The Rising Costs of Medicare:
Spatiotemporal, Age-Related Trends in Medicare Expenditures in the Elderly, 1998-2002

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Introduction

The US population is aging rapidly, and as a result, much attention has been devoted to the provision of health care and health-related expenditures later in life. Understanding health care expenditures to ultimately control health care costs is a matter of particular importance in the academic and health policy domains. Health expenditures constitute a substantial portion of the gross domestic product (GDP) each year, and that proportion increases annually. In 2007, federal spending on Medicare and Medicaid was 4.6% of the GDP, and is expected to increase to 5.9% by 2017. Since the 1960's, costs per Medicare and Medicaid beneficiary has increased 2.5 percentage points faster than per capita GDP. If these trends continue, federal spending on Medicare and Medicaid could reach 20% of the GDP by 2050.[1] Overall, health care expenditures for Medicare increase by approximately $10 billion each year,[2] and that figure is expected to accelerate with the aging of the population in the near future. By 2017, 10-year healthcare spending nationwide is expected to reach $4.3 trillion.[3]

These trends have important implications for health research and policy. Understanding and addressing the demographic and programmatic changes that will ultimately determine future expenditures is critical to planning and budgeting both on the public and private levels. Health care expenditures are not distributed uniformly over time, geography, and age. The composition of health services that comprise total expenditures is also not static. Pneumonia and influenza (P&I), in particular, demonstrate unique characteristic seasonality and age-related trends. This analysis examines hospitalization-based expenditures from three perspectives: age, time, and type of hospitalization (respiratory infection vs. other). The objective of this paper is to describe and present recent age-based, spatial, and temporal patterns of federal health expenditures in the growing elderly population based on a comprehensive database of Medicare claims over a five-year period with particular emphasis on P&I as part of total overall claims.

Methods

We abstracted over 52.4 million hospitalization claims, approximately 6 million of which were pneumonia and influenza-related (ICD-9CM codes 480-487) from the Centers for Medicare and Medicaid Services, which constituted all such claims from January 1, 1998 to December 31, 2002. Claims were aggregated by state of residency, month at hospitalization enrollment, and single year of age. Records of individuals < 65 years of age were excluded from the analysis (< 0.5%), and records of those beneficiaries age 100 and over were grouped into a single 100+ age category. These records were then matched to US Census counts for the corresponding period, age, and state.

The total value of hospitalization claims were summarized by single-year of age, month, year, and state. Average per capita federal spending on Medicare was also estimated. This process was repeated for those with P&I-related hospitalization claims and categorized by age and month of hospitalization enrollment. All data analyses were performed in SAS version 9.0 (Cary, NC) and all graphical displays were created in SPSS version 15.0 (Chicago, Ill.) and Microsoft Excel.

Results

National Expenditures

National expenditures by year and type of health service are shown in Table 1. The total amount of annual hospitalizations increased by just under 500,000 from 1998 to 2002, a 4.8% increase. However, federal expenditures on Medicare in the 65+ population increased 49.1% between 1998 and 2002, with the largest increased observed in cardiology-related charges (58.5%). The proportion of hospitalizations for pneumonia and influenza fluctuated as a percentage of total hospitalizations, but, overall increased by approximately 7% over the period of study.

