

# Patterns of outpatient prescription drug use among Pennsylvania elderly

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*The Pennsylvania Pharmaceutical Assistance Contract for the Elderly (PACE) provides outpatient prescription drug coverage for nearly one-half million State residents 65 years of age or over with income under \$15,000 per year. A description of the PACE program is provided*

*herein, along with data and multivariate results relating to the demographic characteristics of PACE beneficiaries, duration of enrollments, drug utilization and expenditure rates, average prices for covered prescriptions, and drug expense distributions.*

## Introduction

Americans 65 years of age or over represent about 12 percent of the population, yet they purchase 30 percent or more of all prescription medicine sold in the United States (Baum et al., 1985; U.S. Office of Technology Assessment, 1987). In 1986, the elderly had 613 million prescriptions filled at retail drugstores, an average of 15.5 prescriptions per person (Wolfe et al., 1988). And the rate of consumption is rising. According to recent survey data, total annual prescription expenditures for aged Medicare beneficiaries increased by more than 14 per cent per year from 1980 through 1987 (Moeller and Mathiowetz, 1989). A relatively small share of these purchases is reimbursed by insurance. Current estimates indicate that the elderly shoulder about 80 percent of the \$9 billion they spend each year for over-the-counter and prescription drugs (Brown, 1987). For some, the cost of medication represents a major economic burden.

That burden was to have been lightened by the Medicare Catastrophic Coverage Act (MCCA) (Public Law 100-360). When the Act was repealed in November 1989, the elderly lost the Federal coverage of prescription drugs originally scheduled to begin in 1991 and forfeited the potential benefits of an on-line drug utilization review planned for all prescription purchases regardless of payment source. The demise of MCCA also represented a major setback for health services research. The computerized point-of-sale claims system proposed under the law would have produced an incomparable data base for analyzing the changing utilization patterns, costs, and consequences of prescription drug use by the elderly. The research community must now look to other data bases to pursue research in these vital areas.

One of the most promising new sources of information on drug use by the elderly is to be found in the claims files of State pharmaceutical assistance programs (Berry, Smyer, and Lago, 1988). Since 1977, 11 States have implemented these programs to provide low- and moderate-income elderly persons with financial help in paying for prescription drugs. Although the total number of elderly enrolled is currently about one-half that

receiving drug benefits under Medicaid (National Pharmaceutical Council, 1989), the beneficiaries are more representative of the elderly as a class. Income restrictions on eligibility are generally much less stringent than those imposed under Medicaid, and, unlike other welfare programs, most pharmaceutical assistance plans do not impose asset limitations. The programs in New York and Connecticut each cover more than 10 percent of the elderly population in their respective States; in New Jersey, Pennsylvania, and Maine, more than 25 percent of the elderly are enrolled (National Pharmaceutical Council, 1989).

In this article, we present an analysis of outpatient prescription drug claims from the largest of the pharmaceutical assistance programs, the Pennsylvania Pharmaceutical Assistance Contract for the Elderly (PACE). Our study tracks drug utilization and expense patterns for three annual cohorts of PACE enrollees during the period July 1984 to June 1987. Descriptive profiles focus attention on how drug use varies according to enrollee characteristics and shows how these patterns change over time. Multivariate techniques are then employed to help explain the observed patterns. In the final section of this article, we address the generalizability of the PACE experience and suggest some areas for future research.

## Background

PACE is a lottery-financed pharmaceutical assistance program administered by the Pennsylvania Department of Aging. Eligibility is limited to State residents 65 years of age or over with annual incomes of less than \$12,000 (for single residents) and \$15,000 (for married). There are no asset restrictions or spend-down requirements. Persons enrolled in the State's Medicaid program for categorically needy elderly are not entitled to PACE coverage. It is estimated that 45-55 percent of elderly Pennsylvanians meet these criteria (Smyer et al., 1986). Approximately one-half of those eligible for benefits apply for and receive PACE coverage.

PACE provides broad and comprehensive outpatient coverage of legend drugs, insulin, and insulin syringes. It also provides inpatient coverage for eligible nursing home residents, but, given the small numbers involved (less than 3 percent of total enrollees), PACE remains basically an outpatient drug program and is referred to as such

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throughout this article. Experimental drugs, DESI<sup>1</sup> drugs, medical supplies other than syringes, and nonprescription medications are not covered. For medications provided in tablet or capsule form, dosages are limited to the lesser of a 30-day supply or 100 units per claim. The PACE cardholder is required to pay a copayment of \$4 for each prescription received. Participating pharmacies are reimbursed the lower of their usual and customary charge or the average wholesale price plus a dispensing fee of \$2.75, less the copayment amount.

Like many new health care benefit programs, PACE has experienced rapid growth. Enrollments increased from 386,000 during the program's first full year of operation, fiscal year (FY) 1985 (July 1, 1984 to June 30, 1985), to 478,000 in FY 1988. PACE claims payments in FY 1985 were \$57 million, growing to \$165 million in FY 1988. The average State payment per claim increased by nearly 50 percent, from \$10.27 to \$15.03 during this 4-year period. The number of claims filed per enrollee per year nearly doubled from 14.4 in FY 1985 to 22.9 in FY 1988 (Pennsylvania Department of Aging, 1988).

### Characteristics of enrollees

PACE collects basic demographic data (gender, race, income, age, type of residence, and marital status) on each person who applies for and is accepted into the program. The initial application data are supplemented and updated periodically through administrative reviews and an annual re-application process. By combining these sources, it is possible to develop both cross-sectional and longitudinal profiles of the PACE membership.

In Table 1, we present information on the demographic characteristics of persons who enrolled in PACE during the period July 1984-June 1987. We have limited the study population to the 509,646 beneficiaries known to have completed at least one PACE enrollment period during this timeframe. This represents 91.9 percent of all persons who enrolled from July 1984 through June 1987. The tabulations exclude 12,754 persons whose enrollment periods could not be determined because of missing or erroneous data in the PACE cardholder files, 18,070 persons who failed to re-enroll on their first program anniversary, and 14,972 with enrollment gaps. An enrollment period is considered completed if an eligible individual re-enrolls on the next program anniversary date (June 30), or dies, or is administratively cancelled prior to that time. Persons who fail to re-enroll within a month of the next program anniversary are excluded from the data set for the period preceding that date. This procedure was necessary to avoid inflating the enrollment figures with individuals who may have moved out of the State prior to the end of an eligibility period.

We have classified beneficiaries into three cohorts according to date of initial enrollment. The first three columns in Table 1 pertain to the group that joined between July 1, 1984 and June 15, 1985 (Cohort 1). The attributes of these individuals during their initial

enrollment period are shown in the first column. The next two columns show how the size and characteristics of this cohort changed in subsequent years as a result of aging, death, and disenrollment from the program. Of the initial 354,460 persons in Cohort 1, 4.6 percent died in FY 1985. An additional 4.5 percent disenrolled at some point during FY 1986 and are thus excluded from the cohort count for that year. By the end of the third fiscal year (June 30, 1987), the number of persons in Cohort 1 remaining eligible for PACE benefits had fallen to 277,444.

