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A random effects multinomial logit analysis of using Medicare and VA healthcare among veterans with dementia

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Abstract

Aims—To examine longitudinal patterns of VA-only use, dual VA and Medicare use, or Medicare-only use among veterans with dementia.

Methods—Data on VA and Medicare use (1998–2001) were obtained from VA administrative datasets and Medicare claims for 2,137 male veterans with a formal diagnosis of Alzheimer's disease or vascular dementia enrolled in the National Longitudinal Caregiver Study. A random effects multinomial logit model accounting for unobserved individual heterogeneity was used to estimate the effects of patient and caregiver characteristics on use group over time.

Results—Compared to VA-only use, dual VA and Medicare use was associated with being white, married, higher education, having private insurance, Medicaid, low VA priority level, more functional limitations, and having lived in a nursing home or died in that year. Medicare-only use was associated with older age, being married, higher education, having private insurance, low VA priority level, living further from a VA Medical Center, having more comorbidities, functional limitations, and having lived in a nursing home or died. Veterans whose caregivers reported better health were more likely to be dual users, but those whose caregivers reported more comorbidities were more likely to use Medicare only.

Discussion—Different aspects of veterans' needs and caregiver characteristics have differential effect on where veterans seek care. Efforts to coordinate care between VA and Medicare providers are necessary to ensure patients receive high quality care.

Keywords

Dementia; Health services use; Medicare; Veterans; Longitudinal models

1. Introduction

The Veterans Health Administration (VHA) of the Department of Veterans Affairs (VA) is the largest integrated health care system in the US with an estimated 5.6 million users. Since nearly half (48.4%) of VHA users are 65 and older and are also eligible for Medicare, cross-system, or dual use of more than one health care delivery system to obtain care is common among veterans receiving care within the VA. (Department of Veterans Affairs October 2006) Because of its substantial health and policy implications, a number of recent studies have examined veterans' cross-system use of VA and Medicare services. (Wright, Daley et

al. 1997; Borowsky and Cowper 1999; Wright, Petersen et al. 1999; Hynes, Stroupe et al. 2002) VA Information Research Center (VIREC) reports that in 2003, among veterans enrolled in Medicare Fee For Service, 21.9% are VA-only users, 30.3% are Medicare-only users, and 42.6% are dual VA and Medicare users. (Hynes, Cowper et al. 2003) The distribution of veterans seeking care in different systems varies by medical conditions and service types. Veterans who seek care in more than one system or switch the system they choose to receive care are vulnerable to the lack of coordination of care across systems that may result in either under-use of appropriate care or excess-use of care in either or both systems.

These problems are likely to be greater for veterans with dementia because of the substantial challenges of navigating two healthcare systems while demented. As dementia worsens, much of this challenge is borne by the caregivers of the patients with dementia. We therefore hypothesize that both patient and caregiver characteristics affect the choice of where the veteran receives care. In the VA, there are currently 175,621 patients who have a dementia diagnosis, with the number expected to peak at 218,017 in 2017. (Geriatrics and Extended Care Services, Office of Patient Care Services et al. September 2008) Although high health services utilization by patients with dementia is well-documented, most studies have focused on Medicare use; few have examined VA use. (Guterman, Markowitz et al. 1999; Taylor and Sloan 2000; Yu, Ravelo et al. 2003; Bynum, Rabins et al. 2004; Office of Geriatrics and Extended Care and VA Central Office 2004) To date, no research has systematically examined factors associated with using VA and Medicare services by veterans with dementia. Methodologically, most studies on dual-system use have been cross-sectional or repeated cross-sectional. (Wright, Petersen et al. 1999; Weeks, Bott et al. 2005) Consequently, we do not know whether and how patterns of dual use change over time.

Our objectives for this study, therefore, are to examine, over time, patient and caregiver characteristics that are associated with VA-only use, dual VA and Medicare use, or Medicare-only use for patients with dementia. Survey data from a national sample of informal caregivers of elderly veterans clinically diagnosed with Alzheimer's disease or vascular dementia in the VA are combined with data from VA and Medicare administrative files will be used for the analysis.

2. Methods

2.1. Conceptual Framework

We derive our conceptual framework from the random utility model originally developed by McFadden. (McFadden 1974) We assume that at each time period a veteran chooses a care setting (VA-only, Medicare-only, and both VA and Medicare) that maximizes expected lifetime utility. These three care settings are associated with different levels of medical care provisions.

