Patterns and Determinants of Health Services Use and Mortality After VA Nursing Home Care

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Risk factors for institutionalization and death for up to four years for a nationwide cohort (n = 6,488) of males discharged alive from Department of Veterans Affairs (DVA) nursing homes were identified through linked records of the DVA. Two-year cumulative probabilities of nursing home readmission, hospitalization, and death among nursing home dischargees were 0.30, 0.61, and 0.24, respectively. Using multivariate survival analyses, chronic functional impairments and past nursing home use were important predictors of nursing home readmission, whereas hospitalizations for exacerbations of chronic medical conditions were predictors of hospitalization and death. Past hospitalizations predicted all three outcomes. Differences in risk factors for nursing home readmission as compared with hospitalization or death among DVA nursing home dischargees suggest that high-risk patients can be identified at nursing home discharge and that different types of interventions will be necessary to decrease nursing home readmission as compared with hospitalization or death. Future development of linked record systems across multiple settings, both within and outside the DVA, will help to further characterize persons at high risk of institutionalization or death and to design and evaluate targeted interventions to decrease this risk.

As health care reform in the United States unfolds, increasing attention is being paid to monitoring and managing the health care of entire

280

populations over time and across settings. This is in contrast to traditional approaches that have focused on public policy and reimbursement reforms in a single setting (e.g., hospitals, nursing homes, or outpatient physician visits). Understanding the relationships between the use of hospital services and nursing home services is particularly important. For example, although nursing home residents are more severely ill than in the past (National Center for Health Statistics, 1989), little is known about changes in the patterns of hospitalizations among nursing home residents over time. Information is needed on the use of multiple types of health services among the elderly, who are at particular risk for utilization of both long-term and acute care services (Gilford, 1988). Such information, however, is largely unavailable in the United States due to differences in payment sources and information systems among hospitals, nursing homes, and other health care facilities. Nonetheless, such data systems have become particularly necessary with the recent formation of alliances between different types of health care providers (e.g., between hospitals and continuing care retirement centers), and the diversification of services by providers (e.g., the provision of subacute medical and rehabilitation services in nursing homes).

We sought to examine the predictors and patterns of nursing home and hospital utilization and death among a nationwide cohort of persons discharged alive from nursing homes of the Department of Veterans Affairs (DVA). The DVA operates one of the largest managed medical care systems in the western world (Smith & Wolcott, 1991). In geriatric care, the DVA has pioneered the development of a unique continuum of treatment programs that includes 126 nursing homes and 172 medical centers (American College of Physicians, 1991). In addition, the DVA maintains a unique comprehensive, coordinated computerized database that describes the hospital and nursing home utilization and clinical characteristics of its users. In general,

veterans admitted to nursing homes under DVA auspices have service-connected disabilities or relatively low income.

Persons discharged alive from nursing homes are important because (a) nursing home dischargees, both within and outside the DVA, are at high risk for subsequent use of both hospital and nursing home services (Lewis, Cretin, & Kane, 1985a; Linn, Gurel, & Linn, 1977; Vicente, Wiley, & Carrington, 1981) and (b) the number of persons discharged alive from nursing homes outside the DVA is expected to increase substantially as subacute and rehabilitation services are increasingly provided in nursing homes. By identifying the overall risk of nursing home readmission, hospitalization, and death after nursing home discharge and the patient-specific predictors of each type of event, we hoped to (a) examine the feasibility of linking records from multiple types of settings to describe the clinical characteristics and health services utilization of a large population over a substantial period, (b) develop analytic models to describe the predictors of long-term patterns of health services utilization across both acute and long-term care settings, and (c) attempt to identify "target groups" most likely to benefit from specific intervention strategies to reduce potentially avoidable nursing home and hospital admissions.

Methods

DATA SOURCES

We used three primary data sources: the patient assessment file (PAF) and patient treatment file (PTF) from the Department of Veterans Affairs (DVA), and the National Death Index (NDI). The PAF contains information gathered by nursing staff on all persons residing in DVA-operated nursing homes at admission, semiannually, and on return from a hospital stay. This information was gathered to enable resident classification according to Resource Utilization Groups, Version II (RUG-II) (Schneider et al., 1988). The RUG-II nursing home resident classification system is a validated case mix measurement method that quantitatively associates resident characteristics with the amount of nursing services required for care. Information not necessary for RUG-II classification (e.g., limitations in bathing or groom-

ing) was not included in the PAF. The PTF contains information for each hospitalization and nursing home stay in DVA-operated hospitals and nursing homes, as well as in community nursing homes under DVA contract. The NDI is a federally maintained database containing information from all death certificates nationwide. The accuracy of the NDI in ascertaining the fact and date of death among large populations has been demonstrated (Wentworth, Neaton, & Rasmussen, 1983).