In Table 1, there are profiles for two additional cohorts of PACE beneficiaries. The fourth and fifth columns, under the heading Cohort 2, describe the characteristics of the 90,378 beneficiaries who initially enrolled from June 16, 1985 through June 15, 1986 and completed at least one enrollment period. Because of the limited timeframe of the study, there are only two observations for Cohort 2 (FY 1986 and FY 1987). The final column, under the heading Cohort 3, reports the same information for the 64,808 persons who first enrolled in PACE from June 16, 1986 through June 15, 1987.

There are two reasons for stratifying PACE beneficiaries by enrollment cohort. One obvious reason is evident from the data on average months of PACE coverage per year per enrollee shown in Table 2. (To conserve space, Tables 2, 3, 5, and 6 report results for a slightly smaller set of demographic classes than that in Table 1.) It is virtually impossible to interpret cross-sectional data on annual utilization rates unless differences in average length of enrollment during the year are considered. The standard deviations associated with the enrollment period means shown in Table 2 are also important to keep in mind when making cross-sectional comparisons. Because enrollment periods are not normally distributed, confidence intervals about the means are not symmetrical. Not only do PACE beneficiaries have fewer months of coverage in their initial year of enrollment compared with subsequent years, but the average length of enrollment period during the initial year of coverage has also declined. The PACE program was heavily promoted by the State of Pennsylvania and by organizations representing the elderly during the spring and early summer of 1984. Nearly one-quarter of a million eligible residents enrolled by the program inaugural date, July 1, 1984. As a consequence, members of Cohort 1 were PACE-covered for more months (9.03) during FY 1985 than was the case for members of Cohort 2 (6.54 months) during their first fiscal year of eligibility, FY 1986 or for members of Cohort 3 (5.67 months) in their first year, FY 1987.

Another important reason for stratifying enrollees into cohorts is that it helps distinguish sources of change in observed utilization trends. For example, if drug use among the elderly increases over time because of pharmacological advances or other secular factors, we would expect to see higher utilization rates for cohorts entering PACE in later years, irrespective of their average age or length of program exposure. On the other hand, if drug use increases primarily because individuals learn how to make better use of program benefits the longer they are covered, then we would expect to see similar utilization rates for individuals at the same relative points

<sup>1</sup> DESI drugs are medications on the Drug Efficacy Study Implementation List prepared by the Health Care Financing Administration (HCFA). They are not considered efficacious.

**Table 1**  
**Number and percent distribution of PACE enrollees, by cohort and year: Pennsylvania, 1985-87<sup>1</sup>**

Enrollee characteristic	Cohort 1			Cohort 2		Cohort 3
	1985	1986	1987	1986	1987	1987
Number of enrollees	354,460	322,186	289,910	90,378	78,115	64,808
<b>Sex</b>	Percent					
Male	27.6	26.7	25.6	32.2	30.9	31.4
Female	72.4	73.3	74.4	67.8	69.1	68.6
<b>Race</b>						
White	90.5	91.2	91.7	90.3	90.9	89.5
Black	5.0	5.0	4.9	6.4	6.1	6.8
Native American	0.4	0.4	0.5	0.4	0.5	0.6
Asian	0.1	0.1	0.1	0.2	0.1	0.1
Hispanic	0.1	0.1	0.1	0.2	0.2	0.2
Unknown	3.9	3.2	2.8	2.5	2.3	2.8
<b>Income</b>						
\$0-\$3,000	3.9	6.4	6.3	5.7	5.7	4.5
\$3,001-\$6,000	31.0	28.9	27.3	18.5	18.3	18.2
\$6,001-\$9,000	36.7	34.7	35.7	26.2	27.1	27.3
\$9,001-\$12,000	21.2	21.0	21.3	31.3	31.5	31.7
\$12,001-\$15,000	7.3	9.0	9.4	18.3	17.4	18.3
<b>Age</b>						
65-69 years	20.1	15.2	10.5	34.7	30.7	41.4
70-74 years	26.8	27.3	27.4	22.4	23.1	19.8
75-80 years	24.0	25.4	27.0	18.9	20.1	16.3
81-84 years	16.2	17.8	19.3	13.1	14.0	11.6
85 years or over	12.8	14.3	15.7	10.9	12.1	10.9
<b>Residential status</b>						
Private home	83.9	80.3	80.9	81.0	81.7	80.1
Nursing home	2.0	1.9	1.8	4.0	3.4	5.0
Boarding home	1.4	1.4	1.3	1.7	1.6	1.8
Other	12.7	16.4	16.0	13.3	13.3	13.1
<b>Marital status</b>						
Married	33.5	32.2	30.7	37.5	36.8	35.6
Single	8.9	9.1	9.3	9.8	9.8	10.6
Widowed	53.3	54.6	56.0	46.9	47.7	47.2
Separated	1.3	1.1	1.1	2.1	2.0	2.3
Divorced	3.0	2.9	2.9	3.8	3.7	4.2
<b>Mortality</b>						
Living	95.4	93.6	93.7	95.8	93.5	96.3
Deceased	4.6	6.4	6.3	4.2	6.5	3.7

<sup>1</sup>All years given are fiscal years.

NOTE: PACE is Pharmaceutical Assistance Contract for the Elderly.

SOURCE: Pennsylvania Department of Aging, PACE Program, 1984-88.

in their enrollment history, regardless of calendar year. A third possibility is that observed trends in drug use are the result of changes in the composition of the enrolled population over time. This can be readily detected by comparing the demographic makeup of subsequent cohorts of enrollees. It is readily apparent from Table 1 that the initial cohort of PACE beneficiaries is significantly older than enrollees in the next two cohorts.<sup>2</sup> Members of the first cohort are also more likely to be female, be widowed, and have lower average incomes,

<sup>2</sup>This phenomenon occurs in virtually all programs with age-related eligibility criteria. When the program first begins, the potential applicant pool includes all persons above the age cutoff. In subsequent years, the pool is reduced by those who joined in the first year. The principal source of new applicants comes from persons aging into eligibility.

although the differences in these characteristics are less pronounced than in the case of age.