Specifically, let a veteran's utility of choosing a care setting j ($j = 1, 2, 3$ representing VA-only use, Medicare-only use, and dual VA and Medicare use) be $U_j(M, C, X)$, where M is medical care received, C is consumption of all other goods and services, and X is a set of individual specific characteristics. The veteran's objective is to choose M and C at each time period t in order to maximize expected lifetime utility subject to his budget constraint. Formally, the veteran's optimization problem is

$$\begin{aligned} & \text{Max } E_t \sum_{t=0}^T \delta U(M_t, C_t, X_t) \\ & \text{subject to} \\ & P_t M_t + C_t = Y_t, \end{aligned}$$

assuming that the price for consumption is numeraire, the price at time t for medical care is P_t , income is Y_t , and δ is the discount factor.

The indirect utility for care setting j at time t can be written as $V_{jt}(P, Y, X)$. A veteran chooses care setting j if and only if $V_{jt}(P, Y, X) > V_{kt}(P, Y, X) \forall k \neq j$.

2.2. Random Effects Multinomial Logit Model

In a cross-sectional setting, the empirical estimation for the optimization problem can be performed using the multinomial logit model in which the indirect utility function is specified as $V_{ijt} = \alpha_j + X_{it} \beta_j + \varepsilon_{ij}$, where α_j represents the specific constant terms of care setting j , and X_{it} a set of individual specific characteristics. (McFadden 1974) When ε_{ij} is assumed to be independently and identically distributed as a type I extreme value distribution, the probability of a veteran choosing a care setting j is given by the familiar expression

$$P_{ij} = \frac{\exp(\alpha_j + X_{it} \beta_j)}{\sum_{k=1}^J \exp(\alpha_k + X_{it} \beta_k)}, \quad j=1, 2, 3.$$

However, in longitudinal data where there are multiple observations for the same individual, unobserved individual heterogeneity is likely to be present. We model the correlated errors that likely arise through a set of random effects by specifying the indirect utility function as $V_{ijt} = \alpha_j + u_{ij} + X_{it} \beta_j + \varepsilon_{ij}$, where u_{ij} represents the unobserved individual random heterogeneity term. (Gonul and Srinivasan 1993; Revelt and Train 1998; Hartzel, Agresti et al. 2001) In this random effects multinomial logit model, the probability of a veteran choosing a care setting j is

$$P_{ijt} = \frac{\exp(\alpha_j + u_{ij} + X_{it} \beta_j)}{\sum_{k=1}^J \exp(\alpha_k + u_{ik} + X_{it} \beta_k)}, \quad j=1, 2, 3.$$

Assume the individual specific random effects are the same in every period and are uncorrelated and independent across periods. Conditional on unobserved factors, the observations from the i^{th} individual are assumed to be independent.

It is well known that the multinomial logit model depends on the assumption of Independence of Irrelevant Alternatives (IIA), which holds conditionally on all covariates and random errors, although it has been shown that the multinomial logistic regression model is relatively robust in many cases in which this assumption is implausible. (McFadden 1980) Because IIA does not hold marginally with respect to the random errors,

the inclusion of random terms in the estimation model partially relaxes the IIA property. (Grilli and Rampichini 2007)

We estimated the model using the SAS NLMIXED procedure. For the random intercepts u_{ij} we assume a multivariate normal distribution with zero expectation to induce a covariance structure of compound symmetry for repeated measures on individuals. The inclusion of the random intercept has been shown to provide a reasonable fit for many applied problems. (Van Ness, O'Leary et al. 2004) For model identification, we normalized the coefficients to the reference alternative (VA-only) to zero. Therefore, all results are interpreted in relation to this care setting.

2.3. Sample and Data

The sample was drawn from the National Longitudinal Caregiver Study (NLCS), a national investigation of informal caregivers of elderly veterans clinically diagnosed with Alzheimer's disease (AD, ICD-9 331.0) or vascular dementia (VAD, ICD-9 290.4) in the VA. The inclusion and exclusion criteria are fully described elsewhere. (Moore, Zhu et al. 2001; Zhu, Moore et al. 2003) The NLCS dementia patient/caregiver dyads were followed annually with mail surveys for up to three years (1998–2001).

