987) are not included. Other studies by the same authors based on more generalizable populations, however, are included (e.g., Cohen, Tell, and Wallack 1986).

Among the factors found to be associated with institutionalization have been: advanced age (Branch and Jette 1982; Brock and O'Sullivan 1985; Cohen, Tell, and Wallack 1986; McCoy and Edwards 1981; Shapiro and Tate 1985; Vicente, Wiley, and Carrington 1979); ethnic background—nursing home residents are predominantly white (McCoy and Edwards 1981; Palmore 1976); unavailability of informal support—living alone, being unmarried or never having been married, having infrequent or no help from or contact with relatives, etc. (Branch and Jette 1982; Brock and O'Sullivan 1985; Cohen, Tell, and Wallack 1986; Greenberg and Ginn 1979; McCoy and Edwards 1981; Palmore 1976; Shapiro and Tate 1985); mental problems (Branch and Jette 1982; Shapiro and Tate 1985); and dependence in activities of daily living (ADL)—ability to do basic tasks for oneself (bathing, dressing, transferring, toileting, eating) or dependence in instrumental activities of daily living (IADL)—ability to do chores (Branch and Jette 1982; Cohen, Tell, and Wallack 1986; Greenberg and Ginn 1979; McCoy and Edwards 1981; Shapiro and Tate 1985).

The relationship between the availability of financial resources, personal or otherwise, and institutionalization is not clear. Many studies report no statistically significant association between the two variables; a few, however, report a positive one. Two national studies, for example, find that those who receive public or private aid are more likely to be institutionalized than those who do not receive such aid (Cohen, Tell, and Wallack 1986; McCoy and Edwards 1981). Another study finds that newly institutionalized elderly persons in Minneapolis-St. Paul, Minnesota tend to have higher incomes than those receiving care at home (Greenberg and Ginn 1979). Area differences in bed availability also may have an effect on the types of patients, by financial status, that nursing homes admit (Scanlon 1980).

Other patient-level determinants of institutionalization have included being hospitalized (McCoy and Edwards 1981; Shapiro and Tate 1985), seeing a physician on a problem rather than a regular basis (Evashwick, Rowe, Diehr, et al. 1984), and having minimal contact with the health services system in general (Branch and Jette 1982). In addition, several studies have indicated the importance of having a favorable attitude toward nursing home placement (Greenberg and Ginn 1979), and of perceiving one's health as deteriorating (Cohen,

Tell, and Wallack 1986; Evashwich, Rowe, Diehr, et al. 1984; Shapiro and Tate 1985).

The inclusion of community-level variables such as region, climate, and nursing home bed supply generally has been precluded by the use of geographically restricted samples in most analyses. The results from two studies that were able, at least minimally, to address these issues are inconsistent. McCoy and Edwards (1981), for example, found that living in the northeastern or western United States significantly increased one's chances of institutionalization. Cohen, Tell, and Wallack (1986), on the other hand, found that geographic region was not a significant factor. This inconsistency may have been due to the fact that McCoy and Edwards did not control for the effects of patient-related factors, whereas Cohen, Tell, and Wallack did.

In general, the results of these studies suggest that dependence in activities of daily living, lack of social support, mental disorders and other debilitating diseases, and in some studies, superannuation, financial resources, and region are associated with institutionalization.

One important difference between the present study and previously reported work is the inclusion of several community-level variables (i.e., climate and nursing home bed supply) and a number of unique patient-level variables (i.e., a series of diagnosed conditions). The most important difference, however, is that the population studied here includes a random sample of nursing home *residents*. Because data relate to those who are residents, it is useful to keep in mind that the characteristics presented are more reflective of those who enter and stay in nursing homes than of those who enter and are quickly discharged. This is so because, while turnover rates are very high in nursing homes (53.7 percent of all nursing home users leave within three months after admission [National Center for Health Statistics 1979]), the proportion of long stayers in a home at any given time tends to exceed the proportion of residents who are short stayers. Our analysis shows that the average length of stay for an elderly nursing home patient was 938 days at the time of interview, and that 75 percent had over 195 days of residency. Although most nursing home *admissions* tend to result in very short stays—due to death, transfers, or discharge to the community—most *residents* at a given point in time tend to be long stayers. This study is able to describe patients who have become long-stay nursing home users rather than the large population of short stayers who account for only a small proportion of the nursing home resident population.

There have been other studies that look at long stayers specifically. Vicente and colleagues (1979) analyzed determinants of institutional-

ization among those with greater than six months stay (40 percent of their sample of institutionalized). Palmore (1976) also noted that only one respondent in his study had not been institutionalized for six months or more.

