Prevalence and Costs of Chronic Conditions in the VA Health Care System

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Chronic conditions are among the most common causes of death and disability in the United States. Patients with such conditions receive disproportionate amounts of health care services and therefore cost more per capita than the average patient. This study assesses the prevalence among the Department of Veterans Affairs (VA) health care users and VA expenditures (costs) of 29 common chronic conditions. The authors used regression to identify the marginal impact of these conditions on total, inpatient, outpatient, and pharmacy costs. Excluding costs of contracted medical services at non-VA facilities, total VA health care expenditures in fiscal year 1999 (FY1999) were $14.3 billion. Among the 3.4 million VA patients in FY1999, 72 percent had 1 or more of the 29 chronic conditions, and these patients accounted for 96 percent of the total costs ($13.7 billion). In addition, 35 percent (1.2 million) of VA health care users had 3 or more of the 29 chronic conditions. These individuals accounted for 73 percent of the total cost. Overall, VA health care users have more chronic diseases than the general population.

Keywords: *cost; economic; chronic disease; veterans; mental health*

Rising health care costs and limited financial resources have motivated health care providers to better understand the patient populations they serve and the costs associated with the medical services they provide. Chronic conditions are among the largest causes of death and disability in the United States (Murray and Lopez 1996) and therefore account for disproportionate health care utilization and cost (Hoffman, Rice, and Sung 1996). Consequently, such conditions have become the focus of study for health systems desiring a more cost-efficient and cost-effective way to provide medical care to their patients.

Previous research into the prevalence and cost of chronic diseases is usually focused on individual conditions. Several cost estimates have been reported for individual chronic conditions, such as diabetes (American Diabetes Association 1998; Amin et al. 1999; Gilmer et al. 1997; Leese 1992; Selby et al. 1997; Simell et al. 1996), chronic obstructive pulmonary disease (COPD) (Strassels 1999; Strauss et al. 1986; Strassels et al. 2001; Ruchlin and Dasbach 2001; Mapel et al. 2000; Friedman and Hilleman 2001), hypertension (Jacobs 1998; Stason 1989), heart disease (Guico-Pabia et al. 2001; Wittels, Hay, and Gotto 1990), cancer (Leake 1995; Taplin et al. 1995), depression (Simon, VonKorff, and Barlow 1995), and Alzheimer's disease (Weiner et al. 1998).

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Few studies have provided systematic cost estimates for a number of common chronic conditions on a large patient population within an integrated health care system. Group Health Cooperative of Puget Sound and Kaiser Permanente are two staff-model managed care organizations that have each estimated the annual costs of a select set of chronic diseases for their system (Fishman et al. 1997; Ray et al. 2000). These previous studies are limited by the fact that most Group Health Cooperative and Kaiser Permanente enrollees are employed or covered by Medicare. Hence, results from these studies lack information on services that are not covered by private insurance or Medicare (e.g., long-term care). In addition, enrollees have different benefit packages and face different copayments. These differences affect the demand for services and subsequently the relative cost of care for the disease category. Unlike Group Health Cooperative and Kaiser Permanente enrollees, veterans who enroll in the Veterans Health Administration (VA) have a uniform set of health care financing benefits. While it provides medical-surgical and outpatient care, which is similar to Group Health Cooperative and Kaiser Permanente, the VA also offers many other services, including specialized mental health, long-term care, rehabilitation, domiciliary care, and pharmacy benefits. For many of these services, VA is the largest provider in the nation. Therefore, assessing the cost of chronic conditions in the VA provides unique insights into how these conditions affect overall health care costs.

NEW CONTRIBUTION

The VA operates one of the largest integrated health care systems in the United States, providing health care services to more than 3 million veterans in fiscal year (FY) 1999. In addition to having a unique patient population, VA offers more comprehensive health care benefits than Medicare, many managed care plans, or other private health insurance programs. Prescription drug benefits, long-term care, and special programs for substance abuse and mental health are some of these additional VA medical benefits. This study provides the first systematic and comprehensive analysis on prevalence of and expenditures for chronic conditions in the VA. The findings provided by our study should be useful in informing policy makers and providers about resource utilization of patients with chronic diseases, in determining budget allocations to adequately meet projected future costs, and in setting priorities for areas most in need of further research.

METHOD

DATA

This study used data from the VA Patient Treatment File (PTF) and Outpatient Event File (SE) for FY1999, the most recently available files at the time the analysis was conducted (Murphy et al. 2002; Hynes, Joseph, and Pfeil 2002). PTF recorded all inpatient care provided by the VA Health Care System, including acute and long-term hospitalizations, nursing home stays, and residential programs. The Events File contained every encounter to a VA clinic, including primary care and specialty clinics. To calculate the prevalence and unadjusted costs of selected chronic conditions, we included every person recorded in these two files (N = 3,408,760).