For the purposes of this study, we excluded (1) 132 veterans younger than 65 at the beginning of the study to ensure Medicare eligibility during the entire study period; (2) 8 veterans who did not have any VA or Medicare utilization data any time during the study period; and (3) 120 veterans who primarily used the VA for pharmacy services because they have been shown to be less severely ill than other VA patients (Zhu, Gardner et al. 2004). At baseline, the analysis sample consists of 2,137 veterans. Because of patient deaths, the sample size for each succeeding year was 1,992 in 1999, 1,633 in 2000, and 1,300 in 2001. The analysis sample therefore consists of 7,062 observations.

To determine where veterans received their health care, we merged several sources of VA and Medicare data. We used the VA Inpatient and Outpatient Medical SAS Datasets to identify information on VA utilization. (Hynes, Joseph et al. 2002) The Medical SAS Datasets contain patient-level records of utilization and full diagnostic and procedural information for each encounter. We used Medicare Standard Analytic Files (SAFs), a set of public access files that contain demographic, utilization, and expenditure data at the individual level, to identify Medicare services and costs. The following SAFs were used in our analyses: inpatient, skilled nursing facility, outpatient, home health agency, carrier (physician/supplier), hospice, durable medical equipment, and Medicare Provider Analysis and Review (MedPar) files. VA data are stored by federal fiscal year whereas Medicare data are stored by calendar year. We aligned VA and Medicare services use and costs into calendar year summaries using information on dates of service to make these different timeframes compatible.

The study was approved by the James J. Peters VA Medical Center (VAMC) Institutional Review Board.

2.4. Veterans Integrated Service Networks

Until the mid-1990s, the VA operated largely as a hospital system providing general medical and surgical services through relatively independently operated medical centers and other facilities. In 1995, the VA launched a major reengineering of its healthcare system with aims that included better use of information technology, measurement and reporting of performance, and integration of services and realigned payment policies, in order to improve quality of care. (Kizer, Demakis et al. 2000) To this end, the VHA was restructured into 22 Veterans Integrated Service Networks (VISNs) throughout the US (2 VISNs has since

merged in 2002 to form the current 21 VISNs). (Department of Veterans Affairs) Each VISN consists of a geographic area which was developed based on historical patient referral patterns, aggregations of VA assets sufficient to provide a continuum of primary, secondary, and tertiary care, and, to a lesser degree, existing jurisdictional boundaries such as state and county borders. Instead of individual medical centers, the VISN became a basic budgetary and planning unit within the VA healthcare system. The medical centers, as do community-based outpatient clinics, long-term care facilities, domiciliaries, veterans' counseling centers, and home-care programs now belong to one of the 21 VISNs. The entire VA healthcare system now comprises of approximately 1,300 sites of care delivery, including 173 medical centers, 550 outpatient and community-based outpatient clinics, 133 nursing homes, 40 domiciliaries, 75 home care programs, 206 counseling centers, and various contract programs which these networks manage.

2.5. Measures

Dependent Variable—Based on the annualized VA and Medicare inpatient and outpatient utilization data, patients were classified each year into three groups: (1) VA-only, (2) Medicare-only, and (3) dual VA and Medicare use.