The contrast in this study between community residents and nursing home residents should add to these other works' results. It is the long stayers with whom we must be most concerned from a policy perspective, since over time they use the most resources. The short stayers, those who are often only in need of rehabilitation, are the easiest to care for. Therefore, this study is critical for understanding determinants of long-stay institutionalization, as well as for providing a model for predicting institutionalization that can be used together with other information in targeting community care programs more appropriately.

METHODS

DATA SOURCES

Data from two national surveys were used: the 1977 National Health Interview Survey (HIS) and the 1977 National Nursing Home Survey (NNHS) (National Center for Health Statistics 1978, 1979). The HIS represents the civilian, noninstitutionalized population in the United States, and the NNHS represents the corresponding institutionalized population exclusive of Alaska and Hawaii. For purposes of our analyses the two data sets were concatenated. Prior to concatenation, the nonaged (those age 64 or under) in both surveys, and all HIS respondents living in Hawaii and Alaska, were dropped. Combined, the data sets represent substantially the entire aged population in the coterminous United States with the exception of persons residing in long-term care facilities other than nursing homes. (Predominant among the latter would be mental institutions and board and care homes.)

The NNHS is administered periodically to a nationwide sample of nursing homes, their residents, discharges, and staff (National Center for Health Statistics 1979). The 1977 survey was a stratified two-stage probability sample commencing with the selection of facilities and subsequent selection of residents, discharges, and staff from among sample facilities. NNHS data used in this article came exclusively from the resident file. Residents of all types of nursing homes in the nation were included. Data on residents were abstracted from the patient record as a primary source, supported by in-person interviews with the nurse

most familiar with the patient. When necessary, the nurse also checked the patient. In 1977, 7,033 residents were included in the sample; of these, 6,094 were age 65 or over.

The HIS is administered to a nationwide sample of households each year, and is designed to obtain information on the incidence and prevalence of illness and the use of health services (National Center for Health Statistics 1978). In 1977, 111,279 individuals were included in the sample; of these, 11,671 were age 65 or over and living in states other than Alaska or Hawaii.

Although the two surveys were collected at different sampling rates, both were designed as representative samples of their populations. Consequently, it was possible to join the two data sets and apply their separate weights to produce combined national estimates. Each sampled elderly case in the HIS represents, on average, about 1,903 elderly persons living in the community. Each case in the NNHS represents an average of 185 elderly nursing home residents. The total weighted sample size is 23,336,904.

Community-level data—nursing home bed supply and climate—were not available from either survey, but were obtained from other sources and attached to individuals in the merged data set using state and county markers. A nursing home bed supply variable was constructed from 1976 nursing home data obtained from the Area Resource file (ARF) System (U.S. Dept. of Health and Human Services 1984) and intercensal county-level population estimates (U.S. Bureau of the Census 1984). Climate data were obtained from a National Oceanic and Atmospheric Administration (1985) publication.

ANALYTIC TECHNIQUES

Weighted cross-tabular and multivariate analyses were performed to identify patient and community determinants of institutionalization—not of being admitted to an institution, but of being a resident of one at a point in time. The dependent variable was institutional residency, coded 1 for nursing home residents, and 0 for HIS respondents.

The SAS procedure FREQ was used with a WEIGHT statement for the cross-tabular analyses (SAS Institute, Inc. 1985). For the multivariate analyses, two additional procedures were used: LOGIST (Harrell 1986) and RTILOGIT (Shah, Folsom, Harrell, et al. 1984). LOGIST is a procedure designed to fit an unweighted or weighted logistic multiple regression model to a binary dependent variable such as ours. It also adjusts for the skewed distribution of our dependent

variable; in 1977, only 4.8 percent of the elderly resided in nursing homes.

The use of LOGIST alone for variance estimation and hypothesis testing would have yielded misleading results because it fails to take into account the complexity of the two survey sample designs. RTILOGIT is a procedure used in conjunction with LOGIST to adjust for this complexity. Using output from LOGIST and two additional pieces of information—the primary sampling strata and the primary sampling units (PSUs)—RTILOGIT computes estimates of the variances and covariances of the logistic regression coefficients that reflect sample design. Requisite strata and PSU identifiers for the 1977 HIS were available from the National Center for Health Statistics. For the 1977 NNHS, only partial information was available. While the nursing home facility codes provided on the data set served as the PSU indicators, we were forced to crudely approximate the strata information needed, as the original strata variables had been recoded or were not available.

DEFINITIONS OF VARIABLES

The variables included in the analyses were: age, gender, race, marital status, poverty status, functional ability, diagnosed conditions, climate, and nursing home bed supply. Merger of the two data sets required construction of a single set of comparable variables.

Patient-Level Variables

The following patient-level items were drawn directly (with minimal recoding) from the two data sets: age, gender, race, and marital status. Age was a continuous variable that reflected age at interview and ranged from 65 to 99 or older. Gender, race, and marital status were each dichotomous variables. Males, whites, and those not currently married (i.e., widowed, never married, divorced, or separated) were coded 1; others were coded 0.