Expenditures by Age

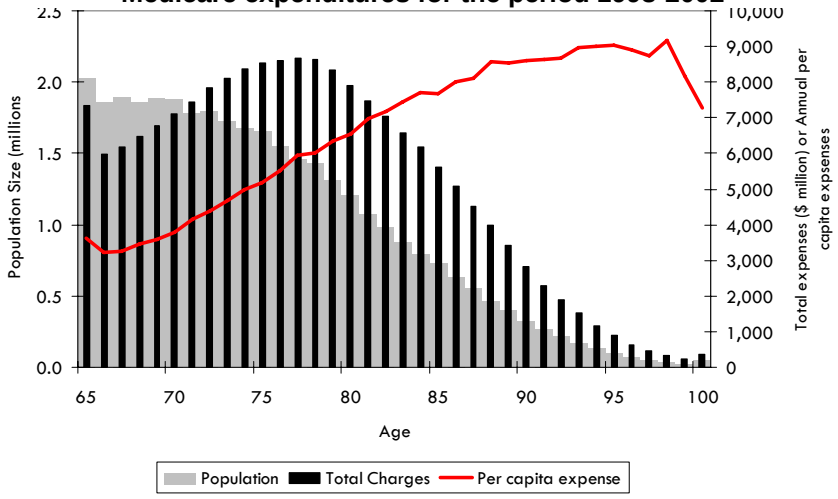
Health expenditures did not increase uniformly by age. Figure 1 shows the age distribution of the average annual total Medicare claims expenditures, as well as the average annual Medicare claims per person, as well as the actual population counts from the 2000 US Census. Total claims are high in age 65, decrease slightly between ages 65 and 66, then increase steadily until peaking

Table 1: National Medicare charges 1998-2002 by broad category of health services

	1998		*1999*		*2000*		*2001*		*2002*	
	Expenditures ($ billions)	% of total	Expenditures ($ billions)	% of total	Expenditures ($ billions)	% of total	Expenditures ($ billions)	% of total	Expenditures ($ billions)	% of total
Cardiology charges	8.2	5.4%	8.9	5.4%	9.8	5.5%	11.3	5.7%	13.0	5.7%
Laboratory charges	16.2	10.5%	17.2	10.5%	18.5	10.5%	21.4	10.6%	24.3	10.6%
Pharmaceutical charges	21.6	14.1%	23.4	14.3%	25.6	14.5%	29.6	14.5%	33.1	14.5%
Other charges	107.4	70.0%	114.3	69.8%	122.2	69.4%	139.8	69.2%	158.6	69.2%
Total charges	153.5		163.8		176.1		202.0		229.1	
Total P&I hospitalizations	1,229,960	11.9%	1,232,994	12.0%	1,219,004	11.8%	1,255,802	11.7%	1,305,976	12.1%
Total hospitalizations	10,292,931		10,303,472		10,303,270		10,720,027		10,791,058	

in the late 70's, at which time expenditures level off and then begin to decrease steadily. For average per capita expenditures, the rates tend to increase with age from age 66 through the early 90's, at which time they begin to level off.

Figure 1: Age-specific population counts (Census 2000), total and average per capita annual Medicare expenditures for the period 1998-2002