Independent Variables—We examined the following independent variables using the conceptual framework developed in Andersen's Behavioral Model of Health Services Use and from existing literature on health services use among veterans. (Burgess and DeFiore 1994; General Accounting Office 1994; General Accounting Office 1999; Mooney, Zwanziger et al. 2000; Hynes, Cowper et al. 2003; Shen, Hendricks et al. 2003; Weeks, Bott et al. 2005; Hynes, Koelling et al. 2007) Predisposing characteristics included age, race (White, Black, and other), education (less than high school, high school graduate, some college, college graduate or above), and marital status (married, widowed, other), all of which were reported by the caregivers in the NLCS. Enabling resources included having other health insurance (private insurance, Medicaid), geographic access to the VA, and VA priority level. We measured geographic access to the VA using a straight line distance between the location of the nearest VAMC and the centroid of the zip code of the veteran's residence. (Department of Veterans Affairs and Veterans Health Administration Office of the Under Secretary for Health for Policy and Planning 2002) Following previous studies (General Accounting Office 1999; Hynes, Koelling et al. 2007), VA priority level was defined as a dichotomous variable indicating high priority (VA priority levels 1–6) or low priority (VA priority levels 7–8). Veterans with high priority included those who had a service-connected disability or whose income was less than a VA defined annual income threshold and have no copay for services. Veterans with low priority included those whose income was higher than the income threshold and who agreed to pay specified copay for services. Characteristics that measure individuals' need for services included comorbidities and functional impairment. Patients' comorbidities were measured by a modified Older Americans Resources and Services (OARS) comorbidity scale reported by the caregivers in the NLCS. (Fillenbaum 1988) Although diagnoses information is available in both VA and Medicare data files, we did not use these because of the likely presence of coding variations between the two systems. Patients' functional impairment was measured by the number of activities of daily living (ADL) impairments reported by the caregivers, (Katz, Ford et al. 1963; Nagi 1976) including difficulty with walking several blocks, climbing a flight of stairs, dressing, walking across a room, bathing, eating, getting in and out of bed, using the toilet, managing money, and taking medicine. We also included dichotomous variables indicating whether the veteran was admitted to a nursing home or died in a study year. Caregiver characteristics included gender, age, education, self-rated health (excellent, good, fair, and poor), number of comorbidities, and caregiver/patient relationship (spouse, adult

child, other relationships). In addition, we included indicators for year as fixed effects to control for trends over time in veterans choice of where to obtain care.

3. Results

3.1. Sample Characteristics over Time

Table 1 reports descriptive characteristics of the sample. At baseline, the average patient was 77 years old, white, married, and had 11 years of schooling. In addition to receiving VA care in the prior year and being eligible for Medicare, 21.9% of the patients also had private insurance, and 7.4% had Medicaid. The majority of the patients were in the high VA priority group (91.7%). Almost two-thirds (62%) of the patients had ADL limitations, with an average of three out of seven ADL limitations. Patients had an average of five comorbidities, with depression, anxiety or emotional problems (64.3%), arthritis (53.4%), and hypertension (48.3%) being the most prevalent. The caregivers are mostly wives (85.3%) and daughters of the veterans with dementia, with a high school education. The caregivers reported fewer than 1 comorbid conditions (mean=0.8, sd=1.2), but the majority rated their health as good (44.8%) or fair (37.6%). Compared to those who died during the study period, those who survived were younger, more likely to be married, less functionally limited, and less likely to have lived in a nursing home during the year.

During the four-year study period, while the proportion of dual users remained relatively stable, the proportion of Medicare-only users increased, and the proportion of VA-only users declined. In 1998 (NLCS baseline), almost all patients were VA users: 41.7% were VA-only users, 55.4% were dual users, only 2.9% were Medicare-only users. By the end of the four-year period, 30.4% were VA-only users, 51.5% were dual users, and 18.1% were Medicare-only users. The distribution of use group did not differ between those who survived during the study period and those who died.

3.2. Random Effects Multinomial Logit Regression Results of the Effects of Patient Characteristics on Use Group over Time

Table 2 presents random effects multinomial logit regression results of the effects of patient characteristics on use group over time. The log-likelihood value from the pooled multinomial logit regression is presented at the bottom of Table 2 for comparison purposes. Results suggest that the random effects multinomial logit regression improved model fit considerably. The standard deviations of the random coefficients are statistically significant and suggest substantial variation between individuals in their choices of where to obtain care.

Results show that compared to VA-only use, the probability of dual use was higher for veterans who had private insurance (OR=3.04, $p<.01$), Medicaid (OR=1.23, $p<.05$), and who had low VA priority level (OR=1.62, $p<.001$). The probability of dual use also was higher for veterans with more ADL limitations (OR=1.179, $p<.001$), who lived in a nursing home during the year (OR=1.909, $p<.001$) or died (OR=2.460, $p<.001$). Veterans who were white, married, and have higher education more likely to be dual users (OR=.798, $p<.10$). Veterans whose caregivers reported better self-rated health were more likely to be dual users (OR=1.60, 1.52, 1.44 for excellent, good, and fair self rated health as compared to those with poor self rated health, all $p<0.05$). There is a trend toward higher probability of dual use during the study period but the effects were only marginal.