Poverty. Poverty, also a dichotomous variable, was coded 1 for those determined to be living in poverty and 0 for all others.

This variable was defined for HIS respondents according to family income and size. (See U.S. Bureau of the Census 1978, for the specific definition used.) Over 10 percent of HIS respondents did not have a family income reported. We imputed a poverty status for respondents with unknown income based on the distribution of poverty within their PSUs. Results of analyses that excluded respondents with

unknown income did not differ significantly from those that included them; thus, the analyses reported here exclude them.

The 1977 NNHS collected no direct information on income, so nursing home residents were classified as living in poverty if any of their charges for nursing home care were paid by Medicaid, general welfare, or a charitable organization. The lack of comparability with poverty status as defined by family income and size in the HIS is recognized but unavoidable. Persons supported in part by Medicaid or welfare can, and perhaps often do, have incomes above the poverty line. However, they still represent the lower portion of the income distribution.

Level of Functional Dependency. Individuals were classified by their most severe functional dependency into one of four mutually exclusive groups. In order of their severity, the groups were: (1) needs help in toileting or feeding, or both; (2) needs help in bathing or dressing, or both, but does not need help in toileting or feeding; (3) needs help in mobility but does not need help in toileting, feeding, bathing, or dressing; and (4) does not need help in any of the above. Three dichotomous variables (1, 0) were created to represent these four groups; the "no help needed" group served as the reference—that is, omitted—group. The constructed variables and corresponding items from the NNHS and HIS are presented in Table 1.

The first two groups reflect the considerable work of Katz and others in defining and measuring the consequences of illness among the aged and chronically ill in their ability to perform six basic ADL—feeding, continence, transferring, toileting, dressing, and bathing (Katz and Akpom 1976; Katz, Ford, Moskowitz, et al. 1963). When properly defined, the six Katz ADL functions form a hierarchical scale, meaning that for most individuals limitation in a more primitive function (e.g., feeding) includes limitation in a more developed function (e.g., transferring). Since the 1977 HIS did not collect specific data on continence and transferring, it is likely that the dependency level of individuals whose severest dependency was one of these two functions was underestimated.

Further work by Spector and colleagues indicates that this hierarchical relationship among ADL functions can be extended to include more developed functions (Spector, Katz, Murphy, et al. 1987). That is, individuals who are dependent in ADL also are likely to be dependent in IADL such as transportation and shopping. In this article the need for human help in IADL is reflected in the need for such help in mobility. The hierarchical ordering of ADL and IADL functions among NNHS and HIS elderly respondents is illustrated in Table 2.

Table 1: Definition of Level of Dependency Measure by Survey

Constructed Variables	*National Nursing Home Survey*	*Health Interview Survey*
Human help needed in toileting/feeding	Resident received bowel retraining, bladder retraining, or catheter in last seven days, does not use the toilet, requires tube or intravenous feeding, or needs help toileting or feeding.	Person needs help toileting or feeding.
Human help needed in bathing/dressing	Resident received full bed-bath in last seven days, remains partially or completely undressed, or needs help bathing or dressing.	Person needs help bathing or dressing.
Human help needed in mobility	Resident is bedfast, chairfast, needs help walking, uses a posey belt, or needs assistance to leave grounds, or resident's primary reason for being in the nursing home is mental illness, mental retardation, or disruptive behavior.*	Person stays in bed all or most of the day or needs help getting around inside or outside the house or neighborhood.

*It is assumed that persons whose primary reason for being in a nursing home is mental illness, mental retardation, or disruptive behavior, or who used a posey belt, need supervision in mobility about the facility, its grounds, or outside its grounds.

Diagnosed Conditions. Diagnosed conditions are reported on both surveys, but the data suffer reliability problems. The HIS data were self-reported, with respondents having the opportunity to identify as many conditions as they chose. The most responsive individual listed 13 conditions. How accurately self-reported diagnosis reflects reality has been the subject of considerable debate. This may be especially problematic for mental disorders. The problem can only be acknowledged here.

The NNHS data on diagnosed conditions were taken from patients' records. Since the quality of such records varies considerably from state to state and from home to home, data in the survey must likewise vary. Further, many of the conditions reported reflect current status that may or may not be related to diagnosis at admission.