### Representativeness of the population

Taken as a whole, the PACE membership has similar demographic characteristics to the general population of elderly in Pennsylvania. But there are some notable differences. The racial mix within PACE is representative of the State. According to 1980 census data, 93.1 percent of Pennsylvanians 65 years of age or over are white (Pennsylvania Department of Commerce, 1988). Among PACE beneficiaries whose race is known, the rate varies between 92 and 94 percent white, depending upon the cohort. The PACE population is slightly older. In 1985, for example, 58 percent of elderly Pennsylvanians were

Table 2

Average number of months of PACE coverage per enrollee, by cohort and year: Pennsylvania, 1985-87<sup>1</sup>

Enrollee characteristic	Cohort 1						Cohort 2				Cohort 3	
	1985		1986		1987		1986		1987		1987	
	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation
Total	9.03	4.10	11.53	1.79	11.48	1.90	6.54	3.71	11.50	1.88	5.67	3.56
<b>Sex</b>												
Male	8.23	4.36	11.37	2.08	11.32	2.17	6.42	3.67	11.31	2.20	5.59	3.50
Female	9.34	3.95	11.58	1.68	11.54	1.80	6.60	3.72	11.58	1.72	5.71	3.58
<b>Race</b>												
White	9.01	4.12	11.55	1.75	11.49	1.89	6.56	3.70	11.51	1.86	5.67	3.54
Black	9.29	3.79	11.40	1.91	11.38	2.02	6.41	3.65	11.39	2.07	5.89	3.73
<b>Income</b>												
\$0-\$3,000	9.24	3.90	11.44	1.91	11.36	2.08	7.07	3.53	11.39	2.04	6.50	3.74
\$3,001-\$6,000	10.30	3.12	11.45	1.90	11.46	1.92	6.65	3.68	11.44	1.96	6.04	3.64
\$6,001-\$9,000	0.06	3.39	1.54	1.77	1.52	1.83	6.58	3.69	1.53	1.82	5.79	3.59
\$9,001-\$12,000	7.65	4.56	11.58	1.72	11.52	1.85	6.42	3.76	11.51	1.87	5.43	3.52
\$12,001-\$15,000	2.39	0.83	11.65	1.59	11.40	2.08	6.43	3.71	11.53	1.86	5.34	3.36
<b>Age</b>												
65-69 years	7.98	4.41	11.72	1.40	11.65	1.58	6.13	3.61	11.70	1.47	5.65	3.49
70-74 years	9.09	4.12	11.67	1.51	11.63	1.63	6.74	3.72	11.60	1.70	5.65	3.55
75-80 years	9.35	3.98	11.58	1.69	11.55	1.78	6.86	3.75	11.51	1.86	5.71	3.60
81-84 years	9.48	3.85	11.44	1.93	11.41	2.01	6.83	3.75	11.38	2.07	5.74	3.64
85 years or over	9.40	3.76	11.05	2.46	11.08	2.46	6.58	3.74	10.91	2.66	5.68	3.65
<b>Residential status</b>												
Private home	9.01	4.11	11.55	1.76	11.51	1.86	6.56	3.69	11.55	1.80	5.63	3.55
Nursing home	7.56	4.08	10.30	3.07	9.99	3.47	5.63	3.67	10.30	3.14	5.37	3.50
<b>Marital status</b>												
Married	8.20	4.39	11.55	1.77	11.49	1.91	6.63	3.69	11.53	1.85	5.68	3.49
Single	9.18	3.96	11.52	1.81	11.45	1.96	6.33	3.71	11.50	1.85	5.66	3.58
Widowed	9.53	3.84	11.52	1.80	11.49	1.89	6.54	3.72	11.48	1.91	5.68	3.59
<b>Mortality</b>												
Living	9.18	4.08	11.88	0.86	11.83	1.11	6.63	3.71	11.87	0.95	5.73	3.57
Deceased	6.00	3.21	6.29	3.22	6.27	3.26	4.55	2.90	6.15	3.28	4.23	2.88

<sup>1</sup>All years given are fiscal years.

NOTE: PACE is Pharmaceutical Assistance Contract for the Elderly.

SOURCE: Pennsylvania Department of Aging, PACE Program, 1984-88.

65-74 years of age, and 23 percent were 80 years of age or over (Pennsylvania Department of Commerce, 1988). The comparative percentages for PACE beneficiaries in the same year are 47 and 29 percent, respectively. Age differences may help explain the relatively high percentage of females and those who are widowed within the PACE membership. Statewide, 61 percent of the elderly are female, compared with 71 percent in PACE (Pennsylvania Department of Commerce, 1988).

The average incomes of PACE enrollees are clearly below those of the elderly as a class. There are no current Pennsylvania estimates of income distribution by age. For the United States as a whole, approximately 34 percent of the elderly had 1985 incomes over \$12,000 for single people and \$15,000 for couples (the PACE income limits). For those below these limits, 29 percent had incomes of \$5,000 or less, 45 percent had incomes of \$5,000-10,000 per year, and 26 percent fell in the \$10,000-\$15,000 range (U.S. Bureau of the Census, 1987). By comparison, 26 percent of PACE enrollees in 1985 had incomes below \$5,000; 50 percent had \$5,000-\$10,000, and 24 percent had \$10,000-\$15,000.

(These rates were calculated from more detailed classifications of PACE beneficiary income than those shown in Table 1.) In this respect, it appears that PACE beneficiaries are generally representative of the subset of elderly with incomes below \$15,000 per annum.

### Utilization of outpatient prescription drugs

The drug utilization patterns<sup>3</sup> of PACE beneficiaries during the period FY 1985-FY 1987 are depicted in Table 3. The data used to construct this table were compiled from the PACE Claimant Activity File of the Pennsylvania Department of Aging, a record system containing the entire claims history for every PACE beneficiary who enrolled since the inception of the program. PACE reimbursement procedures require that

<sup>3</sup>We use the term "utilization" to denote filled prescriptions. There is no information in the claims files indicating whether individuals actually take the medications they purchase.

Table 3

Average number of PACE claims per person-month of coverage by cohort and year: Pennsylvania, 1985-87<sup>1</sup>