Results in Table 2 also show that compared to VA-only use, the probability of Medicare-only use was higher for veterans who were older (OR=1.08, $p<.001$), married (OR=3.86, $p<.05$) and those with higher education (OR=1.15, $p<0.01$). Not surprisingly, low VA priority level was by far the strongest predictor of Medicare-only use, increasing its probability by

almost 7 fold ($p<.001$). Distance from the nearest VAMC also increased the probability of using only Medicare ($OR=1.03$, $p<.001$). Having private insurance increased the probability of Medicare-only use ($OR=5.70$, $p<.001$). In terms of veterans' health, those with more ADL limitations ($OR=1.178$, $p<.001$), who lived in a nursing home during the year ($OR=2.634$, $p<.001$) or died ($OR=3.227$, $p<.001$) were more likely to use Medicare only, but those with more comorbidities were less likely to use Medicare only ($OR=0.881$, $p<.001$). In addition, veterans whose caregiver had higher comorbidities were more likely to use Medicare only ($OR=1.14$, $p<0.05$). After controlling for veterans' characteristics, there remains a strong trend toward Medicare-only use during the study period.

4. Discussion

In this study we examined the effects of veteran characteristics on their choice of care settings. Results from this analysis show that enabling resources and veterans' needs for services are strongly associated with in which system veterans seek care. In particular, one of the strongest predictors of dual use and Medicare-only use as compared to VA-only use was veterans' VA priority level. Living further away from a VA medical center also increased the probability of using Medicare only. This suggests that demand for care in one system may be affected by changes in another system. It is interesting to note that compared to VA-only use, having private insurance increases the likelihood of dual use as well as Medicare-only use, while having Medicaid increases the likelihood of dual use but decreases an individual's likelihood of Medicare-only use. It is possible that these insurance variables are a proxy measure of the veteran's social economic status, for which our analyses that are restricted to variables available in administrative datasets did not include.

Compared to the VA-only group, veterans with higher number of functional limitations, who lived in a nursing home or died during a study year were more likely to be dual users or Medicare-only users, suggesting decreased VA reliance for those who are sicker and more functional impaired. The strong relationship between these needs variables and the higher likelihood of dual use suggests that efforts to coordinate care between VA and Medicare providers are necessary to ensure patients receive high quality care. On the other hand, compared to the VA-only group, number of comorbidities had the opposite effect and was associated with decreased probability of Medicare-only use. While the reasons for the differences in the effect of comorbidities and functional limitations on use group are unclear, results suggest that different aspects of veterans' needs have differential effect on where veterans seek care. In this study veterans' comorbidities were reported by the caregivers in the NLCS. Future research will explore the diagnoses information available in both VA and Medicare data files to examine extent to which the two systems are capturing unique diagnoses or diagnoses overlap and how individuals are using the two systems of healthcare.

Results from this study also suggest that where the veterans receive care are associated with characteristics of the caregivers of the veterans with dementia. In particular, compared to caregivers who reported poor self rated health, veterans whose caregivers reported better self-rated health were more likely to be dual users, but veterans whose caregiver had more comorbidities were more likely to use Medicare only. The results suggest that caregivers whose own health is poor may have difficulty dealing with the challenges of navigating multiple healthcare systems and suggest unmet service needs of these caregivers. We controlled for the amount of informal care the veterans received in our multivariate analyses, but the effects of the amount of informal care the veterans received on where the veteran received formal health care were statistically insignificant. Future research will examine in more detailed the effects of caregiver characteristics on where veterans receive care.

There are several limitations of the study. First, as mentioned before, because our study sample was drawn from elderly US veterans with dementia who had used VA services during the year prior to study enrollment, our sample may not be representative of all veterans with dementia who were eligible for both Medicare and VA services. A study that compared the characteristics of VA users and veterans who did not use VA services showed VA users were older, less educated, and in poorer health. (Liu, Maciejewski et al. 2005) Our sample of previous VA users therefore provides insights into patterns of healthcare use among a more vulnerable segment of veterans with dementia. Starting from a sample of VA users also is relevant to VA administrators as they consider budget and resources plans. Second, in this study we examined overall patterns of VA and Medicare services use. Use of specific types of VA and Medicare services may be different from overall patterns. Our future work will examine how patients use specific types of services over time in more detail. Third, there have been important secular changes in both VA eligibility criteria and Medicare reimbursement policies since our study. For example, Medicare Part D may have changed the context for dual VA-Medicare use in recent years. Future studies that examine VA-Medicare use will take these policies changes into account.