While the HIS used International Classification of Disease (8th revision) (ICD-8) codes, the NNHS used specially created codes. For this analysis, the HIS codes were matched to the NNHS codes; those we could not match were dropped. The comparable codes were then

Table 2: Hierarchical Ordering of National Nursing Home Survey and Health Interview Survey Elderly Respondents by Type of Dependency

Percent of those dependent in feeding who are also dependent in		
	NNHS	*HIS*
Toileting	92.2%	86.1%
Dressing	98.1	94.0
Bathing	99.6	98.4
Mobility	94.9	96.6
Percent of those dependent in toileting who are also dependent in		
	NNHS	*HIS*
Dressing	95.6	92.0
Bathing	98.8	98.5
Mobility	94.0	98.0
Percent of those dependent in dressing who are also dependent in		
	NNHS	*HIS*
Bathing	99.0	90.6
Mobility	87.7	90.4
Percent of those dependent in bathing who are also dependent in		
	NNHS	*HIS*
Mobility	81.4	89.4

collapsed into eight diagnostic groups. These groups were: (1) arthritis/rheumatism; (2) cancer, anemia, kidney trouble, or digestive disease; (3) circulatory disease; (4) diabetes; (5) injury; (6) mental disorder; (7) nervous system disease; and (8) respiratory disease. Each group was represented by a dichotomous variable (1, 0). Table 3 presents the variables and the corresponding items from each of the two surveys.

Community-Level Variables

Climate. Climate has been shown in earlier research to be an important determinant of institutionalization (Scanlon 1980), reflecting perhaps a regional difference in utilization as well as a difference based on the relationships among illness, the ability to care for oneself, and the severity of the weather. Our measure of climate was a continuous variable, heating-degree days. Specifically, individuals were assigned the sum of their state's monthly heating-degree values for 1977, which were drawn from a National Oceanic and Atmospheric Administration (1985) publication. The value for a given month is the sum of the number of degrees by which each average daily temperature fell below

65°F for that month. The higher the value, the colder the climate. Annual heating-degree days ranged from a low of 910 for individuals living in Florida to a high of 9,058 for those living in North Dakota.

Nursing Home Bed Supply. Two measures of nursing home bed supply at the county level were used. The more familiar one, the number of nursing home beds per 1,000 elderly, was used in the cross-tabular analyses. The less familiar measure, the number of unfilled or unoccupied nursing home beds per 1,000 elderly, was used in the multivariate analyses as a control on the supply of beds relative to demand, and represents the difference between beds and residents. These variables were constructed from 1976 nursing home data drawn from the ARF (U.S. Dept. of Health and Human Services 1984) and intercensal estimates of the 1976 elderly population (U.S. Bureau of the Census 1984).

Earlier research (Scanlon 1980) indicates that nursing home utilization is constrained by the number of beds available. He found that because of nursing home selection practices, unfilled beds (market tightness) had no effect on the nonpoor. Unfilled beds had a positive effect on utilization among the poor, as with more unfilled beds (a sign of a slack market) a larger share of Medicaid demand is served. The use of an imputed poverty status for a large percentage of the HIS sample, however, made the measurement of the interaction between unfilled beds and poverty status less reliable and, therefore, the interaction was not tested.

Omitted Variables

Significant omissions from the list of variables, as dictated by the data, were indicators of respondent social support and a price variable.

Social Support. Social support, extensively discussed in the scholarly literature as a factor contributing to nursing home use (Wan and Weissert 1981), was not adequately measured by either survey. Although a living spouse is the most important type of social support, other relatives and friends may supply sufficient care to prevent institutionalization. While living arrangements—for example, alone or with others—could be determined for HIS respondents, nothing comparable was available for nursing home residents. Adequate data would include such factors as the number and relationship of nearby relatives and their distance from the subject's home if in the community or home prior to entering the nursing home. These are potential indicators of the help such relatives may have provided at the time of the survey or prior to nursing home admission.

Table 3: Definition of Diagnostic Groups by Survey

Constructed Variables	*National Nursing Home Survey*		*Health Interview Survey*
	Primary Diagnosis Last Medical Examination	*Current Conditions*	*ICD-8 Classifications*
Arthritis/rheumatism	Arthritis/rheumatism	Arthritis/rheumatism	Arthritis or rheumatism, except rheumatic fever
Cancer, anemia, kidney trouble, or digestive disease	Cancer, anemia, cirrhosis of liver, or ulcers	Cancer, anemia, kidney trouble, and/or constipation	Neoplasms; pernicious, iron deficiency, and other anemias; nephritis, nephrosis, and other diseases of urinary system; ulcers, functional disorders of intestines, and cirrhosis and other diseases of liver
Circulatory disease	Congestive heart failure, hardening of arteries, heart attack, ischemic heart disease, high blood pressure, phlebitis, pulmonary embolism, rheumatic heart disease, stroke, or other circulatory problem	Hardening of arteries, stroke, hypertension, heart trouble, and/or edema	Diseases of the circulatory system