Because of the large sample size, we randomly selected a 20 percent sample of this population for a multivariate analysis on costs attributable to each chronic condition. The subsample was identified using the RANUNI function in SAS. Since new patients may have partial health care utilization during the year, we excluded patients who were not in the VA system in the previous year (81,770). The final sample for regression analysis has 599,975 patients. We compared the prevalence and average costs per disease of the regression sample with the study population. We obtained race/ethnicity, marital status, military service–related disability, and low-income eligibility from the outpatient event file, and patient mortality within FY1999 from the VA's Beneficiary Information and Records Locator Subsystem (BIRLS). The BIRLS file is updated daily in real time.

SELECTION OF CHRONIC CONDITIONS

We selected 29 common chronic conditions based on prior studies (Ray et al. 2000; Fishman et al. 1997), designated research areas for VA (Office of Research and Development 1998), and VA quality enhancement programs (the QUERI initiative; Demakis et al. 2000). Because VA is a major provider of mental health and substance abuse care, we further divided these into eight and five categories, respectively (see Table 1 for complete listing of 29 conditions plus subcategories).

CHRONIC DISEASE IDENTIFICATION AND CLASSIFICATION

We identified patients with the chosen chronic conditions using ICD-9 diagnoses recorded in the inpatient PTF and outpatient event files in FY1999. Both files contain up to 10 ICD-9 diagnostic codes for each admission or

TABLE 1 Number of Chronic Conditions among Veterans Affairs (VA) Patients

Number of Conditions	*Persons with Condition*	*% of Total Population*	*Mean Age*	*Average Total Cost ($) per Person*	*% of Total Costs to VA System*
No conditions	958,921	28	51	648	4
1 or more conditions	2,449,839	72	60	5,833	96
1 condition	678,512	20	57	1,995	9
2 conditions	591,599	17	61	3,366	13
3 or more conditions	1,179,728	35	62	9,277	73

encounter. We reviewed the classification methods from the Kaiser Permanente (KP) study (Ray et al. 2000) and other published studies (Peterson et al. 1994; Deyo, Cherkin, and Ciol 1992). We compared these classification methods with the Clinical Classifications Software (CCS) developed by the Agency for Healthcare Research and Quality (2000). CCS, a classification system developed by a panel of physicians, allocates all ICD-9 codes into broad medical conditions. Because the CCS has to exhaust all ICD-9 codes, some codes that do not clearly identify a disease have to be classified into a broad group. Therefore, the classification methods used by KP and other studies are generally more conservative in disease classification than CCS.

When selecting ICD-9 codes to identify a disease, we conducted a sensitivity analysis when the classification methods differ between the CCS and the published studies. In general, CCS has more inclusive criteria than KP and published VA studies. For most of the 29 conditions in our study, using CCS increased the number of patients by approximately 1 percent or less. In these cases, we chose to be conservative and to follow the KP system along with the published VA literature. For the medical conditions where CCS had a discrepancy of 1 percent or larger from the other methods, physicians reviewed these codes. Diagnostic codes that did not clearly specify a chronic condition were excluded. For example, CCS includes ICD-9 code 490 (bronchitis) in COPD. However, code 490 does not distinguish between acute or chronic. In contrast, the KP classification system excluded code 490 from COPD for this reason. Thus, for COPD, we followed the more conservative classification method.

We used all of the diagnostic codes in the inpatient and outpatient files to identify patients with each chronic condition. For most conditions, we used a single diagnosis to classify a patient. Patients with both asthma and COPD diagnoses were classified as asthma only. For depression, we required two or more outpatient diagnoses or a single diagnosis from a psychiatric clinic.

Thus, all VA patients using care during FY1999 were associated with chronic conditions that were coded during one or more inpatient stays or outpatient encounters. The diagnoses and specific codes used to identify each condition are available on request from the authors.

DETERMINATION OF MEDICAL CARE COST

We estimated annual costs of medical care incurred by VA for FY1999 (1 October 1998 through 30 September 1999). The costs were grouped for inpatient, outpatient, and outpatient pharmacy services. Inpatient care included medical/surgical stays, rehabilitation, specialty mental health, and long-term hospitalizations (i.e., intermediate medicine, domiciliary, and nursing home care). Outpatient care included all health care services provided at VA outpatient clinics. For inpatient stays that spanned fiscal years (i.e., stays with admission dates before 1 October 1998 or discharge dates after 30 September 1999), we allocated total inpatient cost proportional to the number of days that occurred within FY1999. All estimated expenditures were in 1999 dollars.