STUDY POPULATION

Our interest was in examining patterns and predictors of health services use and mortality after nursing home care. We first identified all persons admitted to DVA-operated nursing homes during fiscal year 1987 (October 1, 1986, through September 30, 1987) (n = 11,915). The temporal sequence of nursing home and hospital stays for this nursing home admission cohort was determined using admission and discharge dates recorded in the PTF for the four-year period October 1, 1985, through September 30, 1989. Records for approximately 5% of residents were excluded because of inconsistencies (e.g., records indicating two simultaneous hospital admissions). The high internal consistency of the database has been described more fully elsewhere (Williams, Mehr, & Fries, 1994).

Among the nursing home admission cohort, 2,879 persons (24%) died in the nursing home or after transfer to a DVA hospital; 1,921 (16%) were still in a DVA nursing home or hospital as of October 1, 1989; and 6,744 (57%) were discharged alive from all DVA institutional care before October 1, 1989. Of the 6,744 persons discharged alive, records for an additional 296 persons (4%) were excluded because of an inadvertent inconsistency in the criteria defining membership in the nursing home admission cohort. The resulting study population comprised 6,488 persons.

OPERATIONAL DEFINITIONS

A *nursing home admission* was defined as admission to a DVA-operated nursing home, with or without an immediately preceding DVA

Index NH
admission

Index NH
discharge

|←—Index NH stay—→|

Out of DVA system

DVA hospital

DVA-operated
nursing home

Death

October,
1986
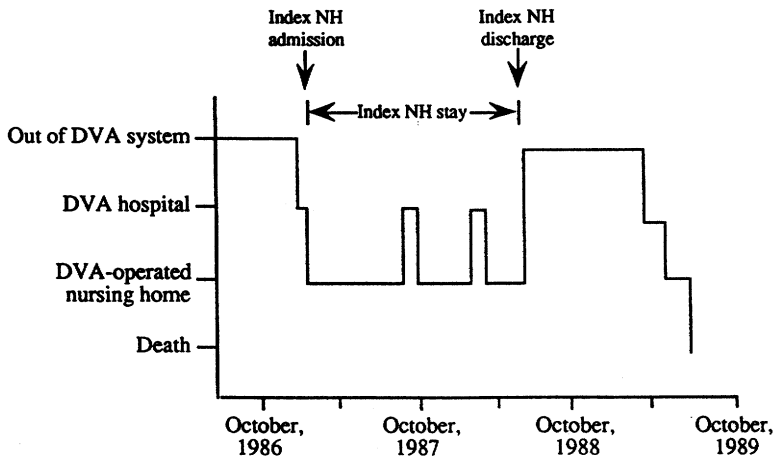
October,
1987

October,
1988

October,
1989

Figure 1. Health services use of hypothetical patient illustrating operational definitions
of index nursing home (NH) admission and discharge.

hospital stay. Persons who were transferred from a nursing home to a
hospital and then returned to a nursing home were not considered
(new) admissions. *Nursing home discharge* was defined as occurring
only upon death or leaving all DVA-supported institutional care, not
merely upon transfer to the hospital. Calculated nursing home *lengths
of stay* excluded intervening hospital stays. The nursing home stay
defining the study population is called the *index* nursing home stay.
Other nursing home stays were called *prior DVA nursing home stays*
(stays preceding the index nursing home stay) or *nursing home read-
missions* (stays following the index nursing home stay). Figure 1
illustrates the operational definitions of index nursing home *admission*
and *discharge*.

*DEPENDENT (OUTCOME) VARIABLES
AND STATISTICAL METHODS*

Risk factors for DVA nursing home readmission, hospitalization,
and death after nursing home care were examined using discrete time
proportional hazards survival analysis (Allison, 1982) because vary-
ing amounts of time elapsed between discharge from the index nursing

home stay and the end of follow-up among members of the cohort (Allison, 1984). In our population, each outcome influenced the risk of the occurrence of the other two outcomes, but in different ways. Nursing home readmission and hospitalization are likely to change the risk of the other two outcomes, whereas death renders patients ineligible for nursing home readmission or hospitalization. To account for this we developed separate models for the risk of each event, while incorporating information on the remaining two events into each model as time-varying covariates. In the discrete time models, one-month intervals were used to estimate the influence of patient characteristics on the risks of nursing home readmission, hospitalization, and death following nursing home discharge; one-week intervals were used to examine the influence of nursing home readmission and hospitalization (time-varying covariates) on the risk of the remaining events.