Diabetes	Diabetes	Diabetes	Diabetes mellitus
Injury	Hip or other bone fracture	Hip or other bone fracture	Fractures of skull, spine, trunk, and limb
Mental disorder	Chronic brain syndrome, mental retardation, neurosis, psychosis, senile psychosis, senile not psychotic, alcoholism, drug addiction, or other mental disorder	Senility, mental retardation, mental illness, chronic brain syndrome, alcoholism, and/or drug addiction	Psychoses, neuroses, personality disorders, other nonpsychotic mental disorders, mental retardation, and senility without mention of psychosis
Nervous system disease	Epilepsy, multiple sclerosis, or Parkinson's disease	Parkinson's disease	Multiple sclerosis, paralysis agitans, and epilepsy
Respiratory disease	Asthma, bronchitis, emphysema, pneumonia, or other respiratory problem	Chronic respiratory disease	Bronchitis, pneumonia, emphysema, asthma, and other chronic diseases of respiratory system

Price. Earlier research has suggested that individuals who would be private patients are quite price sensitive (Scanlon 1980). As Medicaid eligibles face significant and widely different amounts of cost sharing, their demand may be responsive to price as well. Sufficient information to estimate reliably the average price faced by community residents was not available in either survey.

Despite the limitations noted in the data used, they are the best data available and, as this article shows, they permit accurate prediction of institutional residency.

RESULTS

CROSS-TABULAR ANALYSES

Variables Associated with Institutionalization

Bivariate results are largely consistent with expectations (Table 4). Age, marital status, poverty, dependency level, and certain diagnoses are all strongly associated with institutional residency. About 10 percent of aged persons who were 75 years of age or older and about 10 percent of those who were unmarried were institutionalized, in contrast to only about 1 percent of their younger or married counterparts. Similarly, approximately 15 percent of those who were in poverty resided in a nursing home compared to only 3 percent of those not in poverty.

Nursing home residency dramatically increases with level of dependency. Less than 1 percent of those with no mobility or personal care dependency, and only about 2½ percent of those dependent in mobility only, resided in a nursing home. However, about a third of those dependent in bathing or dressing, and almost two-thirds of those dependent in toileting or feeding, were institutionalized.

Institutionalization also is associated with having certain diagnostic conditions (mental disorders, cancer, anemia, kidney trouble, digestive disease, nervous system disease, diabetes, and circulatory disease) with dramatic variation across diagnoses in the percentage of elderly institutionalized. Approximately 43 percent of elderly persons whose diagnoses included mental illness were nursing home residents. In contrast, only about 12 percent of those with arthritis/rheumatism, and less than 8 percent of those with respiratory disease, were institutionalized.

Gender, race, nursing home bed supply, and climate (heating-degree days) are also associated with institutionalization, although

effects are not as dramatic as those associated with other variables. Although more female than male aged and more white than nonwhite aged were institutionalized, the differences were small. A somewhat greater percentage of elderly resided in a nursing home in the relatively high-bedded areas than in the relatively low-bedded areas. Similarly, slightly more aged persons were nursing home residents in the coldest climates than in the warmest climates, but this may be confounded by the outmigration of healthy elderly to warmer climates (Unger and Weissert 1988).

Combined Effects

Tables 5 and 6 assess the combined effects of several of the characteristics shown in Table 4 to be associated with residency in a nursing home. The top rows and columns of Table 5 show the effects of superannuation and marital status combined. The "old-old" who have no living spouse are more likely to be in an institution than "young-old" married persons: 14.7 percent compared to 0.4 percent. Presumably, much of this effect reflects the presence in very old age of additional risk factors, such as personal care dependency and high-risk diagnoses. The remainder of the table shows how the presence of multiple risk factors greatly increases the probability of nursing home residency. The percentage of unmarried "old-old" who were institutionalized, for example, increases from 14.7 percent to 30.1 percent with the presence of a high-risk diagnosis, to 46.8 percent with the presence of bathing or dressing dependency, and to 78.1 percent with the presence of toileting or feeding dependency.

Table 6 indicates the effect of area nursing home bed supply on institutional residency for these "high-risk" persons (excluding the control for diagnoses). A much larger percentage of these individuals were institutionalized in high-bedded areas (90.6 percent) than in low-bedded areas (60.1 percent). This may indicate that having fewer available beds leaves the dependent elderly without institutional care, or it may indicate that they find alternative sources of care or that supply may be lower in response to lower demand.