Inpatient and outpatient costs were obtained from the average cost database developed by the VA Health Economics Resource Center (HERC). For medical and surgical hospitalizations, costs were allocated to each hospital stay using a relative weight developed from a cost regression based on Medicare's Diagnostic Related Group (DRG) relative value weight and length of stay (Wagner, Chen, and Barnett 2003). Nursing home costs were adjusted for acuity by the Resource Utilization Group (RUG) II measure (Yu et al. 2003). For inpatient rehabilitation and mental health care, a simple per diem cost was calculated (Yu et al. 2003). Outpatient health care costs were based on the Current Procedural Terminology (CPT) codes recorded in the database. HERC developed relative weights for all the CPT codes recorded in the VA database (Phibbs et al. 2003). The relative weights were primarily based on: Medicare Resource Based Relative Value Unit (RVRBS) (Hsiao et al. 1992), Relative Value Units developed by the Ingenix Corporation (2000), the 1999 survey of the American Dental Association (2000), Wasserman's (2000) dental fee schedule, and the payments allowed by the California Workmen's Compensation System (State of California 1999). These relative weights were used to allocate VA outpatient costs to each encounter (Wagner, Chen, and Barnett 2003; Phibbs et al. 2003; Yu et al. 2003).

Costs for outpatient pharmacy were obtained from the 1999 VA Decision Support System (DSS) national extract. DSS extracted costs from the VA accounting system and allocated them to direct service departments (e.g., outpatient pharmacy clinic). Overhead costs were distributed to each direct service department. The overhead costs were further allocated to department

products based on volume and on relative value units in resource use (Yu et al. 2003). Because FY1999 was the 1st year for the DSS pharmacy national extract, we observed unrealistic outliers caused by errors in data entry (e.g., using gram for milligram). We also found that most of the outliers were in three facilities. Therefore, we replaced outpatient pharmacy costs for patients in these three facilities by national averages. Because the rest of the outliers accounted for only 0.1 percent of the total records, we included them in the calculation of average costs for the entire population. Such outliers can significantly affect regression coefficients, however. Consequently, we used the Winsorizing transformation for the regression sample. This transformation replaces the extremes by the next value counting inwards from the extremes (Barnett and Lewis 1994). We Winsorized 0.1 percent, approximately 600 of the most expensive records, of the outpatient pharmacy data in the sample.

We calculated average annual costs per person for all 3.4 million patients whether they had any of the 29 chronic conditions. Because a person could have multiple chronic conditions, the 29 groups are not mutually exclusive. Therefore, the sum of costs of the 29 conditions do not equal the total costs for people with the 29 conditions. The unadjusted costs for each chronic condition group also included costs of health care for other medical conditions. In addition to total annual cost per person, we examined inpatient medical/surgical, other inpatient, outpatient, and outpatient pharmacy costs for people with each of the 29 chronic conditions. We summarized costs for patients with zero, 1, 2, and 3 or more chronic conditions. These findings are displayed in Table 1 and discussed below.

For those who died during the year, we reported actual costs. On average, decedents had 6 months of health care use. We did not adjust their costs to 12 months for two major reasons. First, health care costs accelerate rapidly during the final months of life (Garber, MaCurdy, and McClellan 1998). Expanding these costs to 12 months would substantially overestimate annual costs. Second, for a population, reporting actual annual costs for each disease reflects the fact that some patients die during any year. Although adjusting costs for partial use of health care during the year might be more accurate at the patient level, the adjusted average cost of a disease for a population would always overestimate actual average costs of the population in any year.

REGRESSION ANALYSIS

Using a 20 percent random sample of the patients (n = 599,975), we regressed total annual costs on patient descriptors of: age, gender, race, service-related disability, low-income eligibility, and the 29 chronic conditions. Interactions between age and chronic conditions were also included in

the regression. We used age as a continuous variable in the final model because the relationship between age and costs was approximately linear in preliminary analyses. Other independent variables were treated as dichotomous. All independent variables were expressed as deviations from their respective means so that the constant term was equal to the sample means. Substituting independent variables with their deviations from the mean, however, would not change the value of the estimated coefficients in the regression. In addition to examining total costs, we assessed inpatient, outpatient, and outpatient pharmacy costs in separate regression models with the same independent variables.