Enrollee characteristic	Cohort 1						Cohort 2				Cohort 3	
	1985		1986		1987		1986		1987		1987	
	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation
<b>Total</b>	1.72	1.71	2.08	1.89	2.25	1.98	1.70	1.78	1.97	1.90	1.71	1.84
<b>Sex</b>												
Male	1.60	1.70	1.93	1.87	2.07	1.97	1.63	1.80	1.90	1.94	1.63	1.83
Female	1.77	1.70	2.14	1.90	2.31	1.98	1.72	1.77	2.00	1.88	1.75	1.85
<b>Race</b>												
White	1.73	1.71	2.09	1.90	2.26	1.99	1.70	1.79	1.98	1.91	1.72	1.86
Black	1.55	1.57	1.88	1.72	2.06	1.80	1.60	1.68	1.88	1.75	1.59	1.66
<b>Income</b>												
\$0-\$3,000	1.67	1.68	2.08	1.93	2.28	2.06	1.71	1.77	1.98	1.95	1.74	1.89
\$3,001-\$6,000	1.75	1.68	2.08	1.88	2.24	1.97	1.64	1.75	1.89	1.87	1.68	1.81
\$6,001-\$9,000	1.76	1.70	2.10	1.89	2.27	1.98	1.69	1.76	1.95	1.86	1.71	1.85
\$9,001-\$12,000	1.67	1.73	2.08	1.90	2.24	1.99	1.75	1.82	2.04	1.93	1.77	1.87
\$12,001-\$15,000	1.59	1.77	2.04	1.87	2.18	1.98	1.65	1.76	1.93	1.90	1.63	1.82
<b>Age</b>												
65-69	1.57	1.73	1.92	1.91	2.11	2.03	1.62	1.80	1.92	1.94	1.62	1.81
70-74	1.66	1.70	1.98	1.89	2.13	1.98	1.61	1.75	1.84	1.88	1.61	1.80
75-80	1.76	1.70	2.11	1.90	2.25	1.98	1.71	1.74	1.96	1.85	1.75	1.83
81-84	1.86	1.71	2.22	1.88	2.38	1.98	1.83	1.77	2.10	1.86	1.89	1.94
85 or over	1.85	1.66	2.22	1.86	2.38	1.94	1.92	1.81	2.19	1.90	1.97	1.92
<b>Residential status</b>												
Private home	1.70	1.68	2.05	1.87	2.21	1.96	1.64	1.72	1.91	1.85	1.63	1.77
Nursing home	2.43	2.23	2.82	2.42	2.95	2.49	2.78	2.52	2.99	2.51	2.87	2.60
<b>Marital status</b>												
Married	1.61	1.71	1.95	1.88	2.10	1.98	1.61	1.75	1.87	1.88	1.60	1.81
Single	1.57	1.60	1.91	1.81	2.07	1.89	1.56	1.69	1.81	1.82	1.58	1.76
Widowed	1.82	1.71	2.19	1.91	2.36	1.99	1.79	1.80	2.07	1.91	1.81	1.87
<b>Mortality</b>												
Living	1.70	1.68	2.03	1.84	2.19	1.93	1.66	1.74	1.90	1.83	1.68	1.81
Deceased	2.20	2.10	2.83	2.44	3.06	2.48	2.45	2.29	2.91	2.51	2.60	2.41

<sup>1</sup>All years given are fiscal years.

NOTE: PACE is Pharmaceutical Assistance Contract for the Elderly.

SOURCE: Pennsylvania Department of Aging, PACE Program, 1984-88.

participating pharmacies submit a separate claim for each prescription drug dispensed, whether it is a new prescription or a refill. Claim counts thus provide a complete measure of aggregate utilization.

In Table 3, we present mean PACE utilization rates per month of enrollment by cohort and fiscal year together with the standard deviation associated with each mean value. As in the case of other health services, the distribution of prescription use is highly skewed to the right (Figure 1). For this reason, confidence intervals cannot be directly determined from the standard deviations shown in this table. We have chosen to display drug utilization rates in monthly rather than annual terms because the latter are highly sensitive to differences in length of enrollment period (Table 2).<sup>4</sup> As can be readily seen, average monthly utilization levels in the initial year of enrollment (columns 1, 4, and 6) are far below those

in subsequent years. The relative degree of variation about the mean also appears to fall somewhat with increased program longevity.

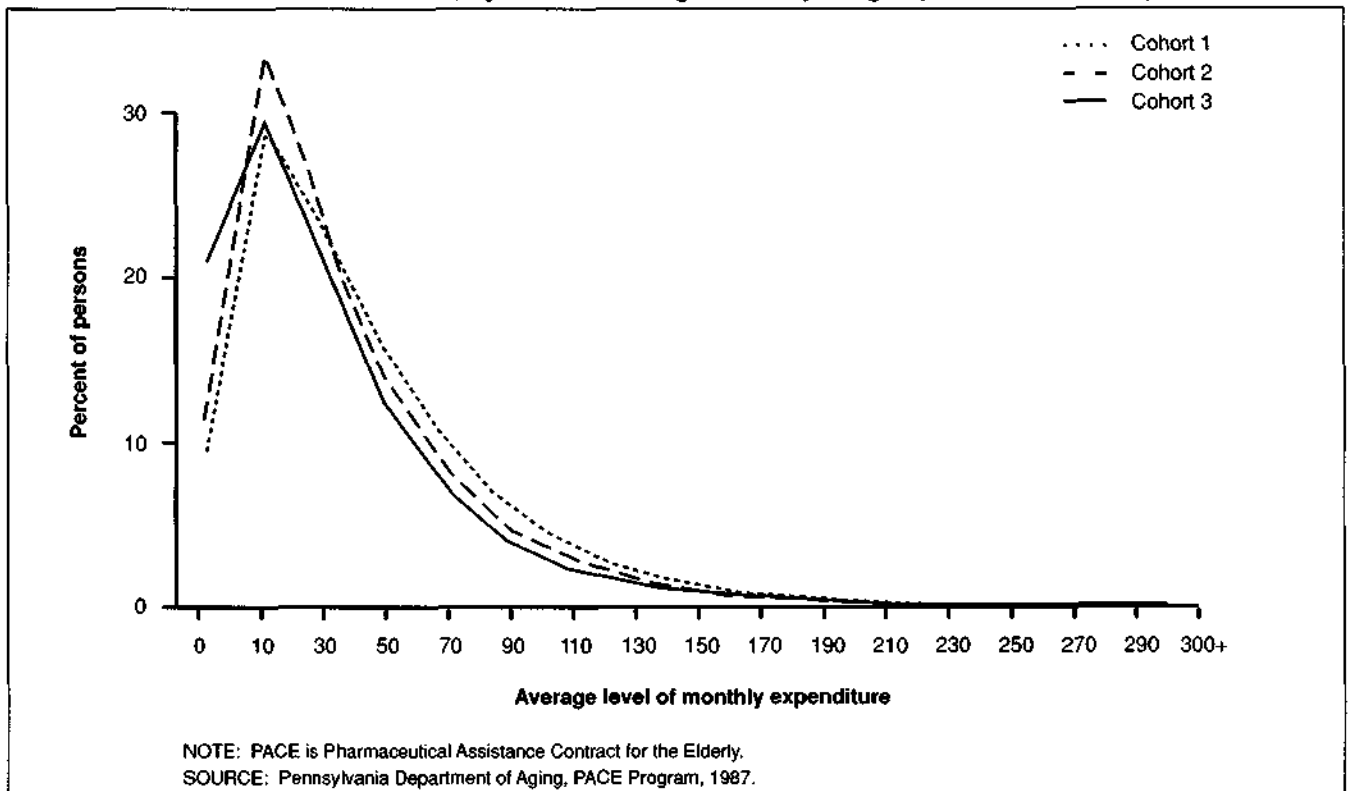
Many of the relationships seen in Table 3 are similar to those in the Current Medicare Survey (CMS), the National Medical Care Utilization and Expenditure Survey, the National Medical Care Expenditure Survey, and the National Medical Expenditure Survey (NMES): Medicine use increases with age, females are heavier users than males, white people fill more prescriptions than black people, and persons who are separated, widowed, or divorced use more drugs than either married or single persons. (LaVange and Silverman, 1987; Grindstaff, Hirsch, and Silverman, 1981; Moeller and Mathiowetz, 1989). As might be expected, there is little variation in utilization among persons in different income classes who have the same insurance coverage.