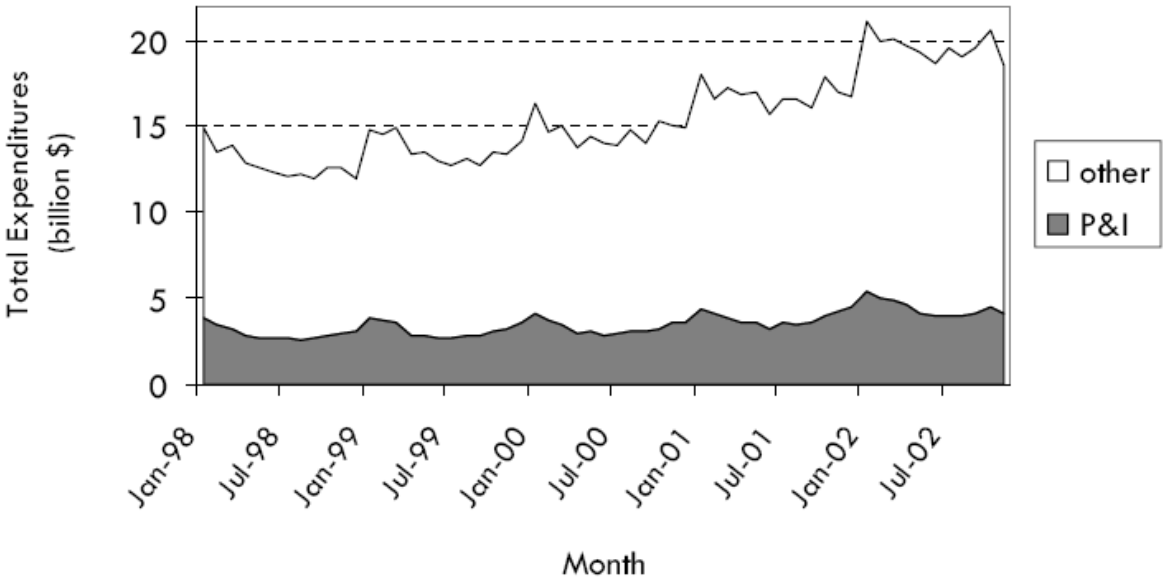


Expenditures Overall and for Pneumonia and Influenza over Time

Medicare expenditures increased steadily throughout the period of study. Figure 2 shows the monthly time-series of total expenditures and expenditures by broad category. While total expenditures increased, there was a marked seasonality in hospitalization charges. In some years, there were significantly higher monthly charges in the winter months than in the rest of the year. In 1999 and 2002, there were more than 20% higher total Medicare charges per month between December and March than between April and November. This number fluctuated from

year to year, but increased to nearly 38% in pneumonia and influenza hospitalizations throughout the five years of study.

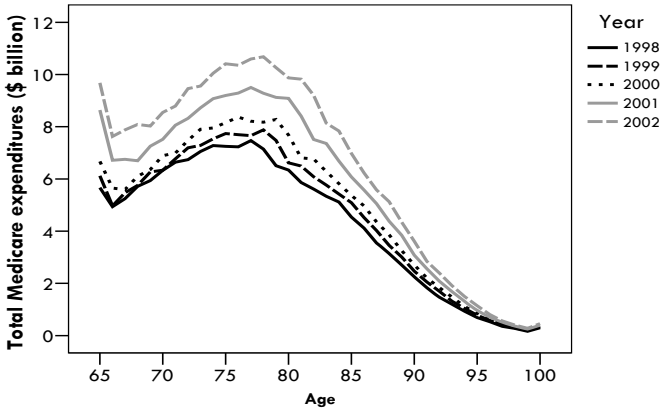
Figure 2: Monthly Medicare expenditures (1998-2002) overall and for P&I related expenses



Total Expenditures by Age and Time

The observed trends in age changed slightly each year. The peak of total expenditures increased by approximately 0.5 years of age for each year in time (Fig. 3). In addition, the decline observed between ages 65 and 66 was sharper in 2001 and 2002 than it was for the period 1998-2000.

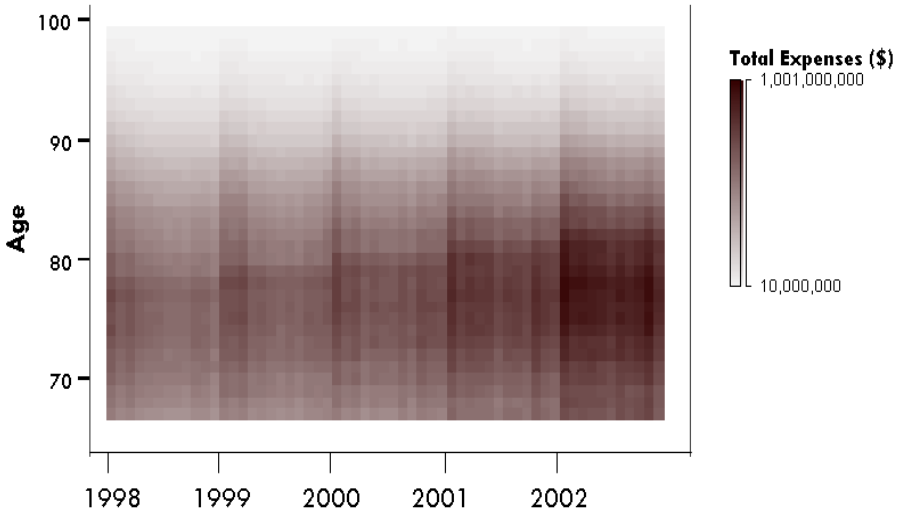
Figure 3: Total Medicare expenditures in billions by year and single year of age (1998-2002)



Changes in the seasonality by age over time were also apparent. In Figure 4, month is on the horizontal axis, and age is on the vertical axis. The intensity of color shows the magnitude of total Medicare expenditures for each month at each individual age. The winter peaks in expenses are

shown through the vertical stripes in the three or four months surrounding each new calendar year. The diagonal banding for age 78 in 1998, leading to those age 82 in 2002 could indicate a potential cohort-based trend in expenditures. Such trends were also observed when examining the average per capita Medicare expenses, as well as P&I-based hospitalizations.

