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# Introduction

Stroke is a major public health issue with direct costs for care estimated at \$41.6 billion and indirect costs in terms of lost productivity from either illness or death estimated at an additional \$21.1 billion for 2007.<sup>1</sup> At least 2% of all U.S. adults living in households report having had a stroke<sup>2</sup> and over 65% of white stroke survivors and 47% of black stroke survivors living in households are ages 65 years and older.<sup>3</sup> Stroke is a major cause of serious, long-term disability in the United States,<sup>4</sup> and nearly 45% of all stroke survivors ages 65 years and older have moderate or severe disability.<sup>5</sup> Stroke has remained the third leading cause of death since 1938.<sup>6</sup> The numbers and rates for stroke deaths have declined throughout the 20<sup>th</sup> century;<sup>7</sup> however, the decline has been less apparent since the 1990s.<sup>8-10</sup> In 2003, stroke accounted for 157,689 deaths among U.S. residents.<sup>11</sup>

There were an estimated 942,000 hospital stays for stroke in short-stay U.S. hospitals in 2002, with 71% of these hospitalizations occurring among adults ages 65 years and older.<sup>12</sup> Observed declines in both hospital case fatality and death rates suggest improved survival after a stroke event.<sup>13</sup> In addition, more than 1 in 5 Medicare stroke hospitalizations receive an “ill-defined” diagnosis—a disturbing proportion given the need for an accurate diagnosis to guide treatment.<sup>14</sup> There are geographic and racial/ethnic disparities in stroke burden in terms of risk factors,<sup>15</sup> awareness of stroke symptoms,<sup>16,17</sup> place of death (in-hospital versus out-of-hospital),<sup>18,19</sup> prevalence,<sup>20</sup> hospital rates,<sup>13,21</sup> subtype diagnoses,<sup>14</sup> discharge destinations,<sup>21</sup> level of disability,<sup>5</sup> and death rates.<sup>22</sup> These disparities may reflect geographic and racial/ethnic variations in preventing risk

factors, detecting and controlling risk factors, stroke awareness levels, emergency transport systems and policies, access to care, and health system or emergency department policies regarding stroke evaluation and treatment.

In 2000, the Centers for Disease Control and Prevention (CDC) first placed a focus on stroke by emphasizing (1) prevention and control of all risk factors for stroke along with heart disease, (2) increased awareness of the signs and symptoms of heart attack and stroke, and (3) secondary prevention among persons surviving acute stroke events.<sup>23</sup> In 2001, CDC provided funds to organizations to design and pilot-test statewide Paul Coverdell National Acute Stroke Registry prototypes to measure and improve the quality of care for stroke patients.<sup>24,25</sup> The state-based national cardiovascular health program was renamed the National Heart Disease and Stroke Prevention Program to emphasize the importance of stroke.

In 2003, the *Atlas of Stroke Mortality: Racial, Ethnic, and Geographic Disparities in the United States* was published to provide health professionals and concerned citizens with information at the local, state, and national levels to identify populations at greatest risk for stroke death and in greatest need of prevention efforts.<sup>22</sup>

By 2004, state program priorities were further enhanced to improve the prevention and control of high blood pressure and high cholesterol, improve the quality of cardiovascular disease-related health care, increase public awareness of and emergency response to acute stroke and heart attack, and eliminate health disparities.<sup>26</sup> In 2004, CDC funded four state health

departments to establish Paul Coverdell National Acute Stroke Registries (Georgia, Illinois, Massachusetts, and North Carolina). In 2007, three additional states were added (Michigan, Minnesota, and Ohio). These registries are designed to monitor and improve the quality of care for acute stroke patients.

To provide additional support to states to monitor and improve the quality of care for stroke, the *Atlas of Stroke Hospitalizations Among Medicare Beneficiaries* presents national Medicare data at the county level for the aggregated time period of 1995–2002. Stroke hospitalizations were defined as those for which the principal diagnosis on the Medicare hospital claim form was cerebrovascular disease, indicated by codes 430–434 and 436–438 according to the *International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification* (ICD-9-CM). Hospitalizations for which the principal diagnosis was transient ischemic attacks (ICD-9-CM code 435) were excluded.

Data are presented for both women and men and for U.S. racial and ethnic groups, which are limited in this report to blacks, Hispanics, and whites. The national maps allow comparisons across all U.S. counties of hospitalization rates for all strokes and selected stroke subtypes. The proportions of 30-day case fatalities and those discharged to selected destinations following hospitalization for a stroke also are mapped at the county level.

We have also provided maps showing the location of all short-term general hospitals and those with neurological services, emergency departments, and rehabilitation care services.

The major limitation of this report is that the data are from Medicare Part A forms, which are administrative records collected for claims reimbursement and do not constitute a national surveillance system. Because 29% of all stroke hospitalizations in the United States occur among patients younger than 65 years,<sup>12</sup> it is not known whether the geographic patterns in this report of Medicare beneficiaries ages 65 years and older would be similar if the results included younger patients. Another limitation is that the data for race and Hispanic ethnicity are not reported separately. This reporting practice can contribute to the misclassification of race and ethnicity and the underreporting of Hispanics.<sup>27</sup> (See Appendix B for more details.)

In addition, Medicare claims do not distinguish between first or recurrent strokes, nor do they indicate the severity of the stroke. Another major limitation of using Medicare claims records is the inability to determine accuracy of physician or administrative reporting of stroke subtype diagnoses, procedures, or comorbid conditions such as hypertension, diabetes, and atrial fibrillation. Variations between states may also reflect either regional patterns in financial incentives to report specific information or regional differences in medical opinion regarding definitions for specific diagnoses.

Furthermore, there is no additional information on the claims record regarding medical management or medical therapy for the hospitalization, hospital characteristics (e.g., urban versus rural, academic medical center versus community hospital, number of beds, average number of stroke patients, availability

of stroke units or diagnostic technology), or performance indicators. Despite these limitations, Medicare claims do represent the only currently available source of state-specific and national data that allow assessment of racial/ethnic disparities and mapping of the available information about stroke hospitalizations at the county level.

An important strength of this *Atlas* is our examination of geographic disparities in stroke hospitalizations for blacks, Hispanics, and whites in the United States. Previous reports have focused predominantly on blacks and whites. Although data quality limitations exist, we hope that presenting these maps will help public health agencies and advocacy groups improve health outcomes for diverse populations. Federal agencies and other organizations have made stroke care an urgent priority and have advocated steps toward improving acute stroke care.<sup>25, 28-32</sup>

The data presented at the county and state levels give state public health agencies, quality improvement organizations, and their hospital system partners insightful information that should prompt other needs assessments and efforts to improve the availability of diagnostic equipment and hospital stroke teams with expertise in diagnosis and treatment. Better medical reporting of stroke-related information on hospital records and Medicare claims is also needed to determine whether the observed patterns genuinely reflect access to care and other quality of care issues or regional reporting biases.<sup>14</sup> Ideally, advancements in these arenas will help clinicians and hospital systems improve their quality of care for stroke patients.

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