This is the first study that examined longitudinally patterns of use of VA and Medicare services for veterans with dementia. For planning purposes, it is important for healthcare systems to know prospectively where their patients will likely be seeking care. There also may be quality of care implications for knowing where patients seek healthcare if misallocation of resources leads to reductions or eliminations of services. More importantly, for patients with dementia and other chronic conditions, coordinated efforts between the VA and Medicare are necessary to ensure patients receive high quality care.

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Table 1

Characteristics by Use Group at Baseline (n=2,137).

Variables	
Use Group (%)	
VA-only	41.7
Dual use	55.4
Medicare-only	2.9
Veteran Characteristics	
Age, mean (sd)	77.0 (5.4)
Race (%)	
White	80.8
Black	13.7
Other	5.5
Years of schooling, mean (sd)	11.0 (3.5)
Marital status (%)	
Married	87.8
Widowed	7.6
Other	4.6
Health insurance (%)	
Private	21.9
Medicaid	7.4
VA Priority group, (%)	
1–3	39.0
4–6	52.7
7–8	8.4
Distance to nearest VAMC, miles (sd)	32.7 (34.8)
Died (%)	6.8
Lived in nursing home (%)	7.2
Number of comorbidities, mean (sd)	5.3 (2.9)
Number of ADL limitations, mean (sd)	2.8 (2.6)
Caregiver Characteristics	
Female (%)	97.6
Age, mean (sd)	67.9 (10.4)
Years of Schooling Completed, mean (sd)	12.0 (2.7)
Relationship to veteran (%)	
Spouse	85.3
Child	9.2
Other	5.5
Self rated health (%)	
Excellent	9.7
Good	44.8
Fair	37.6

Poor	7.9
Number of Comorbidities, mean (sd)	0.8 (1.2)

Table 2

Random Effects Multinomial Logit Regression Results of the Effects of Patient Characteristics on Use Group Over Time.

Variables	Dual Use ^a		Medicare Only ^a	
	Odds Ratio	s.e.	Odds Ratio	s.e.
<u>Predisposing Characteristics</u>				
Age	1.005	(0.008)	1.080	(0.023) ***
White	1.368	(0.132) ***	1.375	(0.459)
Married	1.886	(0.582) **	3.855	(2.565) **
Years of Schooling Completed	1.033	(0.012) ***	1.153	(0.038) ***
<u>Enabling Resources</u>				
Have Private Insurance	3.043	(0.288) ***	5.701	(1.221) ***
Have Medicaid	1.234	(0.172) **	1.536	(0.591)
Low VA priority Level	1.623	(0.233) ***	6.567	(1.607) ***
Distance to the Nearest VAMC	1.003	(0.001)	1.034	(0.003) ***
<u>Need for Services</u>				
Number of Comorbidities	1.013	(0.013)	0.881	(0.034) ***
Lived in a Nursing Home in the Year	1.909	(0.291) ***	2.634	(0.836) ***
Died in the Year	2.460	(0.442) ***	3.227	(1.165) ***
Number of ADL limitations	1.179	(0.023) ***	1.178	(0.068) ***
<u>Caregiver Characteristics</u>				
Female	1.274	(0.359)	0.951	(0.634)
Age	1.013	(0.006) **	0.998	(0.017)
Years of Schooling Completed	0.989	(0.015)	0.941	(0.039)
Relationship to care recipient (reference=spouse)				
Child	1.098	(0.726)	1.089	(0.540)
Other	1.583	(0.610)	3.012	(3.071)
Self rated health (reference = poor)				
Fair	1.444	(0.189) ***	0.844	(0.278)
Good	1.523	(0.206) ***	1.244	(0.427)
Excellent	1.600	(0.291) ***	1.881	(0.892)
Number of Comorbidities	0.998	(0.026)	1.141	(0.077) *
<u>Year Indicators</u>				
1999	1.188	(0.097)	1.884	(0.296) *
2000	1.213	(0.113)	1.88	(0.333) ***
2001	1.604	(0.128) *	3.675	(0.370) ***

^aReference group = VA only

*, **, *** significant at 0.10, 0.05, and 0.01 levels, respectively.