Figure 4: Age-specific and monthly total Medicare expenditures in the US elderly (1998-2002)



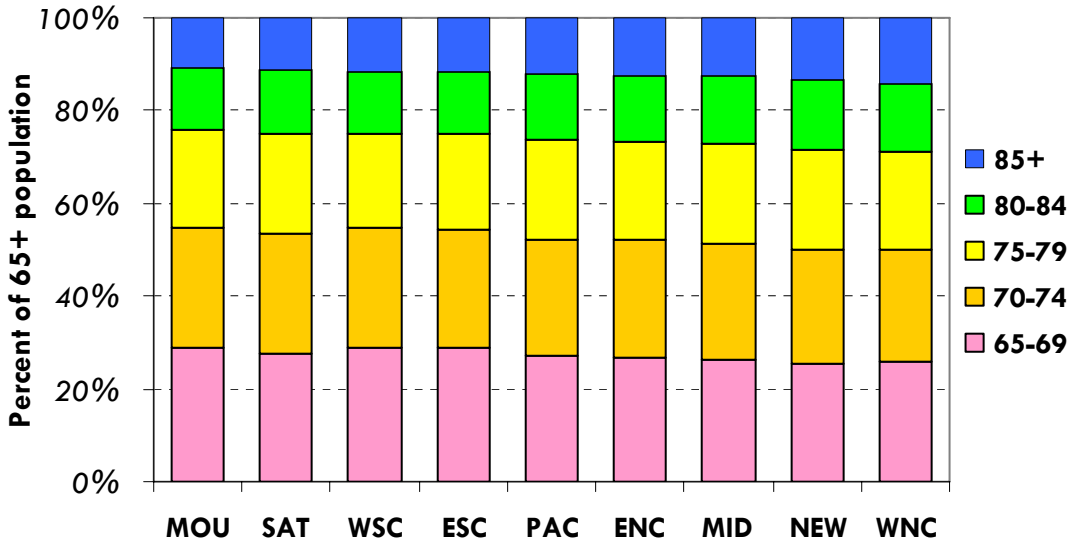
Expenditures by Geography: Census Division and State

There is substantial variation in the per capita Medicare expenditures by geography. First, it is important to understand the differences in population distribution that potentially underlie the observed differences in expenditure patterns. Figure 5 shows the population distribution by five-year age categories for each of the nine Census Bureau divisions.

Figure 5 shows that US regions and divisions vary by the distribution of the older population, in general. The West North Central region, which includes the Dakotas, Minnesota, Iowa, Nebraska, Kansas, and Missouri, has the highest percentage of the 65+ population that is 85+ (14.2%), whereas the adjacent Mountain states (Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, and New Mexico) has the lowest percentage (10.7%). The West South Central states (Texas, Oklahoma, Arkansas, and Louisiana) had the highest proportion of the youngest (65-69) older population (29.0%), whereas New England had the lowest proportion of 85+ who were 65-69 (25.5%). The differences in population distributions among individual states are even more

apparent. Nevada, for example, has one of the highest percentages of the 65+ population that is 65-69, compared to states such as North Dakota, Rhode Island, and Nebr

Figure 5: Population percent age distributions of the 65+ population in nine Census Bureau divisions for Census 2000 ordered by percent 85+



Key: MOU = Mountain, SAT = South Atlantic, WSC = West South Central, ESC = East South Central, PAC = Pacific, ENC = East North Central, MID = Mid-Atlantic, NEW = New England, WNC = West North Central

aska, which have among the highest percentages of the 65+ population that are age 85 or older.