The dependent variables for the survival models are the risks of nursing home readmission, hospitalization, or death (three separate but related end points) at a given time after nursing home discharge, provided that the event had not already occurred. *Nursing home readmission* was defined as the first admission to a DVA nursing home after the index nursing home discharge. To focus on risk factors for hospital admissions to acute medical units, post-nursing home *hospitalization* was defined to exclude admission to intermediate medicine (subacute) wards, alcohol/drug rehabilitation units, or long-term psychiatric facilities, which were experienced by 608 (9%), 61 (1%), and 74 (1%) of nursing home dischargees, respectively. This end point is hereafter termed *acute hospitalization*. Mortality status was determined using information from the National Death Index (NDI) for the period through December 1989 for the discharge cohort.

In developing the models, we were concerned with the possibility that residents could have been discharged from DVA nursing homes to community nursing homes not under DVA auspices. These persons would have been falsely considered "out" of the nursing home. To investigate this possibility, separate analyses were carried out excluding the 604 individuals (9%) who were listed in the PTF as discharged to a community nursing home after DVA nursing home care. These results differed from results for the entire nursing home discharge

cohort only in expected and trivial ways. Statistical analyses were carried out using mainframe SAS (SAS, 1989) and SAS/PC (SAS, 1990).

INDEPENDENT (PREDICTOR) VARIABLES

Predictor variables for the demographic and socioeconomic characteristics of the nursing home discharge cohort were generally taken from PTF records for the index nursing home stay. Medical diagnoses were recorded as ICD-9-CM codes for the primary diagnosis (diagnosis responsible for length of stay) in the PTF for hospitalizations. Groups of ICD-9-CM codes were prospectively chosen to define diagnostic categories hypothesized to be of relevance (available on request from the authors). These included several types of acute and chronic conditions likely to affect functional status (e.g., hip fracture, cardiac disease, dementia, cerebrovascular disease, arthritis, psychotic condition, substance abuse, and cancer).

Information on events occurring before the index nursing home admission was limited to a 12-month period because this information was available for all patients. Information on the presence of terminal illness and resident functional status was taken from the PAF nursing assessment most closely preceding nursing home discharge. The last nursing home assessment occurred a median (interquartile range) of 48 (17-109) days prior to nursing home discharge. The PAF includes information to enable resident classification by Resource Utilization Groups, Version II (RUG-II). In this system, residents' clinical characteristics and ADL status are used to assign them to one of five categories:

- Heavy rehabilitation: heavy use of physical or occupational therapy.
- Special care: any of several conditions, including coma, nasogastric feeding, quadriplegia, and stage four decubiti; also, high ADL dependence.
- Clinically complex: any of several treatments or conditions, including wound care, chemotherapy, urinary tract infection, and terminal illness or any of the conditions qualifying for special care and low ADL dependence.

- Behavioral problems: physical aggression, verbal abuse, regressive behavior, or hallucinations.
- Reduced physical function: residents not classified in any other group.

These five categories are defined hierarchically in the order listed here; residents are classified in the first category for which criteria are met (Schneider et al., 1988). In general, the five RUG-II clinical categories describe groups of residents that are homogeneous with respect to clinical characteristics and nursing home resource consumption.

Only 18 patients (0.3%) had records that did not include a continuous history through death or April 1989. These were therefore classified as "lost to follow-up."

The behavioral model of health services utilization developed by Andersen (1968) and modified by others (Branch et al., 1981; Evashwick et al., 1984; Eve, 1988; Eve & Friedsam, 1980; Wolinsky, Coe, & Mosely, 1987; Wolinsky et al., 1983) was used to examine risk factors for nursing home readmission, acute hospitalization, and death.

MODEL DEVELOPMENT

Bivariate relationships between predictors and each outcome (nursing home, acute hospitalization, and death) were examined graphically and statistically through stratified life tables. The bivariate results were then verified and multivariate models were constructed, using discrete-time proportional hazards methods.

