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National Spending on Cardiovascular Disease, 1996–2008

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To the Editor

In spite of great strides made in recent years to improve its prevention and treatment, cardiovascular disease (CVD) remains the most costly contributor to national health expenditures (1,2). As part of an effort to improve our understanding of the appropriate allocation of resources among CVD treatment, prevention, and research, we have developed estimates of national spending on CVD.

We include as CVD those conditions within ICD-10 Chapter IX (diseases of the circulatory system, ICD-10 I00-I99) and hyperlipidemia (ICD-10 E75, E78), the latter because of its close association with CVD. We develop time series estimates of the portion of the National Health Expenditure Accounts (NHEA) devoted to prevention, treatment, and research associated with these conditions. The NHEA, which are produced by the Center for Medicare and Medicaid Services, are the U.S. government's official estimates of national health care spending (3). Because the NHEA are not reported by condition nor partitioned into prevention and treatment expenditures, we use supplementary data and methods to develop the expenditure estimates reported here.

To estimate treatment expenditures, we use methods and data described by Roehrig et al. (1). Briefly, we decompose NHEA personal health spending estimates for each year into cells defined by service type (hospital care, physician and clinical services, prescription drugs, etc.) and population segment (civilian non-institutionalized population, nursing home residents, etc.). For each year, we use supplementary data to estimate how each cell's personal health spending was distributed across medical conditions and add results across all cells to produce annual personal health spending by condition. We include spending on hyperlipidemia in the presence of CVD as treatment expenditures. Similarly, we count spending on hypertension (ICD-10 I10-13, I15, I67.4) as treatment only if it is in the presence of other CVD. We use data from the Medical Expenditure Panel Survey (MEPS) to identify the portion of expenditures on hypertension and hyperlipidemia that is associated with patients with CVD. MEPS is a product of the Agency for Healthcare Research and Quality that provides detailed estimates of healthcare utilization and spending by the U.S. civilian noninstitutional population (4).

Our estimates of prevention expenditures are based on methods and data described by Miller et al. (5, 6). Using data gleaned from the literature and national data sets such as MEPS, we

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include estimates of spending for counseling, screening (for hyperlipidemia as well as for CVD), and treatment of hypertension and hyperlipidemia in the absence of other CVD (using MEPS data to distinguish spending for these conditions in patients without CVD).

For research expenditures, we use estimates from the National Institutes of Health (NIH) to identify the fraction of NHEA research expenditures that are devoted to CVD and to partition research into treatment versus prevention of CVD (7). In addition, we note that commercial research spending (e.g., by pharmaceutical and device manufacturers) is included in the NHEA within expenditures for treatment and prevention interventions, because that is how industry recovers the cost of this research. We have developed separate estimates of this portion of research spending by combining the NIH estimates with data reported by Moses et al. (8), including updates for the most recent years from some of Moses' sources. Moses' estimates are based on data published by biotechnology trade organizations. Because these data are not broken out by medical condition, we assume this distribution is similar to that reported for NIH spending.

Table 1 summarizes our results. For each year from 1996 through 2008 (the most recent year for which all source data were available), we show CVD expenditures in current year dollars broken down into treatment, prevention, treatment research, and prevention research, with a further breakout of prevention and treatment for specific conditions or risk factors. We also express these results as the percent of total CVD spending and percent of total NHEA contributed by each of these components. The final four lines of the table consist of estimates of the portion of treatment and prevention expenditures that are re-invested into research, as well as total research spending including this commercial research.

Since 1996, overall spending on CVD has grown at a compound annual growth rate of 5.7%. This is somewhat less than the overall rate of growth of the NHEA during the same period (6.8%), and is due to the slower growth rate of spending on CVD treatment (4.8%). (For comparison, updates to the results of Roehrig et al. (1) suggest that spending on diabetes and cancer has grown over the same time at rates of 8.5% and 7.3%, respectively.) As a result, CVD spending as a percent of the NHEA has declined moderately. The relatively slow growth rate in CVD treatment expenditures might be related to the long-term decline in smoking. It might also be related to the increased capability and aggressiveness associated with treating hypertension and hyperlipidemia. In fact, the more rapid growth rate of CVD prevention spending (9.9%) is largely attributable to the growing emphasis on treating these two CVD risk factors.

As a percentage of total CVD spending, spending on CVD prevention is much higher than the 8% to 9% of total NHEA spending attributable to prevention that is estimated elsewhere (3,4). This is because our estimates of CVD prevention spending include treatment for hypertension and hyperlipidemia in patients without diagnosed CVD. We estimate that expenditures to prevent CVD have grown to become more than 20% of total CVD expenditures. (We recognize, however, that some clinicians and researchers would consider hypertension and hyperlipidemia to be conditions rather than risk factors. Our breakout in Table 1 allows all hypertension and hyperlipidemia spending to be reallocated to treatment rather than prevention, which would cause CVD prevention expenditures to drop to 3.6% of the total in 2008.)