Skewed distribution, heteroscedasticity, and retransformation problems in health care expenditure models have been well recognized by health services researchers (Duan 1983; Manning 1998; Manning and Mullahy 2001). We examined three models: (1) an OLS regression with robust error estimation and raw costs as the dependent variable, (2) a semilog regression where costs were transformed by a natural logarithm function and retransformed with the smearing estimator (Duan 1983), and (3) a generalized linear model (GLM) with gamma distribution and natural logarithm as the link function. The functional form of the GLM model was identified using the modified Park test recommended by Manning and Mullahy (2001). The results, however, showed that both the smearing semilog and the GLM models predicted substantially worse than the OLS model in mean costs for each of the chosen chronic diseases. The modeling analysis suggested that a model of exponential form, either indirectly through a semilog transformation or directly through a GLM modeling with logarithmic link, did not fit these data appropriately. One possible reason was that an exponential function reflected multiplicative impact of a chronic condition on costs. As discussed by Ray et al (2000), there was no compelling theoretical reason why the cost impact of having a chronic disease should be multiplicative rather than additive. Also, except for age, all of the independent variables were dichotomous, which might be inappropriate to fit into an exponential model. Therefore, we used the OLS model with robust error estimation to examine costs attributable to each chronic condition.

RESULTS

SAMPLE CHARACTERISTICS

For FY1999, 3,403,757 people used the VA health care system. The average age of this population was 58 years and 90 percent were male. Three percent of this population died within the fiscal year. Death rates were substantially

above this VA average for patients with lung cancer (34 percent), renal failure (18 percent), Alzheimer's disease (17 percent), dementia (15 percent), and congestive heart failure (13 percent). Forty percent of all patients were single (unmarried), 46 percent were in the VA's low-income category, and 35 percent had a service-related disability, indicating reduced copayments for care. Among the 3.4 million patients, 11 percent were African American and 4 percent were Hispanic, according to the medical records.

The regression sample had 599,975 persons. Because we excluded patients who did not have any records in the previous year, the total average cost was slightly higher in the regression sample ($4,937 vs. $4,381). The sample contains a higher proportion of veterans with service-related disabilities than the entire population (41 percent vs. 35 percent). The average age of the regression sample was 59 years and 91 percent of them were male. Other demographics were similar for the regression sample and the entire study population.

PREVALENCE AND COSTS

The number of patients with chronic conditions and their health care costs are summarized in Table 1. Among the 3.4 million VA patients, 72 percent (2.45 million) had one or more conditions, and 35 percent had three or more. Excluding costs of contract medical services provided at non-VA facilities, VA health care expenditures totaled $14.3 billion in FY1999. The 72 percent of patients with common chronic diseases accounted for 96 percent ($13.7 billion) of these total expenditures. Furthermore, the 1.2 million patients with three or more chronic conditions were intensive users of the VA health care system, accounting for 73 percent of the total cost.

Prevalence of chronic conditions and unadjusted average annual costs per person are tabulated for each of the 29 condition groups in Table 2. The unadjusted cost is the total health care cost for people who have that chronic condition, including costs of treating other medical conditions. The most common chronic disease was hypertension, which was present in nearly 1.3 million people, or 37 percent of VA patients in FY1999. The most expensive conditions were the result of spinal cord injury ($26,735 per person per year) and renal failure ($22,656 per person per year), but the patterns of resource use differ between the two conditions. Medical/surgical hospitalizations accounted for most of the costs for renal failure patients, whereas long-term care hospitalizations accounted for most of the costs for spinal cord injury patients.

TABLE 2 Common Chronic Conditions among Veterans Affairs (VA) Patients: Age, Gender, Mortality, and Average Annual Cost per Patient in Fiscal Year 1999

Chronic Condition	*Persons with Condition*	*% of Total Population*	*Mean Age*	*% Male*	*% Deaths*	*Average Cost ($)*				
						Total	*Medical/ Surgical*	*Other Inpatient*	*Out-patient*	*Out-patient Pharmacy*
Acid-related disorders	169,721	5.00	62	95.90	4.00	9,046		1,577	2,783	940
AIDS/HIV	18,364	0.50	46	97.50	5.20	12,325	4,202	1,942	3,292	2,889
Alcoholism	210,469	6.20	51	97.30	3.40	11,551	3,131	4,425	3,406	590
Alzheimer's Disease	20,042	0.60	76	96.00	16.60	19,309	4,671	11,661	2,286	690
Arthritis	549,603	16.10	62	95.20	2.30	6,075	1,890	1,073	2,364	748
Asthma	85,278	2.50	57	88.70	2.50	6,881	2,393	1,055	2,531	902
Benign prostatic hyperplasia	307,160	9.00	69	99.90	3.20	6,910	2,533	1,124	2,455	799
Cancer (all other causes)	74,050	2.20	64	93.40	12.30	12,131	6,638	1,984	3,510	1,093
Cerebrovascular disease/stroke	72,793	2.10	68	97.70	8.90	14,482	6,838	3,184	3,440	1,020
Colorectal cancer	24,997	0.70	69	97.60	10.70	13,811	7,525	1,339	3,908	1,039
Congestive heart failure	161,171	4.70	70	98.10	12.60	15,050	8,292	2,356	3,267	1,135
Chronic obstructive pulmonary disorder	318,861	9.40	67	97.90	8.60	10,618	4,858	2,281	2,587	891
Dementia	35,692	1.00	73	97.00	14.80	19,522	6,072	9,412	3,195	843
Depression	235,852	6.90	54	89.90	2.00	8,657	1,784	2,373	3,481	1,019