Multivariate modeling for each of the three dependent variables proceeded systematically. Variables were entered into the model in the order listed in Table 1, according to the Andersen model of health services utilization. Time-varying covariates were then included, and the effects on coefficients of previously entered variables were examined. Variables that did not significantly ($p < 0.05$) improve the overall model using the likelihood ratio test (Hosmer & Lemeshow, 1989) were removed from the final models. Value was placed on developing the simplest possible models because models were, in part, intended to be easily interpretable and to point toward potential clinical or

Table 1

Odds Ratios (95% Confidence Intervals) From Final Models Predicting Risk of Nursing Home Readmission, Acute Hospitalization, and Death After Nursing Home Care[a] (n = 3,372)

Variable	% of residents[b]	Nursing home readmission[c]	Acute hospitalization	Death[c]
Predisposing				
Age (10-year increments)		1.10 (1.02, 1.19)	—	1.39 (1.28, 1.51)
Marital status		—		—
Married	44		Ref	
Never married	15		0.78 (0.67, 0.91)	
Separated/divorced/				
widowed	41		0.95 (0.86, 1.06)	
Enabling				
Means test				—
Service-connected,				
<$18,000/yr	39	Ref	Ref	
Not service-connected,				
<$18,000/yr	55	1.09 (0.95, 1.26)	0.89 (0.80, 0.98)	
>$18,000/yr	5	0.61 (0.40, 0.94)[d]	0.57 (0.42, 0.77)	
Nonveteran, not applicable	2	1.41 (0.88, 2.24)	0.92 (0.65, 1.29)	
Needs				
Terminally ill	3	—	—	2.83 (2.11, 3.80)
Eating impairment		—	—	
None	47	Ref		
Partial	36	1.30 (1.11, 1.51)		
Moderate	11	1.04 (0.83, 1.30)		
Severe	6	1.33 (1.01, 1.74)		
RUG-II clinical classification		—		
Heavy rehabilitation	32		Ref	Ref
Special care	5		1.20 (0.95, 1.53)	1.17 (0.80, 1.69)
Clinically complex	24		1.05 (0.92, 1.19)	1.37 (1.12, 1.67)
Behavioral problems	4		0.65 (0.47, 0.90)	1.17 (0.75, 1.82)
Reduced physical function	35		1.04 (0.92, 1.07)	1.20 (0.99, 1.45)
Cardiac disease	6	—	1.24 (1.04, 1.48)	1.91 (1.20, 3.04)
Neoplasm	9	—	1.53 (1.31, 1.78)	2.78 (2.30, 3.37)
Chronic obstructive pulmonary				
disease	3	—	1.43 (1.16, 1.77)	1.63 (1.24, 2.16)
Psychotic condition	5	—	0.64 (0.49, 0.82)	—
Health services utilization				
Index NH length of stay				
≤1 month	28	Ref	Ref	Ref
1-6 months	50	0.67 (0.57, 0.78)	0.98 (0.88, 1.10)	0.84 (0.72, 0.99)
> 6 months	22	0.38 (0.30, 0.48)	0.71 (0.61, 0.82)	0.64 (0.51, 0.81)
No. of prior DVA hospitalizations —		1.22 (1.14, 1.29)	1.32 (1.26, 1.37)	1.19 (1.12, 1.26)
Admitted to index NH from				
DVA hospital	74	0.46 (0.39, 0.55)	—	—
Any prior DVA NH stay	10	2.17 (1.80, 2.60)	—	—
Time (months)	—	0.91 (0.90 0.93)	0.94 (0.93, 0.94)	1.01 (0.99, 1.03)

a. Odds ratios are interpreted as the odds of experiencing the event (nursing home readmission, hospitalization, or death) during any given month, provided that the event has not already occurred, relative to the odds of the event among persons without the characteristics of interest, after controlling for other variables in the model. Results for verification model are shown. Dashes signify variables not included in model. "Ref" signifies reference category for dummy variables.

b. Numbers may not add up to 100% because of missing values.

c. Includes terms for interactions between age and time, not shown.

d. *p* > 0.05 in development model.

programmatic reforms that could influence the risk of each outcome among nursing home dischargees. Only variables that statistically improved risk prediction were included in the models.

The proportionality assumption was examined by visually inspecting log (–log) survival curves and by examining the statistical significance of interaction terms between variables and time in the models. The only significant variation in the proportionality assumption occurred with age; increased age had a slightly stronger positive effect over time on the risk of nursing home readmission and death. Therefore, terms accounting for these effects were included in the final model. To minimize the influence of random effects, a split-sample technique was used for all analyses. Models were developed using a 50% random sample of the data ("development sample") and verified using the remaining half of the data ("verification sample").