There were notable differences in age-specific expenditure patterns by region and division. As described above, per capita Medicare expenditures increase steadily with age. Per capita spending was calculated by dividing the total Medicare expenditures for that geographic area and age group by the total 2000 population of that age group and geographic region. Figure 6 shows the average annual per capita spending by five-year age groups for the period 1998-2002. For those 85+, the divisions with the lowest per capita Medicare expenditures included Mountain, West North Central, and New England regions. The three highest divisions with respect to per capita Medicare expenditures were the Mid-Atlantic, West and East South Central divisions. Most of the lines are roughly parallel to each other, with some slight crossing over, suggesting that the age increase in expenditures is fairly uniform across divisions. There is more deviation in per capita spending at ages 85+ than in younger age groups. However, for some divisions the age increase in Medicare expenditures was substantially higher than for others. The Mid-Atlantic region

experienced the sharpest overall increases in expenditures with age. From the 65-69 age group to the 85+ age group, average per capita Medicare spending increased from $3,700 to over $11,500, an increase of over $7,800. The division with the next highest increase from ages 65-69 to 85+ was the West South Central division, with an increase of just under $6,000 per person.

As suggested by the divisional graph, age-specific expenditures increased with age for all states (Figure 7). For some states, expenditures within each age category were higher than others. In general, the southeast and south central states tended to have the highest expenditures compared with other states. The state with the highest expenditures, however, was New Jersey, and this was true for all five age categories. Washington, Oregon, and the southern mountain states tended to have the lowest overall Medicare expenditures in each age group.

Another important observation to note is that there is substantial variation in the types of charges upon which the Medicare expenditures. Figure 8 illustrates the category of Medicare charges as a percent of total Medicare expenditures. In the Mid-Atlantic division, accommodation charges represent a greater proportion of the total charges, compared to the other divisions for the population aged 65-69. This difference is even larger in the 85+ population. Comparing types of charges overall between the two age categories, we observe that the largest increases occurred in the accommodations category. The population age 85+ had approximately 30-50% higher accommodations charges than their counterparts in the 65-69 year old group. Anesthesia charges as a percentage of total charges decreased from 1-2% for 65-69 year olds to less than 0.5% for those aged 85 and above. Cardiology charges remained roughly the same as a percentage of total expenditures for both age groups, while laboratory charges increased up to 50% in some divisions comparing the two age groups.

Discussion

Our analysis, which utilized the most comprehensive database of nationwide hospitalization claims for the 65+ population suggests that between 1998 and 2002, there were distinct trends in Medicare expenditures with respect to age and time. Over the five-year span, total expenditures

Figure 6: Annual age-specific annual expenditures by Census division (1998-2002)