(continued)

TABLE 2 (continued)

Chronic Condition	Persons with Condition	% of Total Population	Mean Age	% Male	% Deaths	Average Cost ($)				
						Total	Medical/ Surgical	Other Inpatient	Out-patient	Out-patient Pharmacy
Diabetes	532,926	15.60	64	97.40	4.60	7,846	2,971	1,440	2,435	1,000
Headache	121,456	3.60	51	76.00	1.40	6,557	1,735	1,145	2,852	825
Hepatitis C	38,312	1.10	49	96.80	4.60	12,898	4,184	3,655	4,041	1,017
Hypertension	1,256,034	36.80	64	96.80	3.40	6,444	2,402	1,137	2,140	765
Ischemic heart disease	560,626	16.40	67	98.30	5.40	8,668	3,977	1,292	2,499	899
Lower back pain	361,868	10.60	55	92.80	1.90	6,159	1,744	1,034	2,610	771
Lung cancer	29,637	0.90	67	98.00	33.70	19,196	11,022	2,491	4,497	1,186
Multiple sclerosis	11,460	0.30	54	88.00	4.40	12,785	3,169	5,013	3,050	1,554
Parkinson's Disease	29,972	0.90	72	98.30	9.50	12,225	3,553	5,207	2,344	1,121
Peripheral vascular disease	132,153	3.90	68	98.40	7.20	13,489	6,788	2,319	3,324	1,058
Prostate cancer	106,195	3.10	72	99.90	6.60	8,250	3,123	1,175	2,988	965
Renal failure	58,109	1.70	67	98.30	17.90	22,656	13,094	3,085	5,047	1,430
Spinal cord injury	19,855	0.60	56	97.00	6.90	26,735	5,311	15,864	3,293	2,267
Substance abuse										
Cocaine abuse	58,426	1.70	45	96.50	1.20	14,163	1,842	7,008	4,762	551
Stimulant abuse	6,081	0.20	44	95.40	1.50	13,307	1,702	6,137	4,777	691
Opiate addiction/ abuse	27,448	0.80	47	96.80	2.40	15,296	2,696	5,939	5,892	769
Drug dependence, nondependent abuse of drugs	292,704	8.60	53	95.30	2.50	9,390	2,714	2,860	3,112	704

Drug psychoses	16,857	0.50	47	96.00	3.00	18,535	3,460	9,526	4,842	707
Psychoses										
Schizophrenia	115,876	3.40	53	94.70	3.30	14,385	1,924	7,456	3,932	1,074
Manic depressive	71,606	2.10	51	89.90	2.10	12,190	1,768	5,419	3,993	1,010
Post-traumatic stress disorder (PTSD)	171,364	5.00	53	93.90	1.70	8,284	1,459	2,285	3,534	1,006
Antisocial personality disorder	7,004	0.20	45	97.70	1.70	19,304	2,427	11,267	4,858	752
Borderline personality	8,172	0.20	43	68.20	1.40	17,439	2,042	8,518	5,627	1,252
Personality disorders	39,299	1.20	48	91.20	1.80	14,701	1,972	7,202	4,546	982
Paranoid states/ other nonorganic psychoses	47,644	1.40	57	94.90	5.80	15,230	3,388	6,790	4,038	1,013
Other psychotic conditions	567,600	16.70	56	92.10	4.00	9,690	2,651	3,107	3,031	901

ATTRIBUTABLE COSTS

Health care costs attributed to each condition were analyzed through regression models. Since all independent variables in the regression models are expressed in deviations from their respective means, the intercepts are exactly equal to the sample means. For example, the intercept in the total cost model is $4,947, which is the average cost of the sample. Therefore, the reference group of the regression is the sample average. If the coefficient of a disease (e.g., asthma) is not statistically significant, it means that having the disease (e.g., asthma) does not add extra cost to the sample average. Furthermore, the age-condition interaction terms are all equal to zero when age is equal to the sample mean.