Results

CHARACTERISTICS OF THE STUDY POPULATION

The mean (SD) age of the population was 66 (12) years; 40% were under 65. Essentially all residents (97%) were male. Twelve percent were black, and 94% were poor, with incomes less than $18,000 per year. Between 18% and 38% required constant human supervision in eating, toileting, or transferring. Most (85%) had been patients in a DVA hospital during the 12 months preceding the index nursing home stay, and 10% had lived in a DVA nursing home.

Median (interquartile range) follow-up time for the cohort (time from nursing home discharge to death or October 1989) was 710 (415-849) days. During follow-up, 1,567 (25%) persons were readmitted to nursing homes of the DVA, 3,825 (59%) were hospitalized (including admissions to nonmedical hospital units, such as intermediate medicine or psychiatric medicine), and 1,617 (24%) died. The cumulative probabilities of DVA nursing home readmission, hospitalization, or death after one year were 23%, 49%, and 14%, respectively (Figure 2). After two years the probabilities had increased to 30%, 61%, and 24%, respectively.
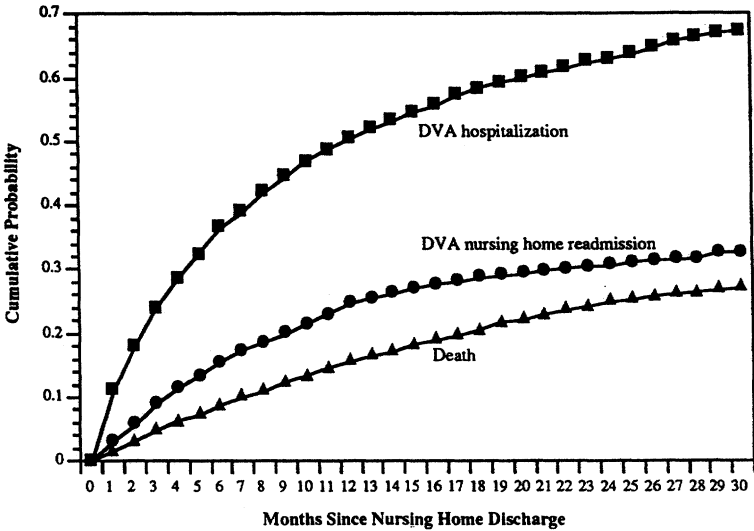
Figure 2. Cumulative probability of DVA nursing home readmission, hospitalization, and death after DVA nursing home care (life table method, $n = 6,744$).

RISK FACTORS

The adjusted odds ratios and 95% confidence intervals from the multivariate verification models using information available at the time of index nursing home discharge are shown in Table 1. Time-varying covariates (e.g., the effect of postdischarge hospitalization on the risk of death) are not included in the models shown because they had no significant effects on the coefficients shown and are discussed separately later. The adjusted odds ratios are interpreted as the odds of having the event of interest during any given month after nursing home discharge, provided that the event had not already occurred, adjusting for all other variables in the model. For example, at any given point in time after nursing home discharge, the risks of nursing home readmission and death were 10% and 39% higher, respectively, with each decade of age among persons who had not experienced each type of event.

Race, DVA compensation status, period of service or region, and the presence of an inpatient Geriatric Evaluation Unit had no inde-

pendent influence on the likelihood of any of the three events. The measure of functional impairment that best predicted nursing home readmission was eating, with progressive levels of impairment generally increasing the probability of this event. Eating impairment was not associated with acute hospitalization or death, and other measures of functional impairment, such as requiring human assistance in toileting and transferring, were not associated with increased risk of any of the three outcomes. Compared with the RUG-II class "Heavy Rehabilitation," membership in the RUG-II classes "Clinically Complex" and "Reduced Physical Function" increased the odds of death by 37% and 20%, respectively. In contrast, after accounting for eating impairment, RUG-II clinical classification did not predict readmission to the nursing home.

Past hospitalizations for particular medical conditions were not associated with nursing home readmission. However, having a hospitalization for cardiac disease (including coronary artery disease and congestive heart failure), chronic obstructive pulmonary disease, or a malignant neoplasm increased the probability of acute hospitalization and death by magnitudes ranging from 24% to 178%. Prior hospitalizations for dementia, arthritis, movement disorders, hip fracture, cerebrovascular disease, alcohol/drug abuse, or affective disorders did not affect the risk of nursing home readmission, acute hospitalization, or death.