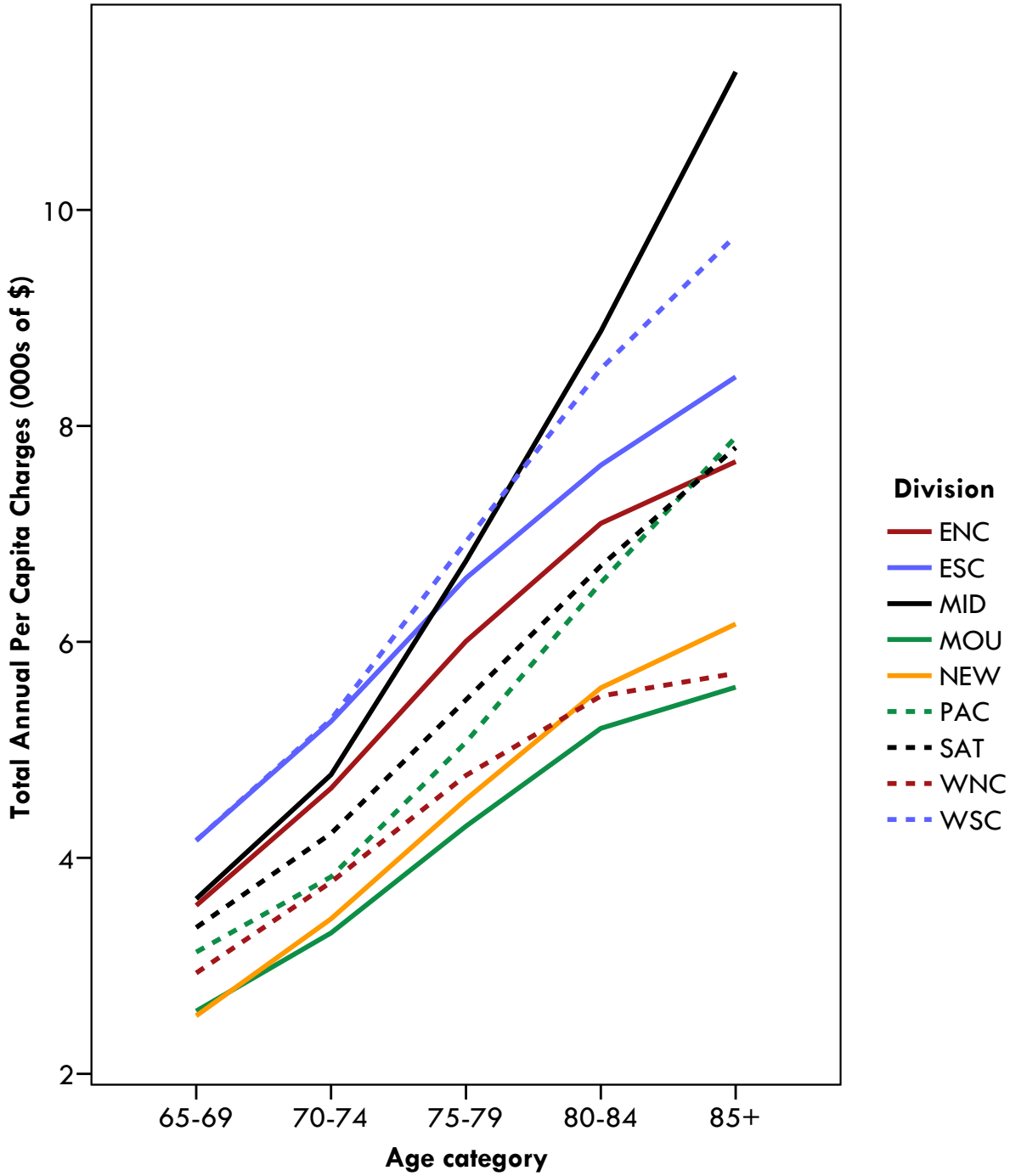


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Figure 7: Total five-year age-specific annual expenditures by state (1998-2002)