Regression coefficients from the four OLS models reflect marginal costs from the sample mean (see Table 3). For the total cost model, 24 of the 29 conditions show positive coefficients that are statistically significant at the 1 percent or 5 percent level, indicating significant health care costs attributed to these conditions. For example, the marginal total annual cost is $23,000 for renal disease, $11,000 for dementia, and $5,000 for Alzheimer's disease. The marginal total cost from hypertension, however, is only $600.

Coefficients in the cost component models reflect the marginal impact of each health condition on total, inpatient, outpatient, and outpatient pharmacy costs, respectively. Comparison of coefficients across cost component models provides patterns of marginal cost impacts among chronic conditions. For example, the coefficient in the total cost model for patients with AIDs/HIV is 2,071 and not statistically significant (see Table 3). However, the coefficient for AIDs/HIV patients in the pharmacy cost model is 2,369 and significant at the 1 percent level. These coefficients suggest that patients with AIDs/HIV cost $2,369 more in pharmacy clinics than the sample average, but their inpatient and outpatient costs are similar to the average.

Similarly, for asthma and benign prostatic hyperplasia, marginal outpatient and pharmacy costs are positive and significant at the 1 percent level. For psychoses, the marginal impact on total cost is negative and statistically insignificant. The marginal impacts of psychoses, however, in the cost components models are all significant, but in opposite direction: negative for inpatient costs, and positive for outpatient and pharmacy. This suggests that the increase in outpatient and pharmacy costs from psychoses cancels out the decrease in inpatient costs, making the net impact on total cost statistically insignificant. The estimated coefficient and standard error for Alzheimer's disease suggest that this disease group has a lot of variation. Only the outpatient pharmacy cost shows significant marginal impact.

TABLE 3 Regression Model of Total Annual Costs, Inpatient Costs, Outpatient Costs, and Pharmacy Costs (N = 599,975)

	Total Cost		*Inpatient Cost*		*Outpatient Cost*		*Outpatient Pharmacy Cost*	
Chronic Condition	R^2 = *0.19*	SE	R^2 = *0.12*	SE	R^2 = *0.23*	SE	R^2 = *0.13*	SE
Acid-related disorders	2,099**	424	1,085**	403	714**	92	300**	38
AIDS/HIV	2,071	1,460	86	1,385	–283	332	2,269**	227
Alzheimer's Disease	4,947	3,517	3,764	3,441	525	663	658*	281
Arthritis	1,241**	172	572**	159	591**	44	78**	18
Asthma	55	365	–347	339	27**	91	124**	40
Benign prostatic hyperplasia	461	386	–698	357	818**	105	341**	42
All other cancers	9,670**	904	5,977**	849	2,983**	201	710**	83
Colorectal cancer	12,023**	1,836	7,218**	1,673	3,813**	438	992**	184
Lung cancer	29,594**	2,481	22,512**	2,383	5,489**	480	1,592**	212
Cerebrovascular disease	3,406**	1,075	2,255*	1,037	972**	224	179*	88
Congestive heart failure	8,340**	900	6,852**	861	963**	192	525**	68
Chronic obstructive pulmonary disorder	1,051*	457	204	437	475**	95	372**	39
Dementia	10,969**	2,225	8,629**	2,200	1,919**	436	422**	159
Depression	4,239**	321	3,770**	298	584**	87	–115**	33
Diabetes	2,564**	261	922**	246	891**	65	751**	29
Headache	1,013**	276	824**	251	166*	77	23	34
Hepatitis C	3,837**	1,220	2,852*	1,153	722*	323	263*	115
Hypertension	626**	155	147	146	278**	39	201**	16
Ischemic heart disease	4,942**	318	3,036**	299	1,520**	78	386**	31
Lower back pain	935**	170	653**	156	227**	50	56**	20
Multiple sclerosis	4,321**	1,626	1,882	1,566	529	322	1,910**	213
Parkinson's Disease	9,170**	2,542	4,989*	2,462	3,199**	583	981**	186

(continued)

TABLE 3 (continued)