Spending on CVD research is small, representing roughly 1% of total CVD spending in recent years. (For comparison, spending on cancer research represents more than 5% of total spending on cancer, both because spending on cancer research is much greater than on CVD research and because spending on cancer treatment is less than on CVD treatment.) If commercial research spending is included in the total, both total research expenditures and

their annualized growth rate (9.4%) are considerably larger. (As noted earlier, however, commercial research spending is also included in the expenditures for CVD treatment and prevention.)

Differences in our estimates from those of other researchers are attributable to differences in methods and in what is being counted. For example, our estimate of CVD spending for 2007 is significantly larger than that of Roger et al. (9) primarily because our estimates include spending by nursing home residents and other institutionalized individuals in addition to the civilian, non-institutionalized population that is the focus of their estimates. Our estimates also differ from others in that we separately capture prevention and research expenditures and include a time series that allows tracking trends in spending.

Our objective in this correspondence is to present estimates of CVD spending that will contribute to a more informed discussion of our nation's allocation of health care resources to CVD treatment, prevention, and research. However, this quantification of expenditures does not address the question of whether the money has been well spent. Cohen et al. (10) observe that the variation in cost-effectiveness across different preventive interventions is extreme and is similar to that found for different treatment interventions, suggesting that opportunities for improving the overall cost-effectiveness of health expenditures through the reallocation of resources exist both within and between the broad categories of prevention and treatment. Our analysis of a subset of these interventions that focus on treatment and prevention of CVD leads to a similar conclusion. Ongoing research (including the research program that led to these estimates) is beginning to address these issues in more detail, but much work remains to be done to develop an understanding of the most cost-effective allocation of resources to CVD and among CVD treatment interventions, prevention interventions, and research to improve the efficacy of these interventions.

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Table 1

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Expenditures (billions of dollars):													
Treatment	$ 133.6	$ 138.2	$ 143.2	$ 148.7	$ 153.3	$ 161.4	$ 166.6	$ 183.0	$ 192.0	$ 203.2	$ 205.0	$ 223.0	$ 234.4
Heart conditions	*$ 81.0*	*$ 80.7*	*$ 81.6*	*$ 83.0*	*$ 87.2*	*$ 91.4*	*$ 94.2*	*$ 106.8*	*$ 111.1*	*$ 119.6*	*$ 117.0*	*$ 129.5*	*$ 137.1*
Coronary Heart Disease	*$ 53.5*	*$ 51.1*	*$ 50.5*	*$ 48.8*	*$ 50.4*	*$ 54.4*	*$ 55.2*	*$ 61.8*	*$ 63.0*	*$ 67.6*	*$ 69.4*	*$ 77.2*	*$ 82.6*
Congestive Heart Failure	*$ 12.3*	*$ 13.5*	*$ 15.1*	*$ 14.9*	*$ 15.8*	*$ 15.5*	*$ 17.6*	*$ 18.7*	*$ 20.7*	*$ 23.2*	*$ 24.2*	*$ 24.5*	*$ 24.7*
Dysrhythmias	*$ 12.6*	*$ 13.6*	*$ 12.0*	*$ 13.5*	*$ 13.6*	*$ 15.1*	*$ 16.4*	*$ 19.0*	*$ 20.0*	*$ 20.6*	*$ 19.4*	*$ 22.3*	*$ 24.4*
Cerebrovascular disease	*$ 22.9*	*$ 23.0*	*$ 23.8*	*$ 24.2*	*$ 24.6*	*$ 24.0*	*$ 24.0*	*$ 24.9*	*$ 26.5*	*$ 26.0*	*$ 30.2*	*$ 33.3*	*$ 38.0*
Prevention	$ 22.1	$ 25.4	$ 27.5	$ 30.4	$ 33.9	$ 37.9	$ 43.3	$ 47.9	$ 52.7	$ 57.2	$ 61.3	$ 66.2	$ 68.3
Hypertension	*$ 13.3*	*$ 15.3*	*$ 16.4*	*$ 18.0*	*$ 19.8*	*$ 21.8*	*$ 24.0*	*$ 25.9*	*$ 28.0*	*$ 30.2*	*$ 30.7*	*$ 31.3*	*$ 30.5*
Hyperlipidemia	*$ 4.0*	*$ 4.9*	*$ 5.4*	*$ 6.5*	*$ 7.7*	*$ 9.2*	*$ 11.5*	*$ 13.9*	*$ 16.4*	*$ 18.2*	*$ 21.0*	*$ 24.5*	*$ 26.9*
Treatment Research	$ 1.0	$ 1.1	$ 1.2	$ 1.3	$ 1.4	$ 1.6	$ 1.8	$ 2.0	$ 2.2	$ 2.3	$ 2.3	$ 2.4	$ 2.4
Prevention Research	$ 0.2	$ 0.2	$ 0.2	$ 0.2	$ 0.3	$ 0.3	$ 0.3	$ 0.4	$ 0.4	$ 0.4	$ 0.4	$ 0.4	$ 0.5
Total	$ 156.9	$ 164.8	$ 172.1	$ 180.6	$ 188.9	$ 201.2	$ 212.1	$ 233.2	$ 247.3	$ 263.0	$ 269.0	$ 291.9	$ 305.6
Expenditures (percentages of total):													
Treatment	85.1%	83.8%	83.2%	82.3%	81.2%	80.2%	78.6%	78.5%	77.7%	77.2%	76.2%	76.4%	76.7%
Heart conditions	*51.6%*	*48.9%*	*47.4%*	*46.0%*	*46.2%*	*45.4%*	*44.4%*	*45.8%*	*44.9%*	*45.5%*	*43.5%*	*44.4%*	*44.8%*
Coronary Heart Disease	*34.1%*	*31.0%*	*29.3%*	*27.0%*	*26.7%*	*27.0%*	*26.0%*	*26.5%*	*25.5%*	*25.7%*	*25.8%*	*26.4%*	*27.0%*
Congestive Heart Failure	*7.9%*	*8.2%*	*8.8%*	*8.2%*	*8.4%*	*7.7%*	*8.3%*	*8.0%*	*8.4%*	*8.8%*	*9.0%*	*8.4%*	*8.1%*
Dysrhythmias	*8.1%*	*8.3%*	*7.0%*	*7.4%*	*7.2%*	*7.5%*	*7.7%*	*8.1%*	*8.1%*	*7.8%*	*7.2%*	*7.6%*	*8.0%*
Cerebrovascular disease	*14.6%*	*14.0%*	*13.8%*	*13.4%*	*13.0%*	*12.0%*	*11.3%*	*10.7%*	*10.7%*	*9.9%*	*11.2%*	*11.4%*	*12.4%*
Prevention	14.1%	15.4%	16.0%	16.8%	17.9%	18.8%	20.4%	20.5%	21.3%	21.7%	22.8%	22.7%	22.4%
Hypertension	*8.5%*	*9.3%*	*9.5%*	*9.9%*	*10.5%*	*10.8%*	*11.3%*	*11.1%*	*11.3%*	*11.5%*	*11.4%*	*10.7%*	*10.0%*
Hyperlipidemia	*2.6%*	*3.0%*	*3.2%*	*3.6%*	*4.1%*	*4.6%*	*5.4%*	*5.9%*	*6.6%*	*6.9%*	*7.8%*	*8.4%*	*8.8%*
Treatment Research	0.6%	0.7%	0.7%	0.7%	0.8%	0.8%	0.8%	0.8%	0.9%	0.9%	0.9%	0.8%	0.8%
Prevention Research	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%
Expenditures (percentages of national health expenditures):													
Treatment	12.3%	12.1%	11.9%	11.6%	11.1%	10.8%	10.2%	10.3%	10.1%	10.1%	9.5%	9.8%	9.8%
Heart conditions	*7.5%*	*7.1%*	*6.8%*	*6.5%*	*6.3%*	*6.1%*	*5.8%*	*6.0%*	*5.9%*	*5.9%*	*5.4%*	*5.7%*	*5.7%*