The somewhat lower person-month utilization rates for persons in the \$12,000-\$15,000 income category can be explained by differences in marital status. By definition, all members of this class are married. In fact, once

<sup>4</sup>The reader can calculate cohort-specific annual utilization rates in any fiscal year by multiplying the monthly rates shown in Table 3 by the average months of enrollment shown in the like cells in Table 2.

Figure 1

Distribution of PACE enrollees, by level of average monthly drug expenditure: Pennsylvania, 1987



marital status and other factors are controlled, persons in this class actually had higher drug use than did enrollees in any other income class (see section on "Multivariate analyses").

The one obvious difference between these and previous survey results lies in the high average level of use evident among PACE enrollees as a class. The recent NMES survey, for example, found that Medicare beneficiaries 65-69 years of age obtained an average of 13.2 prescription drugs in 1987 (Moeller and Mathiowetz, 1989). PACE enrollees in the same age group obtained 26.2 (Cohort 1) and 23.0 (Cohort 2) drugs in FY 1987, based on annual utilization data.

The residential status findings are of interest because none of the previously published surveys includes institutionalized elderly. (As of this writing, the NMES survey of institutionalized elderly has not been published. Several other studies have examined drug utilization patterns of nursing home residents [Beers et al., 1988].) The data in Table 3 show that, depending upon the cohort, 33-76 percent more prescriptions per month are filled on behalf of nursing home residents than is the case for PACE recipients residing in their own homes. Also available for the first time are data on prescription drug use by persons who die in a given year. The mean monthly utilization rates for decedents shown in Table 3 make it clear that impending death has a sharp, positive effect on prescription drug use. Depending on cohort and year, survivors use 29-55 percent fewer drugs on a monthly basis than do decedents in the months preceding their deaths.

Perhaps the most striking results in Table 3 involve the relationship between time and recipient utilization. As

noted earlier, drug utilization rates may change over time either because of secular environmental factors that affect all elderly persons or because of the increased experience that comes with exposure to the program. Were there any secular increases in prescription drug use over the 3 years of this study, it should be evident in columns 1, 4, and 6 of Table 3, which report monthly utilization rates for the three cohorts in their initial year of PACE eligibility. In fact, the average number of prescriptions filled per enrollee per month in the first year of enrollment was a virtually constant 1.71 (columns 1, 4, and 6). In the second year of enrollment, average monthly utilization rates were actually lower for members of Cohort 2 (1.97) than for members of Cohort 1 (2.08). For the most part, the same basic patterns hold for the various demographic subgroups of PACE enrollees.

Contrast these results with the dramatic increase in average utilization rates from one year to the next for members of the same cohort. In the case of Cohort 1, the average number of claims per person-month increased 21 percent (1.72 to 2.08) from FY 1985 to FY 1986, and an additional 8.2 percent (to 2.25 claims) the next year. Enrollees in Cohort 2 experienced a 15.9-percent increase in utilization (1.70 to 1.97 claims per month) in their second year of coverage.

### Prescription drug charges

In Table 4, the average usual and customary charges for drugs used by PACE enrollees are shown. These are the prescription prices that recipients would face without PACE coverage. Reading down the columns in this table,

Table 4

Average billed charge per claim for PACE-covered drugs by cohort and year: Pennsylvania, 1985-87<sup>1</sup>

Enrollee characteristic	Cohort 1						Cohort 2				Cohort 3	
	1985		1986		1987		1986		1987		1987	
	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation
Total	\$15.01	6.68	\$16.45	7.04	\$18.02	7.86	\$17.00	8.44	\$17.98	8.52	\$18.64	9.72
<b>Sex</b>												
Male	15.47	7.06	16.94	7.49	18.58	8.38	17.53	8.71	18.59	9.00	19.32	10.47
Female	14.84	6.54	16.28	6.87	17.83	7.67	16.76	8.30	17.72	8.30	18.35	9.36
<b>Race</b>												
White	14.99	6.70	16.43	7.05	18.00	7.86	16.96	8.36	17.94	8.49	18.59	9.67
Black	15.37	6.49	16.87	7.03	18.39	7.75	17.48	9.36	18.54	8.79	19.19	10.40
<b>Income</b>												
\$0-\$3,000	14.83	6.71	16.20	6.77	17.80	7.78	16.78	8.05	17.95	8.43	18.01	9.08
\$3,001-\$6,000	14.66	6.35	16.30	6.91	17.87	7.78	16.73	8.37	17.66	8.13	18.50	10.32
\$6,001-\$9,000	14.85	6.48	16.37	6.97	17.93	7.86	16.86	8.45	17.86	8.24	18.56	9.58
\$9,001-\$12,000	15.46	7.07	16.69	7.25	18.20	7.88	17.13	8.48	18.10	8.68	18.71	9.53
\$12,001-\$15,000	16.29	7.84	16.88	7.43	18.48	8.04	17.33	8.52	18.30	9.05	18.96	9.78
<b>Age</b>												
65-69	15.45	7.15	16.93	7.45	18.69	8.30	17.36	8.72	18.36	8.58	18.87	9.59
70-74	15.14	6.78	16.68	7.23	18.35	8.03	17.20	8.75	18.22	8.67	18.95	10.30
75-80	15.07	6.55	16.56	7.03	18.17	7.86	16.91	7.98	18.01	8.28	18.76	9.41
81-84	14.79	6.38	16.23	6.73	17.83	7.60	16.75	8.07	17.72	8.07	18.56	9.93
85 or over	14.28	6.34	15.63	6.59	16.99	7.46	16.00	8.09	16.89	8.89	17.25	9.24
<b>Residential status</b>												
Private home	15.06	6.69	16.52	7.09	18.10	7.91	17.13	8.55	18.09	8.48	18.82	9.85
Nursing home	13.66	6.25	14.75	6.48	16.16	7.30	15.15	7.77	16.16	0.77	16.53	8.06
<b>Marital status</b>												
Married	15.32	6.96	16.75	7.37	18.38	8.07	17.19	8.42	18.22	8.67	18.80	9.69
Single	14.97	6.92	16.39	7.31	17.86	8.26	16.91	8.41	17.86	8.75	18.81	10.18
Widowed	14.81	6.46	16.27	6.79	17.83	7.68	16.83	8.47	17.82	8.42	18.43	9.38
<b>Mortality</b>												
Living	15.01	6.69	16.45	7.04	18.01	7.81	16.99	8.44	17.96	8.40	18.62	9.67
Deceased	14.89	6.48	16.47	7.09	18.11	8.54	17.16	8.35	18.27	10.12	19.17	11.00

<sup>1</sup>All years given are fiscal years.

NOTE: PACE is Pharmaceutical Assistance Contract for the Elderly.