Chronic Condition	*Total Cost* R^2 = *0.19*	SE	*Inpatient Cost* R^2 = *0.12*	SE	*Outpatient Cost* R^2 = *0.23*	SE	*Outpatient Pharmacy Cost* R^2 = *0.13*	SE
Peripheral vascular disease	9,268**	919	6,997**	880	1,669**	204	602**	74
Prostate cancer	6,121**	865	2,249**	780	3,472**	300	401**	96
Renal failure	22,836**	1,662	12,309**	1,507	8,676**	646	1,850**	130
Spinal cord injury	8,331**	2,192	5,990**	2,177	346	303	1,995**	190
Alcoholism	3,124**	452	1,769**	431	1,540**	106	–186**	33
Substance abuse	5,534**	304	3,496**	287	1,874**	71	163**	28
Psychoses	–132	233	–1,870**	225	1,105**	50	633**	21
Age*Acid-related disorders	7	3	7	7	–3*	1	–2*	1
Age*AIDS/HIV	71*	33	46	31	30**	8	–5	5
Age*Alzheimer's Disease	–19	46	–3	45	–7	9	–9*	4
Age*Arthritis	–13**	3	–10**	3	–3**	1	0	0
Age*Asthma	35**	7	26**	6	7**	2	3**	1
Age*Benign prostatic hyperplasia	4	6	12*	5	–4**	1	–3**	1
Age*All other cancers	–45**	14	–19	13	–20**	3	–6**	1
Age*Colorectal cancer	–80**	26	–40	24	–30**	6	–10**	3
Age*Lung cancer	–265**	36	–201**	34	–46**	7	–18**	3
Age*Cerebrovascular disease	29	16	29	15	0	3	0	1
Age*Congestive heart failure	–30*	13	–23	12	–2	3	–4**	1
Age*Chronic obstructive pulmonary disorder	27**	7	32**	7	–2	1	–3**	1
Age*Dementia	–72*	30	–48	30	–18**	6	–6**	2
Age*Depression	–89**	6	–94**	6	1	2	5**	1
Age*Diabetes	–12**	4	–2	4	–5**	1	–6**	0

Age*Headache	–5	5	–18**	5	10**	2	3**	1
Age*Hepatitis C	7	25	–1	24	10	6	–1	2
Age*Hypertension	–3	3	–3	2	0	1	–1**	0
Age*Ischemic heart disease	–43**	5	–25**	5	–15**	1	–3**	0
Age*Lower back pain	–8*	3	–16**	3	7**	1	2**	0
Age*Multiple sclerosis	–18	31	–5	30	11	6	–23**	4
Age*Parkinson's Disease	–71*	35	–27	34	–37**	8	–7**	3
Age*Peripheral vascular disease	–63**	13	–46**	13	–11**	3	–6**	1
Age*Prostate cancer	–54**	12	–21	11	–31**	4	–1	1
Age*Renal failure	–151**	24	–38	22	–92**	9	–21**	2
Age*Spinal cord injury	154**	40	145**	40	20**	6	–12**	3
Age*Alcoholism	28**	9	37**	9	–11**	2	1*	1
Age*Substance abuse	–64**	6	–41**	5	–22**	1	–2**	0
Age*Psychoses	66**	4	74**	4	–3**	1	–6**	0
Demographic information								
Marital status: Unmarried	1,203**	35	1,022**	33	196**	8	–15**	3
African American	1,902**	60	1,496**	57	432**	15	–27**	5
Hispanic	540**	80	304**	76	216**	21	20*	8
Service-connected disability	646**	41	–4	38	509**	10	142**	4
Low–income	185**	42	–120**	39	227**	10	79**	4
Age	6**	1	2	1	2**	0	3**	0
Female	605**	44	350**	41	240**	11	15**	5
Constant	4,947**	16	2,574**	15	1,785**	4	588**	2

*$p < .05$. **$p < .01$.

All social-demographic variables are positive and significant at the 1 percent level. Age has two effects on costs. While costs increase with age in general (the age coefficient of six), age affects costs in different directions for specific medical conditions. For lung cancer, for example, the total cost increases with age by $6 per year above the average age (59 years), and the age-cancer interaction reduces total cost by $265 per year above the average age. The net effect suggests that older patients with lung cancer receive progressively less aggressive treatments.

DISCUSSION

VA data for FY1999 indicate that 72 percent of the VA patients have at least one of the 29 chronic diseases and more than one-third have three or more chronic conditions. The prevalence of chronic conditions in VA is much higher than in the general U.S. population. Based on 1987 National Medical Expenditure Survey, Hoffman, Rice, and Sung (1996) show that 47 percent of Americans who have used medical care for their health conditions have one or more chronic conditions. Two recent studies based on managed care populations show that nearly 40 percent of the enrollees have a common chronic illness (Fishman et al. 1997; Ray et al. 2000).

Because the denominators of the two managed care studies included people who do not use any medical care in the study period, adjustments should be made before the comparison to reflect the number of people who do not use any medical care in a year. A study by Ash et al. (2000) showed that 16 percent of Medicare enrollees and 40 percent of the working population (younger than age 65) use no care in a given year. Since both managed care plans contain young and old enrollees, if we assume that 35 percent use no care, the prevalence of chronic conditions among people who used any medical care for the two studies would be approximately 60 percent.