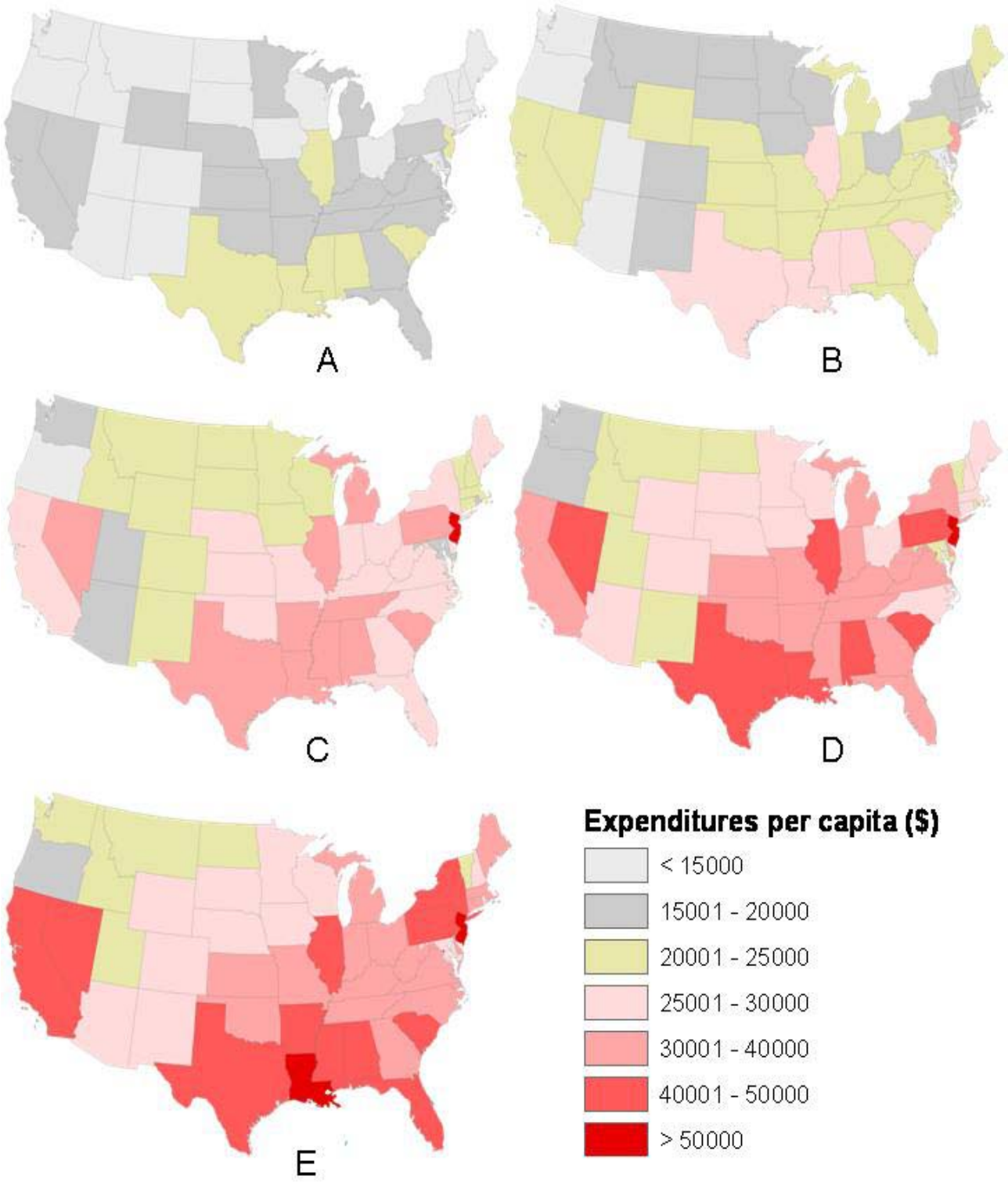
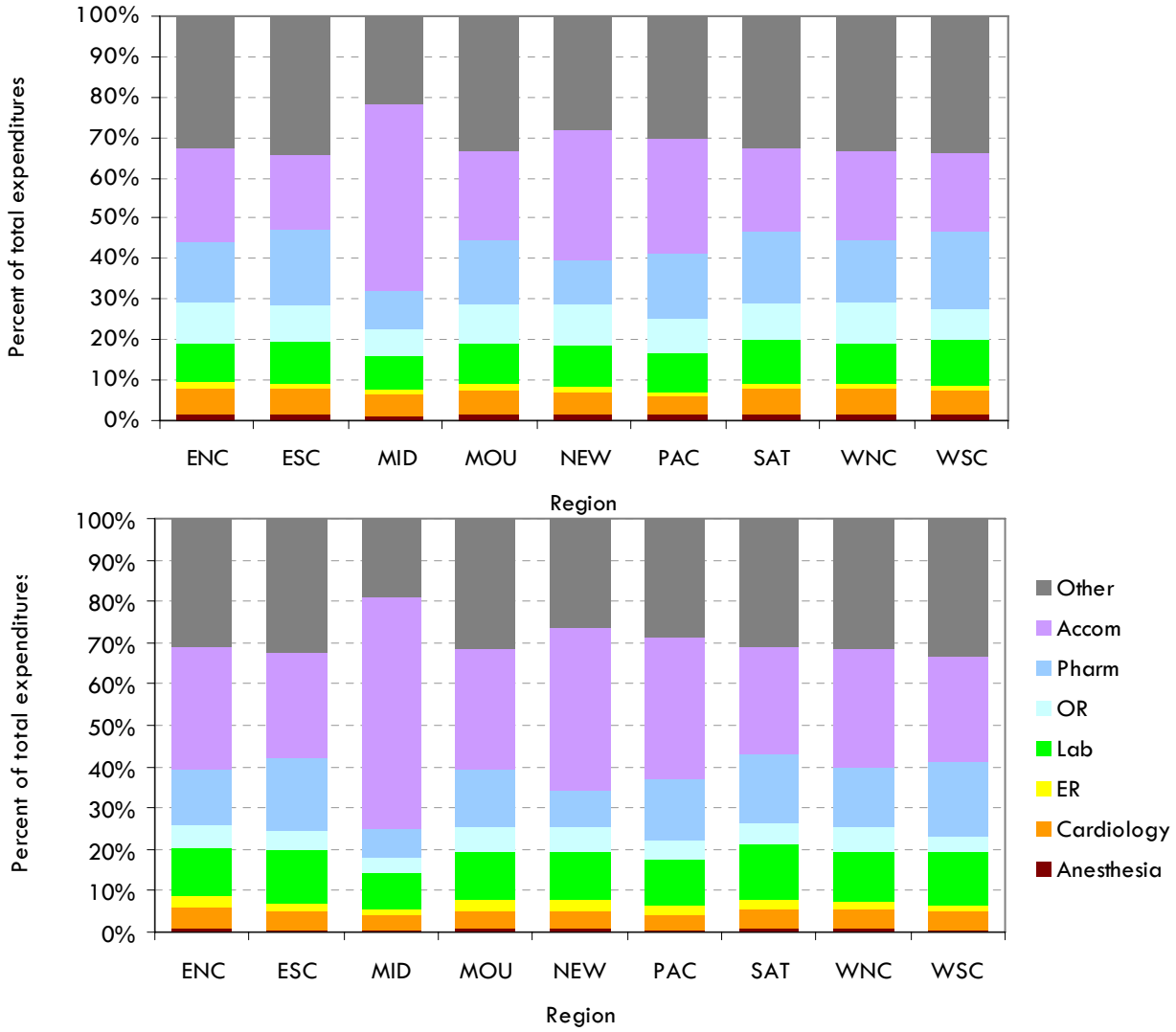