MULTIVARIATE ANALYSIS

Table 7 reports the results of the weighted logistic regression analysis in which all of the independent variables were entered simultaneously. The model was statistically significant (X^2 = 2,366.82 with 18 *df*, $p < .001$), and correctly classified over 98 percent of all cases by residency status. Only about 1 percent of those who were predicted to be

Table 4: Percent Distribution of Demographic, Social, Dependency, Diagnostic, and Contextual Characteristics of Elderly by Residency Status

	Nursing Home Residents	*Community Residents*
Age		
65–74	1.5%	98.5%
75+	10.3	89.7
Gender		
Male	3.1	96.9
Female	6.0	94.0
Race		
Nonwhite	3.6	96.4
White	5.0	95.0
Marital Status		
Married	1.1	98.9
Unmarried	9.1	90.9
Poverty		
No	2.9	97.1
Yes	14.5	85.5
Level of Dependency		
No human ADL or mobility help needed	0.4	99.6
Human help needed in mobility	2.4	97.6
Human help needed in bathing/dressing	35.9	64.1
Human help needed in toileting/feeding	63.3	36.7
Diagnostic Groups		
Respiratory disease	7.7	92.3
Arthritis/Rheumatism	11.7	88.3
Injury	17.9	82.1
Circulatory disease	18.4	81.6
Diabetes	22.2	77.8
Nervous system disease	24.9	75.1
Cancer, anemia, kidney trouble, and/or digestive disease	37.3	62.7
Mental disorder	42.6	57.4

Continued

living in the community actually resided in a nursing home, and less than 13 percent of those who were predicted to be institutionalized actually lived in the community.

All of the independent variables, except gender, were statistically significant ($p < .05$) predictors of institutionalization. The table ranks each type of variable—dichotomous and continuous—in descending order by estimated odds ratio (far right column). The odds ratio indi-

Table 4: Continued

	Nursing Home Residents	*Community Residents*
*Nursing Home Bed Supply**		
Low	2.9	97.1
Medium low	4.3	95.7
Medium high	5.9	94.1
High	8.7	91.3
Climate†		
Warm	4.2	95.8
Mild	4.2	95.8
Cool	5.1	94.9
Cold	6.7	93.3
All Elderly	4.8	95.2

*Counties were grouped into quartiles on the number of nursing home beds per 1,000 elderly.

†States were grouped into quartiles on heating-degree days.

cates the relative risk of institutionalization associated with a given trait. For a dichotomous variable, the odds ratio represents the extent to which the chance of institutionalization is greater for an elderly person with the trait compared to one without—for example, one who was toileting or feeding dependent, or both, had a 74:1 greater chance of institutionalization than one who was functionally independent. For a continuous variable, the odds ratio represents the increased risk of institutionalization for each additional unit—for example, an elderly person age 66 had a 1.04:1 greater chance of institutionalization than one age 65.

The results show that the likelihood of institutional residency increased with the severity of functional dependency. All diagnosed conditions contributed to the contrast between those institutionalized and those not. Further, lack of a spouse, being white, superannuation, and living below the poverty line substantially increased the chances of institutionalization.

The community-level variables—heating-degree days and unoccupied beds—also were significant predictors of institutionalization. The odds of being a nursing home resident were greater for those living in cold climates and for those living in counties with empty beds.

Table 5: Percent of Elderly Residing in Nursing Homes by "High Risk" Characteristics

	65–74	75+	Total
All Elderly			
Married	0.4%	2.9%	1.1%
Unmarried	3.2	14.7	9.1
Total	1.5	10.3	4.8
*One or More High-Risk Diagnoses**			
Married	1.3	6.6	3.1
Unmarried	10.0	30.1	22.3
Total	4.6	21.8	12.8
Bathing/Dressing Dependent			
Married	4.8	14.6	10.3
Unmarried	44.6	46.8	46.4
Total	25.7	39.6	35.9
Toileting/Feeding Dependent			
Married	24.9	40.1	33.7
Unmarried	55.4	78.1	74.0
Total	41.6	70.3	63.3

*Includes arthritis/rheumatism, cancer, circulatory disease, diabetes, digestive disease, injury, kidney trouble, mental disorder, and nervous system disease.

Causes or Effects

Because these results are based on cross-sectional data, it is possible that the characteristics that distinguish aged individuals in nursing homes from those in the community reflect the *effects* of institutional life on patient characteristics rather than the *influence* of patient and other characteristics on institutional residency. It may be that those who enter nursing homes—perhaps a heterogeneous group at the time of admission—become a homogeneous group as they systematically adapt to institutional routines and lose whatever level of individuality and independent function they brought with them to the nursing home. It is noteworthy, however, that our model is consistent—for the most part—with the findings of a number of prospective studies (Branch and

Table 6: Percent of "High-Risk" Elderly Residing in Nursing Homes by Nursing Home Bed Supply

*Nursing Home Bed Supply**	*Unmarried and Age 75 or Older*	
	Bathing/Dressing Dependent	*Toileting/Feeding Dependent*
Low	30.1%	60.1%
Medium low	41.8	76.1
Medium high	53.4	89.4
High	74.0	90.6

*Counties were grouped into quartiles on the number of nursing home beds per 1,000 elderly persons.