Categorizing the index nursing home length of stay as less than one month, one to six months, and more than six months provided results that were essentially identical to more complex schemes, reflecting important differences in brief-, medium-, and long-stay DVA nursing home residents (Williams, Fries, & Mehr, 1993). Contrary to our expectations, risk of each of the three events was inversely related to index nursing home length of stay.

The number of prior DVA hospitalizations of any type during the 12-month period preceding the index nursing home admission consistently and strongly predicted all three outcomes. The risk of each of the three outcomes increased fairly linearly with the number of prior hospitalizations, so this variable was defined as the number of prior hospitalizations to a maximum of four. The risk of nursing home readmission and death after nursing home discharge increased by

approximately 20% and the risk of acute hospitalization increased by 30% for each prior hospitalization.

Being admitted for the index nursing home stay from a source other than a DVA hospital (a condition that was true for about one-fourth of the population) or having a prior DVA nursing home stay (experienced by 10% of the population) each more than doubled the odds of subsequent nursing home readmission.

There was no period after discharge from the index nursing home stay during which the risk of nursing home readmission, acute hospitalization, or death was remarkably high or low relative to other periods. The hazard rate for all three events declined slowly and nearly linearly with time.

RELATIONSHIPS AMONG RISKS

After accounting for information available at the time of discharge from the index nursing stay (Table 1), the risk of nursing home readmission was further and independently increased by admission to any acute medical or intermediate medicine unit, admission to the hospital for hip fracture, and hospitalization for cancer or a psychotic condition. Risk of acute hospitalization following discharge from the index nursing home stay was increased by admission to a psychiatric or alcohol/drug treatment unit. After accounting for the variables in the tables, the risk of death after discharge from the index nursing home stay was strongly increased by any acute hospitalization; by hospitalizations specifically for cardiac disease, cancer, or stroke; and by a nursing home readmission or admission to an intermediate care unit. Coefficients for variables measured at the time of index nursing home discharge (Table 1) were not significantly changed with the inclusion of time-varying covariates.

Discussion

Among the frail elderly, the inability to identify persons at highest risk for particular types of outcomes has been cited as an important reason for the failures of some types of interventions to decrease

institutionalization and death, such as ambulatory geriatric evaluation (Epstein et al., 1990; Rubenstein et al., 1989) and home care (Weissert, 1985). By comparing risk factors for different types of outcomes, groups or individuals at highest risk for particular outcomes may be identified and interventions designed and tested to decrease their event-specific risk. Using administrative data of the Department of Veterans Affairs, we were able to identify and estimate the magnitude of risk factors for each of three outcomes in the same population—nursing home readmission, acute hospitalization, and death.

In this population of DVA nursing home dischargees, separate but overlapping sets of predictors were demonstrated for nursing home readmission versus acute hospitalization and death. These findings suggest that interventions among persons discharged from DVA nursing homes could be tailored to individuals' characteristics to decrease the likelihood of types of health services use, or even death, for which they are at highest risk. The presence of functional impairments, prior nursing home stays (especially in the absence of prior hospitalizations for pulmonary or cardiac disease, cancer, or terminal illness), and admission from a source other than a DVA hospital describe patients at particularly high risk for nursing home readmission. These types of patients may be termed *functionally impaired* (but not medically ill). Functionally impaired patients could be selected for close in-home follow-up and assessment to facilitate early detection of functional decline. Interventions designed to improve informal support systems and in-home caregiving (e.g., through educational interventions aimed at caregivers) could be designed and evaluated based on their ability to reduce rates of nursing home readmission (as opposed to acute hospitalization or death). The feasibility of this type of targeting is suggested by previous research demonstrating lower health services utilization among chronically functionally impaired DVA hospital dischargees who receive intensive home care (Hughes et al., 1990).

Among *medically ill* persons who have been previously hospitalized for acute exacerbations of chronic conditions (e.g., chronic obstructive pulmonary disease or cardiac disease) and who are not terminally ill, more intense outpatient medical follow-up and management of their underlying condition may prove useful in decreasing

their risk of hospitalization or perhaps death. Patients with terminal illnesses or advanced medical diseases can be prospectively identified and evaluated for end-of-life planning and palliative care.