This is much lower than the 72 percent prevalence that we observed among VA patients. The high prevalence among VA patients is probably due to two major factors. First, VA eligibility policy gives high priority to veterans who are either disabled from their military service or live in poverty. Second, veterans are older than the general population and the elderly are more likely to be infirm.

Another important finding is that the 72 percent of patients who had one or more of the 29 chronic conditions accounted for 96.5 percent of total VA health care costs. The 1987 National Medical Expenditure Survey study shows that the 46 percent of people with one or more chronic conditions accounted for 76 percent of total health care costs (Hoffman, Rice, and Sung 1996). People with chronic conditions in the studies by Fishman et al. (1997) and Ray et al. (2000)

accounted for 71 percent and 78 percent of total costs, respectively. It appears that patients without chronic diseases incurred fewer costs in the VA health care system than they did in non-VA health care systems. These patients may be healthier than those observed in non-VA populations, or they may use another insurance plan, such as Medicare, as their primary coverage and the VA as supplement insurance (Wright, Hossain, and Petersen 2000; Wright, Lamkin, and Petersen 2000).

As an integrated health care system with salaried physicians and staff, the VA is more comparable with a staffed managed care organization, such as Kaiser Permanente. The prevalence of chronic diseases in VA is similar to the Kaiser Permanente and Group Health Cooperative studies. The top five chronic conditions among the VA patients are hypertension (37 percent), psychoses (26 percent), ischemic heart disease (16 percent), arthritis (16 percent), and diabetes (16 percent). The top five chronic conditions for Group Health Cooperative population were back and neck pain, heart disease, hypertension, diabetes, and arthritis (Hoffman, Rice, and Sung 1996). In the Kaiser Permanente study, the top five were hypertension, low back pain, benign conditions of the uterus, asthma, and diabetes (Ray et al. 2000).

VA is one of the largest providers of specialty mental health care in the United States. The large number of patients provides a unique opportunity to look at the costs for mental health conditions. For the substance abuse subgroup, patients with nondependent abuse of drugs cost less than the other subgroups (see Table 2), due primarily to lower inpatient substance abuse treatment and lower outpatient cost. Similarly, for mental health conditions, costs for patients with post-traumatic stress disorder (PTSD) and other psychotic conditions were much lower than the other six subgroups.

It should be noted that a substantial number of VA patients are also eligible for Medicare or Medicaid insurance (Shen et al. 2003). Therefore, costs measured in this study are less than the costs for all health care received by these patients. This is likely to vary by condition. For instance, spinal cord injury may be more complete as there are fewer non-VA specialty providers of this care. Yet to understand the cost of chronic illness, it is critically important to combine these data with information from other providers, such as Medicare and Medicaid.

Another limitation is that the regression models do not control for all medical conditions. It is very likely that some medical conditions, such as urinary incontinence, are associated with the 29 chronic conditions. Hence, the marginal costs reflected by the coefficients in the regression model may include some cost impact from those other unobserved medical conditions. However, if a chronic condition increases the probability of having some other medical

conditions, the coefficients estimated in our regression models can also be considered a broadly defined marginal cost of having one chronic condition.

For some services, particularly long-term care, VA contracts with non-VA providers. We do not have detailed information on costs and utilization for contracted services, so these costs are not included in this study. For FY2000, contracted services accounted for about 7 percent of total VA health care cost. The impact of contracted services on our estimates may not be evenly distributed among the 29 chronic conditions, depending on the proportion of each type of care that was contracted for a specific condition.

This is the first study to provide a comprehensive profile of the prevalence and annual costs of common chronic conditions among VA patients. This study shows that veterans who used the VA health care system have a higher prevalence of chronic conditions than the general population. The results may be used by providers, policy makers, and social scientists to set research priorities and guide resource allocation debates. Yet these results also show that management decisions based on information from the general population may not be easily extrapolated to the VA population. Because the VA health care system is an integrated system that provides comprehensive coverage, information from this VA study may provide a more complete pattern of resource use for certain medical conditions. For example, VA provides special treatment programs for substance abuse, and our study suggests that more than 60 percent of marginal costs due to substance abuse are from inpatient care.

As 72 percent of VA patients had one or more of the 29 common chronic conditions and their health care utilization accounted for 96 percent of VA costs, the results in this article provide a comprehensive background in health care resource use for many VA health care and health services studies. Although the cost estimates are specific for FY1999, the type and proportion of resources used for each chronic condition should be relatively stable. The fact that a substantial number of VA patients have multiple chronic diseases raises questions about effective care and efficient use of health care resources for VA patients. As an integrated health care system, the VA has an advantage in providing integrated care for such patients. Future studies are needed to understand and guide the services provided to patients with chronic conditions.

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