Jette 1982; Cohen, Tell, and Wallack 1986; Shapiro and Tate 1985), one of which was national in scope (Cohen, Tell, and Wallack 1986).

IMPLICATIONS OF THE RESULTS FOR THE DETERMINANTS OF INSTITUTIONALIZATION

Institutional residency in a nursing home was shown in this study to be multicausal; all but one of the variables in the model—gender—was statistically significant. While dependency and diagnosis are of paramount importance—with toileting/feeding dependency especially so—several other characteristics also contribute to total risk. Among the other predictors are: marital status, race, poverty status, gender, age, climate, and unoccupied beds. Among diagnoses, presence of mental disorders is the most important factor associated with institutionalization, followed by cancer, anemia, kidney, and/or digestive disorders, and circulatory disease. Injuries, diabetes, arthritis/rheumatism, and nervous system and respiratory disease also exert some influence.

A married person with no high-risk diagnoses and no dependency who lives in a warm climate and is not in poverty is at almost no risk of institutionalization at the average age of 73.47. And, although older age increases risk, the probability of institutionalization will remain quite low unless aging is accompanied by the development of dependency, high-risk diagnoses, and absence or loss of spouse. Even dependency and old age will not necessarily result in institutionalization unless accompanied by other problems. This explains why half of the

Table 7: Logistic Regression Results: Determinants of Institutionalization‡

Independent Variable	Mean	Estimated Coefficient	Odds Ratio: Confidence Interval*	Odds Ratio: Point Estimate
Dichotomous				
Toileting/Feeding dependent	.05	4.3097	54.25-102.07	74.42
Bathing/Dressing dependent	.05	3.5137	24.99-45.10	33.57
Mental disorder	.07	2.7786	12.45-20.81	16.10
Cancer, anemia, kidney trouble, and/or digestive disease	.05	2.2505	6.95-12.96	9.49
Circulatory disease	.22	2.0645	6.16-10.08	7.88
Not married	.47	1.8395	4.57-8.67	6.29
White	.91	1.5038	2.99-6.77	4.50
Poverty	.23	1.2111	2.63-4.28	3.36
Nervous system disease	.01	0.9926	1.34-5.42	2.70
Injury	.04	0.9903	1.84-3.93	2.69
Diabetes	.03	0.9138	1.63-3.81	2.49
Respiratory disease	.05	0.6705	1.26-3.03	1.96
Arthritis/Rheumatism	.11	0.5938	1.37-2.40	1.81
Mobility dependent	.06	0.5438	1.24-2.39	1.72
Male	.41	0.1195†	0.86-1.47	1.13
Continuous				
Age	73.47	0.0358	1.02-1.05	1.04
Unoccupied nursing home beds	7.11	0.0197	1.01-1.03	1.02
Heating-degree days	4,772.62	0.0001	1.00-1.00	1.00
Intercept		-13.7611		

*95 percent confidence level.
†Not significant at the 95 percent level ($p > .05$).
‡Model chi-square = 2,366.82 with 18 *df*, $p < .0001$. Percent cases correctly classified: 98.2.

personal care-dependent aged population in the United States lives in the community (Weissert 1985a).

These findings, while they differ in small respects from those of some earlier studies, are quite consistent with the growing body of evidence suggesting that nursing homes are used by a population of the very elderly suffering multiple problems that reflect the loss of mental, physical, and social resources. Differences from other studies, where they occurred, were in the assignment of a level of statistical significance to a variable in our study, where no significance, rather than significance in the opposite direction, had previously been reported.

One interesting exception is gender—although two studies (Greenberg and Ginn 1979; Shapiro and Tate 1985) found females to be more at risk of institutionalization than males. Our study, like most other studies, did not find gender to be a significant factor. Among the speculative reasons for inconsistencies between findings are that (1) these data represent the national as opposed to smaller area populations; (2) the studies differ with respect to variables included and how they were defined (for example, most did not include community-level variables); and (3) these data represent mostly long stayers.

IMPLICATIONS FOR COMMUNITY CARE: RISK ESTIMATION

For community care to be cost effective it must target its services to individuals who, without such care, would become long-term residents of nursing homes. This and other research show that such persons typically suffer a multiplicity of problems. This suggests that community care programs, which use admission criteria that select recipients on the basis of a single deficit, or deficits in the less primal functions, are likely to serve populations that are not at high risk of institutionalization. For example, over the past 30 years, some community care programs have admitted patients who suffer only one ADL and two IADL dependencies (Kemper, Brown, Carcagno, et al. 1986).

The result has been programs that serve populations which, while they are in need and might benefit from community care, are not at much risk of institutionalization. Consequently, their community care use is not offset by reduced institutional use.