SOURCE: Pennsylvania Department of Aging, PACE Program, 1984-88.

one can see that, within any given year, there is relatively little variation in average prescription prices according to the characteristics of the users. What variation there is follows the pattern first evident in the Medicare CMSs, namely, that average charges tend to be inversely related to utilization rates (Grindstaff, Hirsch, and Silverman, 1981). Nursing home residents have the highest average utilization of any group of enrollees and the lowest average billed charges. The average charge per prescription for male enrollees is 3-5 percent higher than that for female enrollees; the young elderly (65 to 69 years of age) use products that are 3-8 percent more expensive than those used by the elderly 85 years of age or over; and so on. In fact, the only instance where this inverse relationship fails to hold is in the comparison of billed charges for decedents versus survivors. This pattern may be driven by the difference in unit price for maintenance drugs versus single-fill prescriptions. Enrollees with high levels of drug consumption are more likely to have chronic illnesses with treatment therapies involving repeated refills of the same (lower priced) medication.

During the 3 years of this study, the average price per prescription drug used by PACE enrollees increased 9.6 percent from FY 1985 to FY 1986, and 8.7 percent from FY 1986 to FY 1987. These increases are slightly higher than the increase in the Consumer Price Index (CPI) for prescription drugs over the same period. The CPI for prescription drugs increased 8.6 percent from 1985 to 1986 and 8.0 percent in 1987 (U.S. Department of Commerce, 1987).

### Monthly expense for prescription drugs

In Table 5 mean monthly expense levels for prescription drugs used by PACE beneficiaries are shown. Because expense is the product of quantity times price, the variation evident in this table reflects these two underlying factors. (Expense rates are calculated by first summing billed charges at the individual enrollee level, then determining the average per enrollee. For this reason, the values in Table 6 differ slightly from the

**Table 5**  
**Average prescription drug expense per person-month of coverage by cohort and year:**  
**Pennsylvania, 1985-87<sup>1</sup>**

Enrollee characteristic	Cohort 1						Cohort 2				Cohort 3	
	1985		1986		1987		1986		1987		1987	
	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation	Number	Standard deviation
<b>Total</b>	\$26.33	29.22	\$35.00	36.03	\$41.45	41.94	\$29.23	34.85	\$36.20	40.00	\$32.27	40.08
<b>Sex</b>												
Male	25.21	30.05	33.36	36.59	39.39	42.43	29.02	36.60	36.10	42.02	31.68	41.21
Female	26.76	28.88	35.60	35.80	42.17	41.75	29.32	34.00	36.24	39.06	32.54	39.55
<b>Race</b>												
White	26.49	29.34	35.20	36.19	41.68	42.15	29.31	34.88	36.27	40.08	32.47	40.38
Black	24.10	26.94	32.22	32.74	38.54	38.06	28.27	34.75	35.37	38.71	30.31	35.71
<b>Income</b>												
\$0-\$3,000	25.13	28.87	34.50	36.12	41.45	41.81	28.96	33.76	36.14	40.02	32.04	44.78
\$3,001-\$6,000	26.17	28.02	34.55	35.48	40.96	41.89	27.76	33.40	34.00	38.32	31.13	37.71
\$6,001-\$9,000	26.63	28.74	35.08	35.74	41.62	41.27	28.85	33.58	35.63	38.72	32.16	39.60
\$9,001-\$12,000	26.34	30.58	35.46	36.80	41.80	42.62	30.45	35.94	37.77	41.00	33.52	40.63
\$12,001-\$15,000	26.13	32.51	35.42	36.95	41.49	43.11	29.22	36.42	36.54	41.66	31.46	40.84
<b>Age</b>												
65-69	24.86	30.64	33.45	37.65	40.60	44.61	28.66	36.01	36.49	42.62	31.28	40.77
70-74	25.71	29.69	33.95	36.54	40.28	43.39	28.26	34.85	34.64	40.56	31.05	40.03
75-79	27.05	29.16	35.74	36.51	41.90	42.02	29.44	34.15	35.95	38.53	33.07	39.45
80-84	27.95	28.58	36.76	35.18	43.26	40.90	30.85	34.32	37.67	37.99	35.32	40.74
85 or over	26.55	26.60	35.15	33.19	41.09	38.42	30.71	32.77	37.13	36.44	33.85	37.42
<b>Residential status</b>												
Private home	26.07	29.06	34.68	35.90	41.04	41.78	28.58	34.34	35.51	39.56	31.27	39.36
Nursing home	33.49	34.84	42.14	41.21	48.29	47.47	42.89	45.80	48.71	47.25	48.35	50.99
<b>Marital status</b>												
Married	25.23	30.02	33.60	36.64	39.86	42.73	28.28	35.48	35.15	40.77	30.71	40.24
Single	23.82	27.19	31.87	34.20	37.76	39.52	26.57	32.18	32.97	37.32	29.99	39.02
Widowed	27.46	28.93	36.43	35.90	43.01	41.83	30.42	34.47	37.58	39.64	33.75	39.75
<b>Mortality</b>												
Living	26.00	28.76	34.18	35.01	40.49	40.76	28.65	34.17	34.98	38.46	31.59	39.14
Deceased	33.20	36.79	47.08	46.86	55.94	54.80	42.32	46.03	53.67	54.83	50.29	56.76

<sup>1</sup>All years given are fiscal years.

NOTE: PACE is Pharmaceutical Assistance Contract for the Elderly.

SOURCE: Pennsylvania Department of Aging, PACE Program, 1984-88.

product of like cells in Tables 3 and 4.) Given what we know about these factors from Table 3 and 4, we may conclude that:

- Most of the within-cohort, within-year variation is the result of utilization differences associated with the demographic makeup of the three cohorts.
- The within-year, across-cohort variation is primarily the result of effects associated with longevity in enrollment (exposure to program benefits).
- The within-cohort, across-year variation reflects both the utilization effects of longevity in enrollment and inflation in drug prices.

## Size distribution of drug spending

The final set of characteristics of elderly drug use described in this study relate to the size distribution of prescription drug spending. In Figure 1, we show the distribution of PACE beneficiaries by cohort and interval

of drug expense per enrollee per month in FY 1987, by \$20 increments (up to \$300 and over). In Figure 2, the proportion of drug spending per enrollee-month in FY 1987 accounted for by cohort members is shown classed by interval of spending. It must be emphasized that these diagrams depict monthly expense distributions. The variation is even greater when expense is measured on an annual basis because of differences in the average number of months of program eligibility among the three cohorts in FY 1987 (Table 2).

In both figures, the expense distributions for the youngest cohort (3) lie to the left of those for the next-older cohort (2) which, in turn, lie to the left of the oldest cohort (1). This shifting pattern reflects two distinct phenomena.

