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10-Year Resource Utilization and Costs for Cardiovascular Care

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ABSTRACT

BACKGROUND Cardiovascular disease (CVD) imparts a heavy economic burden on the U.S. health care system. Evidence regarding the long-term costs after comprehensive CVD screening is limited.

OBJECTIVES This study calculated 10-year health care costs for 6,814 asymptomatic participants enrolled in MESA (Multi-Ethnic Study of Atherosclerosis), a registry sponsored by the National Heart, Lung, and Blood Institute, National Institutes of Health.

METHODS Cumulative 10-year costs for CVD medications, office visits, diagnostic procedures, coronary revascularization, and hospitalizations were calculated from detailed follow-up data. Costs were derived by using Medicare nationwide and zip code–specific costs, inflation corrected, discounted at 3% per year, and presented in 2014 U.S. dollars.

RESULTS Risk factor prevalence increased dramatically and, by 10 years, diabetes, hypertension, and dyslipidemia was reported in 19%, 57%, and 53%, respectively. Self-reported symptoms (i.e., chest pain or shortness of breath) were common (approximately 40% of enrollees). At 10 years, approximately one-third of enrollees reported having an echocardiogram or exercise test, whereas 7% underwent invasive coronary angiography. These utilization patterns resulted in 10-year health care costs of $23,142. The largest proportion of costs was associated with CVD medication use (78%). Approximately $2 of every $10 were spent for outpatient visits and diagnostic testing among the elderly, obese, those with a high-sensitivity C-reactive protein level >3 mg/l, or coronary artery calcium score (CACS) ≥400. Costs varied widely from <$7,700 for low-risk (Framingham risk score <6%, 0 CACS, and normal glucose measurements at baseline) to >$35,800 for high-risk (persons with diabetes, Framingham risk score ≥20%, or CACS ≥400) subgroups. Among high-risk enrollees, CVD costs accounted for $74 million of the $155 million consumed by MESA participants.

CONCLUSIONS Longitudinal patterns of health care resource use after screening revealed new evidence on the economic burden of treatment and testing patterns not previously reported. Maintenance of a healthy population has the potential to markedly reduce the economic burden of CVD among asymptomatic individuals. (J Am Coll Cardiol 2018;71:1078–89) © 2018 by the American College of Cardiology Foundation.

In the United States, nearly 1 in 3 (approximately 80 million) adults have some form of cardiovascular disease (CVD), which imparts a heavy economic burden, including estimated direct costs of approximately $444 billion (1–4). The CVD costs of care are continuing to rise, with the current costs for treatment accounting for nearly $1 of every $6 spent on health care (2). The evidence to date on the economic implications of CVD screening is less well developed. Screening for CVD has the potential

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to improve clinical outcomes through effective detection of CVD risk and to intensify preventive efforts among asymptomatic individuals. Other forms of screening, such as for lung, breast, and colon cancer, form the basis for preventive health, with robust economic evidence and documentation of the expense of downstream disease states (5). Heretofore, the evidence base on the impact of CVD testing on long-term health care expenditures among asymptomatic, apparently healthy individuals is unknown. The aim of the present analysis was to estimate 10-year CVD costs based on detailed resource consumption patterns collected within MESA (Multi-Ethnic Study of Atherosclerosis), a registry sponsored by the National Heart, Lung, and Blood Institute, National Institutes of Health (6,7).

SEE PAGE 1090

METHODS

MESA ENROLLMENT CRITERIA. Enrollment criteria and CVD testing procedures for MESA have been previously reported in detail (6,7). In brief, a total of 6,814 asymptomatic, apparently healthy individuals (age range: 45 to 84 years) were enrolled. This substudy was approved by the MESA policy and publications committee and undertaken with a data use agreement between Emory University and the University of Washington.

COLLECTION OF BASELINE TRADITIONAL RISK FACTORS. During the baseline visit, participants were queried as to the history of cardiac risk factors. Also recorded were self-reported history of diabetes, hyperlipidemia, and hypertension; a family history of CVD; and smoking history. At this time, lipids, glucose, and blood pressure were measured; details of the methods have been published (6,8). A Framingham risk score (FRS) was calculated on each enrollee, including categories of 10-year predicted risk of <6%, 6% to 9.9%, 10% to 19.9%, and ≥20% (9). Use of a total of 46 drug classes, such as sulfonylurea, beta-blocker, and calcium-channel blocker therapies, were collected in MESA.

NONTRADITIONAL CVD TESTING. At the baseline visit, MESA enrollees had measurement of high-sensitivity C-reactive protein (hsCRP) according to standardized methods (10). High- and low-risk hsCRP was defined as >3 and ≤3 mg/dl, respectively (11). At the baseline visit, all participants underwent coronary artery calcium scoring (CACS). The protocol and methods for CACS were performed by using standardized methods (6,7,10). For the present analysis, CACS was categorized as 1 to 9, 10 to 99, 100 to 399, 400 to 999, and ≥1,000, respectively.

DATA COLLECTION OF SOCIOECONOMIC FACTORS. During the baseline visit, detailed data on socioeconomic status were collected, including marital status, employment status, highest level of education achieved, household income, and health insurance coverage. These variables were candidates for covariate adjustment in the cost models because they are established determinants of health care utilization.

ABBREVIATIONS AND ACRONYMS

ACE = angiotensin-converting enzyme

CACS = coronary artery calcium score

CVD = cardiovascular disease

FRS = Framingham risk score

HF = heart failure

hsCRP = high-sensitivity C-reactive protein

MI = myocardial infarction

FOLLOW-UP METHODS. MESA collected detailed follow-up hospitalization, medication usage, and varied patterns of resource consumption throughout follow-up. In total, MESA participants returned for a total of 4 additional clinic examinations every 2 years. During each follow-up visit, a detailed history of intercurrent office visits, CVD diagnostic (e.g., exercise stress testing) and invasive (diagnostic coronary angiography and coronary revascularization) procedures, and CVD hospitalizations, as well as current and revised prescribed CVD medications, were ascertained. Medicare nationwide mean payments for diagnostic procedures, coronary revascularization, and hospitalizations are provided in Online Table 1. CVD medications included medications for hypertension, diabetes, and dyslipidemia such as diuretic agents, beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, insulin, and statins. Antiischemic and heart failure (HF) medication usage was also collected (e.g., nitrates, ACE inhibitors). In the years when an in-person clinic examination was not scheduled, participants completed follow-up information through a detailed telephone interview. Similar to the clinic visit data collection, data on medication, procedures, and hospitalizations were collected annually. Specific questions on changes in drug therapy and intensification or reduction in dosing were collected annually. During each follow-up contact, enrollees were queried as to whether a new diagnosis of hypertension, diabetes, or dyslipidemia was assigned by their overseeing health care provider. In year 1 of follow-up, participants were queried as to whether they had discussed their MESA test results with their primary care physician. MESA investigators did not provide treatment or procedural guidance based on test findings.

Data on CVD hospitalization were collected similar to the procedural and visit data. Angina or HF hospitalization, coronary revascularization, acute myocardial infarction (MI), or stroke underwent a detailed event adjudication by the MESA morbidity and