Community care programs could employ data such as those from this study to make their targeting more effective. Beta coefficients from the logistic regression analysis results presented in Table 7 could be used to estimate a risk score for each individual applicant to estimate the probability that the individual would be institutionalized in the near future. (Shapiro and Tate 1988 provide an example of this type of application.) Such a score, to be sure, could not be entirely accurate and would never be acceptable as an exclusive criterion for admission to community care, but it could be used to help program operators keep abreast of how well they were doing, on average, in targeting their care to high-risk patients. The risk scores would be assigned by using the following formula:

$$P = \frac{e^{(B_0 + \sum_{i=1}^{k} B_i X_i)}}{1 + e^{(B_0 + \sum_{i=1}^{k} B_i X_i)}} \quad (1)$$

where:

P = predicted probability or risk score.
e = exponential function.
B_0 = intercept term.
B_i = estimated coefficient of ith variable.
X_i = value for ith variable.
k = number of variables.

An example of risk-score computation for a hypothetical home care client is given in Table 8. An 86-year-old unmarried white female living in Ramsey County, Minnesota, with circulatory disease, diabetes, and arthritis, who is dependent in toileting, would have an estimated risk score of .8188.

As noted, this estimate is subject to error for a number of reasons, not the least of which is that it reflects determinants of institutionalization in 1977. Policy or other factors, or both, may have changed since then. Further, the model is based on cross-sectional data and, therefore, may not predict institutionalization prospectively as accurately as it classifies it cross-sectionally. Finally, the risk score itself, however accurate, should be used as only one element in a professional judgment that takes into account other factors, such as the reliability of data items used for the risk estimates, program purposes, potential benefit to the client, budget constraints and, one would hope, client preferences. Some would argue that focusing on high-risk clients may be less effective in preventing institutionalization than concentrating on moderate-risk clients with more potential for improvement.

Indeed, an important concern, which community care operators must acknowledge, is that targeting scarce resources on those at highest risk means leaving out of eligibility many individuals whom the programs now serve. Many who are most likely to benefit from community care in terms of health status outcomes may be the very patients left out of programs that target most effectively the highest-risk population (Weissert, Cready, and Pawelak 1988).

Limiting the targeted population to only those who have at least three high-risk traits (over 75, personal care dependent, and unmar-

Table 8: Example of Risk Score Computation

An 86-year-old unmarried white female living in Ramsey County, Minnesota, with circulatory disease, diabetes, and arthritis who is dependent in toileting would have a risk score computed as follows:

Characteristic	B_i	X_i	$B_i X_i$
Toileting/Feeding dependent	4.3097	1	4.3097
Bathing/Dressing dependent	3.5137	0	0
Mental disorder	2.7786	0	0
Cancer, anemia, kidney trouble, and/or digestive disease	2.2505	0	0
Circulatory disease	2.0645	1	2.0645
Not married	1.8395	1	1.8395
White	1.5038	1	1.5038
Poverty	1.2111	0	0
Nervous system disease	0.9926	0	0
Injury	0.9903	0	0
Diabetes	0.9138	1	0.9138
Respiratory disease	0.6705	0	0
Arthritis/Rheumatism	0.5938	1	0.5938
Mobility dependent	0.5438	0	0
Male	0.1195	0	0
Age	0.0358	86	3.0788
Unoccupied nursing home beds	0.0197	5.9207	0.1166
Heating-degree days	0.0001	8,490	0.8490
Sum			15.2695
Intercept (B_0)	-13.7611		
Risk Score (P)	$= \frac{e^{(-13.7611 + 15.2695)}}{1 + e^{(-13.7611 + 15.2695)}} =$		.8188

ried) reduces the national target population substantially (Weissert 1985a). Even some of these individuals will be uninterested in community care despite their personal care dependency. Some community care programs have found that a third of those to whom community care is offered decline to use it even when it is free. Others will be too sick and near death to use community care, or their needs will be so continuous and intensive that they will be too expensive to support in their homes. Of the remaining subgroup, some will decline community care if they have to pay for it, and others will not qualify for publicly supported care because they are not sick enough or not poor enough or both. Finally, of those who do become participants, recent experiences show that perhaps half will use community care for only six months or less, and many will use it less than daily (Brown, Blackman, Learner et al. 1985).

This is likely to make it difficult for many community care programs to operate efficiently. Unless innovative and effective telephone screening mechanisms, cheap transportation, and effective marketing techniques are employed, daily censuses may be small while unit costs are prohibitively high.

An alternative is to recast the argument for community care in favor of serving both those at high risk of institutionalization and those who have potential for showing health status or caregiver relief benefits, despite the realization that ultimately these improved and expanded services to this highly deserving population will cost more money. We are encouraged that the results presented here will add to the accuracy of predicting who is at risk of institutionalization. Whether we will choose to serve more than those at risk remains to be seen.

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