Figure 8: Total five-year age-specific annual expenditures by type and Census region (1998-2002) for age 65-69 (top) and ages 85+ (bottom)



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increased, while there was distinct seasonality in total expenditures, as well as with Medicare expenditures from hospitalizations due to P&I. Inflation and other related economic factors may be related to the overall broad increases observed in these data. In addition, potential cohort effects were observed for the birth cohorts of 1920 and 1921, as represented by diagonal banding for both overall and P&I-related medical expenditures over the five-year period of study, but requires further research.

Distinct trends were also observed by age and geography. The Mid-Atlantic, South Atlantic, and South Central divisions generally had the highest overall per capita spending. Understanding why these regions have such high expenditures in each age group merits further research and analysis. However, these results demonstrate that reducing health care expenditures and streamlining health case should be tailored to meet the needs of each region's population.

With the recent addition of Medicare drug benefits, total expenditures will likely continue to increase and these increasing costs are exacerbated by an increase in the number of people and proportion of the population eligible for Medicare as the population continues to age. Understanding the large-scale demographic changes that underlie these trends is crucial for planning and preparing for government-sponsored social programs, such as Medicare and Social Security. Such trends will likely have a significant impact on not only the costs of healthcare, but also the provision of health services to those that require care. The same demographic changes that contribute to the rising costs of healthcare also contribute to changes in the demographics of health care providers, including physicians, nurses, laboratory technicians, and other professionals.[4] Understanding and addressing the elemental causes of these trends is essential to control costs and ensure that high-quality and appropriate health care services and preventive programs will be available to all those who need them, especially in the vulnerable elderly population.

References

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