Chronic progressive medical conditions (e.g., dementia, arthritis, movement disorder), even when severe enough to precipitate hospitalization, do not appear useful as markers to identify patients for targeted interventions to prevent nursing home readmission, acute hospitalization, or death.

The feasibility of this approach is supported by the fact that among the 6,448 nursing home dischargees in our study, 1,376 (21%) were admitted from a source other than a DVA hospital; they had had no previous DVA hospitalizations for chronic obstructive pulmonary disease, cardiac disease, or neoplasm; and they were not terminally ill. An additional 986 patients (16%) met the reverse conditions—they were admitted from a DVA hospital, had had a previous DVA hospitalization with one of these three diagnoses, or were terminally ill. Thus, 37% of nursing home dischargees could be exclusively classified as "functionally impaired" or "medically ill" using characteristics identified as risk factors for specific types of outcomes. Additional patients could likely be placed in one or the other group based on other combinations of characteristics (i.e., age, functional status).

Although the logic of identifying and quantifying patient-specific risk factors for particular types of events may seem self-evident, this approach has been remarkably rare in geriatrics health services research. For example, one reason cited for the failure of randomized trials of home care to decrease nursing home utilization has been the low rates of nursing home admission among the control groups (Weissert & Cready, 1989). Patient preselection, based on empirical research and the design of targeted, outcome-specific interventions, will be essential to developing cost-effective interventions to decrease potentially avoidable use of institutional health services and death. The actual success of such efforts remains to be demonstrated.

The increasing availability of information on health characteristics and health services utilization across multiple settings will make approaches similar to those taken here increasingly feasible outside the DVA. For example, the federally mandated Minimum Data Set for nursing home residents is already making available information on the

clinical and functional characteristics and nursing home utilization of nursing home residents throughout the United States. As these and similar data become available to merge with hospital information from Medicare, databases similar to the one developed here will become possible.

The study population of nursing home dischargees constituted the majority (57%) of a nursing home admission cohort. Persons discharged alive from DVA nursing homes were at extremely high risk for subsequent use of DVA institutional health services and death. It is likely that the rates of nursing home readmission (30% two-year risk) and hospitalization (61% two-year risk) are quite high relative to groups outside the DVA (Lewis et al., 1985b). High rates of live discharges and subsequent use of nursing home and hospital services in the DVA probably reflect the close associations of nursing homes with acute hospitals in the DVA and the relatively greater amounts of transitional and rehabilitation care in DVA than in non-DVA nursing homes.

The strongest and most consistent predictors of subsequent use of virtually any measure of institutional health services and of death were measures of past health services use (especially hospitalizations), even after controlling for predisposing, enabling, and needs variables. This is consistent with previous studies that have applied the Andersen behavioral model in predicting health service use among elderly persons living in the community (Béland, 1988; Eve, 1988). DVA patients with multiple hospitalizations may be identified relatively easily, and they are appropriate subjects for more intensive review to discover and modify (when possible) the particular causes of recurrent hospitalizations for each individual. Previous work has suggested that such "multiply hospitalized" patients account for a highly disproportionate share of health care costs (Anderson & Steinberg, 1984) and that individually tailored interventions in this population can significantly decrease their subsequent use of health services (Eggert & Friedman, 1988).

One unexpected finding was the inverse relationship between nursing home length of stay and the risk of each of the three outcomes. Two factors may account for these findings. First, we have previously reported that brief-stay (<1 month) DVA nursing home dischargees

may represent a population of relatively brief serial users of DVA nursing homes who remain at high risk for subsequent DVA nursing home and hospital use and death (Williams, Fries, & Mehr, 1993). The detailed characteristics of this population, and reasons for their serial use of DVA nursing home and hospital services, are unclear. Second, long-stay (>6 months) nursing home patients who are discharged alive may be relatively stable, with stable support systems, as compared with other long-stay patients who die in the nursing home, and thus they are at relatively low risk of institutional admission or death.

In general, risk factors for nursing home readmission were consistent with previous studies that have examined multivariate risk factors for admission to non-DVA nursing homes among large samples of community-dwelling elders (e.g., Branch & Jette, 1982; Greene & Ondrich, 1990; Liu, Coughlin, & McBride, 1991; Shapiro & Tate, 1985; Weissert & Cready, 1989).

The finding that never being married reduced the risk of acute hospitalization was unexpected and should be verified in future studies. One possible explanation is that veterans who never married had established broader informal support systems than married or previously married persons, which proved useful in monitoring and preventing medical deterioration.