As can be seen in Figure 1, there is a sharp drop in the proportion of nonusers and low users as PACE beneficiaries move into their second and third years of program eligibility. Indeed, among first-year enrollees (represented by Cohort 3 in FY 1987), more than 20 percent filed no claims whatever. The rate of nonuse



Table 6

## Regression results on average number of prescriptions filled by PACE enrollees per month of eligibility: 1984-87

Independent variables	Model 1		Model 2		Model 3	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Male	*-.082	.021	*-.037	.015	*-.167	.027
Black <sup>1</sup>	*-.127	.038	*-.087	.028	*-.173	.047
<b>Income<sup>2</sup></b>						
\$3,001-\$6,000	-.014	.049	-.080	.036	*-.139	.052
\$6,001-\$9,000	.061	.048	-.044	.035	-.109	.050
\$9,001-\$12,000	.086	.049	-.022	.036	-.023	.051
\$12,001-\$15,000	.123	.054	.005	.040	.075	.057
<b>Age<sup>3</sup></b>						
70-74	.032	.025	.015	.018	.012	.033
75-79	*.106	.026	.037	.018	*.090	.034
80-84	*.184	.029	.027	.021	*.165	.037
85 or over	*.100	.032	.034	.023	*.125	.040
Nursing home resident <sup>4</sup>	*.773	.052	-.031	.044	*.757	.066
<b>Marital status<sup>5</sup></b>						
Single	-.065	.036	.008	.026	-.032	.043
Widowed	*.163	.025	*.061	.018	*.199	.030
Deceased	*.505	.044	*.134	.026	*.885	.045
<b>Enrollment cohort<sup>6</sup></b>						
Cohort 2	-.045	.024	*-.084	.016	*-.290	.029
Cohort 3	-.027	.027	—	—	*-.474	.032
Rx use in prior year	—	—	*.906	.004	—	—
Intercept	*1.504	.051	*.509	.038	*2.120	.056
R <sup>2</sup>	.017	—	.669	—	.034	—
Degrees of freedom	40,145	—	31,154	—	33,698	—
F-statistic	43	—	3,937	—	73	—

\*Significant at the 0.01 level or better.

<sup>1</sup>Reference group is white (non-Hispanic) enrollees.

<sup>2</sup>Reference group is \$0-\$3,000 annual income.

<sup>3</sup>Reference group is persons 65-69 years of age.

<sup>4</sup>Reference group is persons residing in own home.

<sup>5</sup>Reference group is married persons.

<sup>6</sup>Reference group is Cohort 1 enrollees.

NOTE: PACE is Pharmaceutical Assistance Contract for the Elderly.

SOURCE: Pennsylvania Department of Aging, PACE Program, 1984-87.

among the more experienced Cohort 1 and 2 members is about one-half that level. At the other end of the distribution, there is very little difference among the cohorts. Rather, it is in the middle-upper reaches of the range—from about \$60 to \$160 per month—in which the higher expense rates of Cohorts 1 and 2 members are most evident.

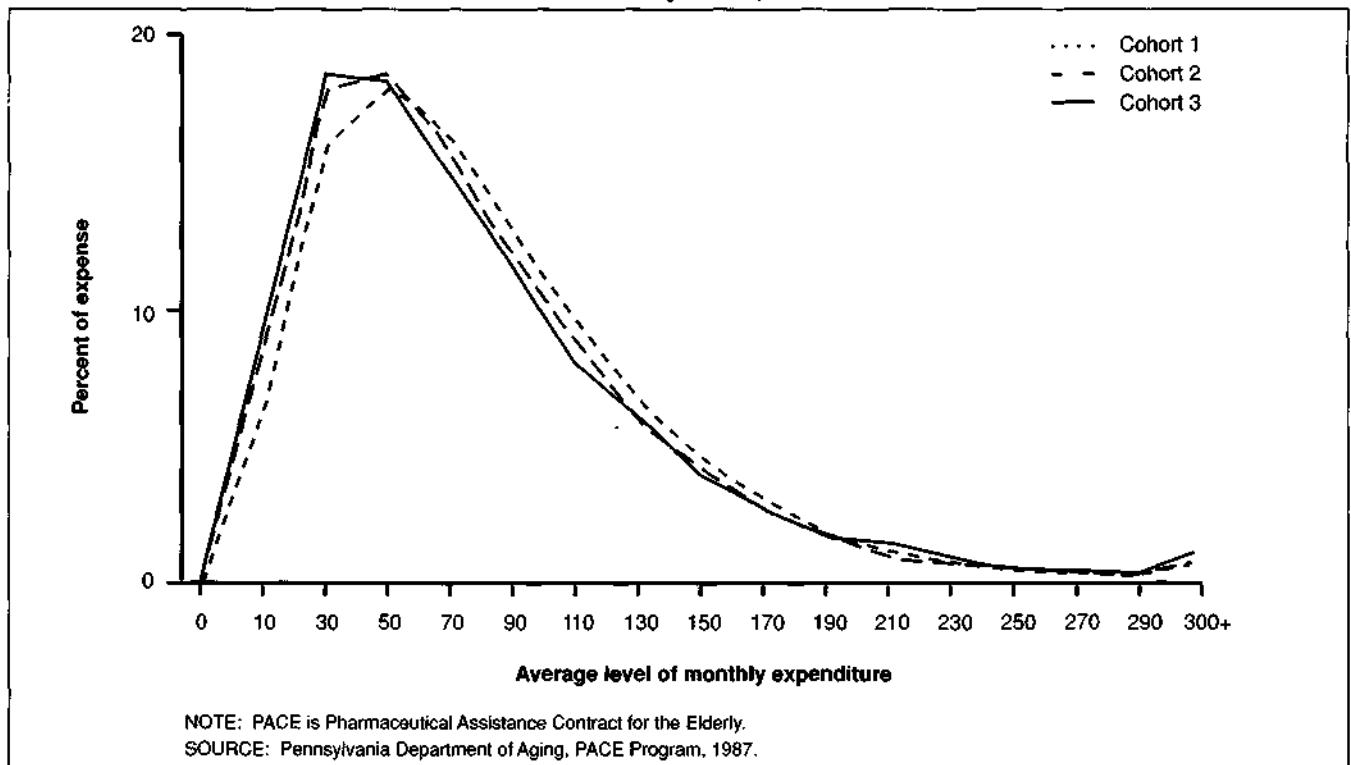
The percentage of total monthly drug expense incurred by PACE enrollees by interval of expense is shown in Figure 2. Although the degree of variation among the three cohorts is less obvious in this figure, it is revealing nonetheless. The biggest differences are again at the lower and middle-upper ranges of the expense scale. Nearly 28 percent of total drug spending by Cohort 3 members was accounted for by those incurring less than \$40 per month on average, compared with just 22 percent in the case of Cohort 1. Fully one-half of the drug bill of Cohort 1 members was accounted for by persons spending \$60-\$160 per month. By contrast, only

44 percent of the expense of Cohort 3 members fell within this range.