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Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cerebrovascular disease	*2.1%*	*2.0%*	*2.0%*	*1.9%*	*1.8%*	*1.6%*	*1.5%*	*1.4%*	*1.4%*	*1.3%*	*1.4%*	*1.5%*	*1.6%*
Prevention	2.0%	2.2%	2.3%	2.4%	2.5%	2.5%	2.6%	2.7%	2.8%	2.8%	2.8%	2.9%	2.9%
Hypertension	*1.2%*	*1.3%*	*1.4%*	*1.4%*	*1.4%*	*1.5%*	*1.5%*	*1.5%*	*1.5%*	*1.5%*	*1.4%*	*1.4%*	*1.3%*
Hyperlipidemia	*0.4%*	*0.4%*	*0.4%*	*0.5%*	*0.6%*	*0.6%*	*0.7%*	*0.8%*	*0.9%*	*0.9%*	*1.0%*	*1.1%*	*1.1%*
Treatment Research	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Prevention Research	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	14.5%	14.4%	14.2%	14.0%	13.7%	13.5%	13.0%	13.2%	13.1%	13.0%	12.5%	12.8%	12.8%
Treatment and Prevention Expenditures Subsequently Invested in Commercial Research:													
Treatment Research	$ 1.3	$ 1.4	$ 1.6	$ 1.8	$ 1.9	$ 2.4	$ 2.6	$ 3.1	$ 3.0	$ 3.4	$ 3.3	$ 3.9	$ 4.3
Prevention Research	$ 0.2	$ 0.3	$ 0.3	$ 0.3	$ 0.4	$ 0.4	$ 0.5	$ 0.6	$ 0.6	$ 0.6	$ 0.6	$ 0.7	$ 0.8
Total Research Investment:													
Treatment Research	$ 2.3	$ 2.5	$ 2.8	$ 3.1	$ 3.4	$ 4.0	$ 4.4	$ 5.0	$ 5.2	$ 5.7	$ 5.7	$ 6.3	$ 6.7
Prevention Research	$ 0.4	$ 0.5	$ 0.5	$ 0.6	$ 0.6	$ 0.7	$ 0.8	$ 0.9	$ 1.0	$ 1.1	$ 1.1	$ 1.2	$ 1.3

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