The presence of functional impairments has been consistently demonstrated to be a risk factor for nursing home admission from the community (Branch & Jette, 1982; Cohen, Tell, & Wallack, 1986; Coughlin, McBride, & Liu, 1990; Greene & Ondrich, 1990; Hanley et al., 1990; Liu, Coughlin, & McBride, 1991; Shapiro & Tate, 1985; Weissert & Cready, 1989), and in some studies for hospitalization from the community (Lubben, Weiler, & Chi, 1989). Therefore, we had expected that the relatively detailed information on impairments in eating, toileting, and transferring available in the PAF would be useful in predicting the risk of nursing home readmission. Among these measures of ADL functioning (including a summative measure of ADL impairments), however, only eating impairments were consistently associated with increased risk of nursing home readmission. Other factors responsible for the original nursing home admission may put dischargees at substantially higher risk for subsequent nursing

home admission as compared with community-dwelling elderly, thus diminishing the independent effects of functional impairments on the risk of nursing home readmission or hospitalization. That eating impairment is the sole predictive ADL further supports this view. Eating impairments usually represent the most severe form of functional impairment. The lack of a graded response to eating impairment, with partial and severe but not moderate impairment associated with nursing home readmission, is perplexing. This could represent a problem in reporting or random variation.

The lack of relationship between medical diagnoses and the risk of nursing home readmission is consistent with previous research that found few relationships between self-reported diagnoses and the risk of nursing home admission from the community (Coughlin, McBride, & Liu, 1990). Also similar to our findings, past studies have demonstrated that the risks of hospitalization or hospital readmission were related to medical status (Holloway, Medendorp, & Bromberg, 1990; Lubben, Weiler, & Chi, 1989; Wolinsky et al., 1983).

For hospitalization and death, the most useful direct measure of residents' status was the RUG-II clinical classification. This classification scheme incorporates information on both the clinical needs (e.g., wound care) and functional status of residents, and it is quantitatively correlated with the use of nursing services in the nursing home. These features may allow the RUG-II scheme to capture phenomena more directly relevant to subsequent use of hospital resources and death more adequately than other, more traditional measures of functional status (e.g., ADL impairments alone).

After accounting for independent risk factors, the risks of nursing home readmission and hospitalization were demonstrated to decrease slowly and fairly linearly with time. The risk of death was fairly constant. These findings imply that there is no particular time period after DVA nursing home discharge when "routine" or systematic patient evaluation and intervention are justified.

This study had several limitations. The first is the lack of generalizability of the findings regarding patient-specific predictors to women and to residents of non-DVA nursing homes. Nursing homes of the DVA serve a relatively young, male population with relatively

high rates of live discharge as compared with non-DVA nursing homes. (National Center for Health Statistics, 1989; Sekscenski, 1990). Available data suggest that the proportion of persons discharged alive from non-DVA nursing homes during the study period was low at around 28% (Lewis, Cretin, & Kane, 1985a), relative to DVA nursing homes (57%). With increasing use of nursing homes for subacute and transitional care, however, the proportion of live dischargees from non-DVA nursing homes is likely to increase.

The second most important limitation of the study was the lack of information on the use of non-DVA health resources by members of the DVA nursing home discharge cohort. How commonly DVA nursing home dischargees use non-DVA health facilities is unknown. This type of bias, if present, would limit the generalizability of the findings to settings outside the DVA. However, the findings reported here are likely to be valid in describing risk factors for post-nursing home health services use within the DVA under current policies.

A third limitation was the lack of information on some facility level characteristics (e.g., staffing ratios, staffing mix, case mix, and size of affiliated hospitals). Combining patient-level with facility-level characteristics may improve the capacity to predict health services utilization and death among nursing home dischargees.

Discharge planners and policymakers in the DVA may conceptualize two basic "types" of nursing home dischargees whose health services utilization is driven primarily by chronic functional impairments versus acute exacerbations of chronic medical conditions to target interventions to decrease nursing home readmission, hospitalization, and death among individuals with high-risk profiles of clinical characteristics and past health service use. The actual utility of this type of approach awaits future studies. Data that combine information on patient characteristics, medical diagnoses, and utilization of multiple types of health services in different settings and across time will undoubtedly become increasingly available within and outside the Department of Veterans Affairs. As this occurs, developing more detailed risk profiles for institutionalization and death, as well as tailored interventions to decrease potentially avoidable events among particular populations, will become increasingly feasible.

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