## Multivariate analyses

The profiles of PACE utilization and expenditures described thus far raise some interesting questions concerning the determinants of prescription drug use by the elderly. We employed two multivariate techniques to further our understanding of the influence of enrollee characteristics and time on medicine use within this population of Pennsylvania elderly. First, multiway repeated-measures analysis of variance was used to test for significant differences in PACE claims per person-month of coverage for members of Cohorts 1 and 2 as reported in Table 3. (Beneficiaries in Cohort 3 were excluded from this analysis because there is but one annual observation of members of this group.) Given the size of the sample (nearly one million observations in all), we expected that even small differences would prove

**Figure 2**  
**Distribution of drug expenses for PACE enrollees, by level of average monthly drug expenditure:**  
**Pennsylvania, 1987**



to be statistically significant, and, indeed, this was the case. Every major effect (gender, race, income, age, residential status, marital status, mortality, fiscal year, and cohort) was significant at conventional levels, as were most interaction effects. We did not test for significant differences in person-months of coverage per year (Table 2), average billed charge per claim (Table 4), or monthly expense (Table 5), but are quite confident, based upon these findings, that similar results would obtain.

Our next step was to develop multiple regression models to estimate the strength of the effect of each demographic and time variable on average monthly drug utilization. In the first of these models, we restricted our observations to the initial enrollment year (FY 1985 for Cohort 1, FY 1986 for Cohort 2, and FY 1987 for Cohort 3) in order to determine whether there were any significant differences in drug use for persons entering PACE in successive years independent of their demographic characteristics. This model, described in Table 6 as Model 1, was estimated with ordinary least-squares (OLS) multiple regression on a 10-percent random sample of enrollees ( $N = 40,161$ ).<sup>5</sup>

The parameter coefficients and standard errors are shown in the left-hand columns of Table 6. For the most part, these results parallel the descriptive findings in

Table 3. Holding other factors constant, being male, black, and single are all associated with lower-than-average use, but in no case does utilization fall below 90 percent of that in the reference category. Nursing home residence and death during the year are the two variables most strongly predictive of above average use. Medicine use also rises with age and income. The two dummy variables designed to test for a secular trend in drug use ("Cohort 2" and "Cohort 3") produced no evidence of any positive upward movement in drug use during the 3-year period. Other things being equal, members of Cohorts 2 and 3 actually filled slightly fewer prescriptions per month in their first year of enrollment (FY 1987) than did the members of Cohort 1 during their first year (FY 1985). The low  $R^2$  (.017) in this model is not surprising. Similar results have been found in other cross-sectional studies of health services utilization by the elderly (Newhouse et al., 1989).

The second model shown in Table 6 was designed to estimate the extent to which average monthly utilization in one year predicts use in the next. This model was estimated for a subset of the same sample of PACE enrollees, namely those who completed at least two enrollment periods from July 1985 through June 1987 ( $N = 31,170$ ). The dependent variable in Model 2 is average use per month in the second year of enrollment (FY 1986 for members of Cohort 1 and FY 1987 for members of Cohort 2). The regressors are the same as in Model 1 except for the addition of a continuous variable "Rx use in prior year" and the deletion of the "Cohort 3" dummy variable.

<sup>5</sup>Utilization equations are typically specified in two steps using logistic regression to estimate probability-of-use equations and then OLS or Tobit to estimate level of use among users. In this case, the number of nonusers during a year was low enough (about 12 percent of the sample) to permit use of the OLS estimator in a single-stage model.

The rise in explanatory power with the addition of the prior-use variable is quite phenomenal, both in absolute terms ( $R^2$  for an otherwise identical Model 2 equation without "Rx use in prior year" was .022) and when compared with research studies that have examined the relationship between prior and current use for other types of health services (Newhouse et al., 1989). Prior use swamps all other individual factors in predicting prescription utilization. Moreover, the coefficient of .906 implies that when individuals increase their use in one year, nearly all of that increase is carried forward to the next. If we assume that prior use is a proxy for current need for prescription medicine, then it is not surprising that the age and nursing home residency variables would lose significance in Model 2. What is surprising, perhaps, is the persistence in utilization differences by gender and race.

We estimated a final regression equation (Model 3) to test for the effect of longevity of enrollment (exposure) on prescription utilization rates. The model is identical to Model 1, except that the dependent variable in this case is the average number of prescriptions filled per month of eligibility in FY 1987. By the end of FY 1987, surviving members of Cohort 1 had accumulated an average of 33 months of exposure to PACE. For Cohort 2, the average exposure was nearly 19 months, and for Cohort 3, it was less than 6 months. We reasoned that if individuals take time to adjust their prescription-filling behavior to insurance coverage, then drug utilization should be a positive function of exposure, all else being equal. Our measures of exposure in Model 3 are the categorical variables "Cohort 2" and "Cohort 3."

Except for these two exposure variables, the parameter coefficients in Model 3 are basically similar to those found in Model 1, suggesting that the underlying relationships between drug use and population demographics remain stable over short time spans. The effects of exposure are evident in this regression. Holding other factors constant, Cohort 2 enrollees filled 0.29 fewer prescriptions per month of eligibility in FY 1987 than did Cohort 1 enrollees. This represents a 13-percent lower utilization rate. Cohort 3 enrollees purchased 0.47 fewer prescriptions, or 21 percent less per month than their Cohort 1 counterparts. Both exposure variable coefficients are statistically significant at better than the .0001 level. The  $R^2$  for Model 3 is .034, still low in absolute terms, but double that of Model 1. In other words, program exposure does help to predict prescription drug use. A note of caution is warranted here. Although these results are consistent with the view that insurance induces higher demand for prescription medicine, they do not prove that such a phenomenon exists. To establish such a relationship would require that the behavior of insured and uninsured persons be compared. In the present study, all persons have the same level of drug coverage provided by the PACE program.

## Conclusion

The importance of PACE and other State-level pharmaceutical assistance programs has grown since the demise of the MCCA. Not only are these programs an

important source of prescription drug benefits for the elderly in States that provide such coverage, but their claims systems also represent a valuable resource for future research and policy analysis. The repeal of MCCA may have prevented outpatient prescription drug benefits from being added to Medicare coverage in 1991, but it has not reduced the need for information about patterns of medicine use and cost among the elderly. The question is: What can be learned from these data bases that has relevance beyond the confines of a given State?

In the case of PACE, there can be no assurance that the utilization patterns depicted in this study are typical of elderly persons elsewhere in the country. In fact, when compared with 1987 NMES survey results (Moeller and Mathiowetz, 1989) it would appear that PACE enrollees are decidedly atypical. Why average utilization in PACE is so much higher than reported in NMES remains to be investigated. Undoubtedly part of the explanation lies in the use of different data sources. (NMES used survey techniques that may under-report the true level of prescription use) and the special characteristics of benefit coverage under PACE. (For example, the PACE dosage limit of a 30-day supply or 100 units means that beneficiaries must refill maintenance drugs prescribed in tablet or capsule form more often than would be the case without such restrictions.) Also, because PACE is a voluntary program, beneficiaries may have an above average propensity to use prescription drugs even before they enroll. Once enrolled, they face lower out-of-pocket outlays for any prescriptions they fill. If the elderly are responsive to prescription drug prices, then some portion of PACE utilization may represent demand induced by the program itself. Why study a program like PACE? It is to answer questions such as these that have clear policy implications for future public efforts to extend prescription drug coverage to the elderly.

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