Trends in Out-of-Hospital Deaths Due to Coronary Heart Disease in Sweden (1991 to 2006)

Kerstin Dudas, PhD; Georg Lappas, BSc; Simon Stewart, PhD; Annika Rosengren, MD, PhD

Background—Case fatality associated with a first coronary event is often underestimated when only those who survive to reach a hospital are considered. Few studies have examined long-term trends in case fatality associated with a major coronary event that occurs out of the hospital.

Methods and Results—Record linkage documented all case subjects 35 to 84 years of age in Sweden during 1991 to 2006 with a first major coronary event (out-of-hospital coronary death or hospitalization for acute myocardial infarction). Of the 384,597 cases identified, 111,319 (28.9%) died out of the hospital, and another 36,552 (9.5%) died in the hospital or within 28 days of hospitalization. From 1991 to 2006, out-of-hospital deaths as a proportion of all major coronary events declined from 30.5% to 25.6% (adjusted mean annual decrease 2.2%, 95% confidence interval 2.1% to 2.4%), however, with a larger decline in 28-day case fatality in hospitalized cases (adjusted mean annual decrease 5.8%, 95% confidence interval 5.5% to 6.0%). As a result of the faster decline in in-hospital deaths, the relative contribution of out-of-hospital deaths to overall case fatality increased, particularly among younger individuals (eg, among those 35 to 54 years of age, no more than 10.8% of all deaths occurred in hospitalized cases during 2003–2006). Although female sex (odds ratio 0.85, 95% confidence interval 0.83 to 0.87) and older age (odds ratio 0.972, 95% confidence interval 0.971 to 0.974 per year) were associated with lower risk for initial out-of-hospital death, each successive calendar year was associated with increased risk (odds ratio 1.041, 95% confidence interval 1.038 to 1.044).

Conclusions—The great majority of all fatal coronary events occur outside the hospital, and this proportion is increasing, particularly among younger individuals. (Circulation. 2011;123:46-52.)

Key Words: myocardial infarction ■ epidemiology ■ mortality ■ population ■ death, sudden

Out-of-hospital death, secondary to coronary heart disease (CHD), by its very nature occurs suddenly and often with little or no warning, representing one of the most frightening but often underestimated aspects of what is still the single biggest contributor to deaths in high-income countries. In a significant number of cases, sudden death can be the first and only manifestation of underlying CHD. Individuals with CHD fortunate enough to reach the hospital are now subject to a range of effective therapeutic modalities that have contributed to observed improvements in case fatality associated with acute myocardial infarction (AMI). It is commonly assumed that such improvements largely explain the overall decline in case fatality rates associated with CHD at the population level. Paradoxically, however, it has been suggested that improved management of AMI has only contributed to a modest 6% to 8% improvement in observed survival trends. There is no disputing that an overall decrease in the rate of individuals affected by CHD is the main driving force behind declines in CHD-related death rates in the population. However, the relative contribution of individuals who experience a sudden fatal event without being admitted to a hospital must be considered.

Clinical Perspective on p 52

Although several large and detailed patient-based registries have been used to investigate case fatality in patients hospitalized with AMI, limited data are available on out-of-hospital CHD. The linked Swedish person-based hospital and death registries offer unique opportunities to analyze trends in in-hospital and out-of hospital case fatality over a prolonged period. The aim of the present study, therefore, was to study trends in case fatality associated with a first-ever major coronary event by examining the combination of CHD-related out-of-hospital deaths and those who initially survive to reach the hospital with an AMI.

Methods

Population and Register

Sweden has a publicly financed healthcare system with hospital care available to all citizens at low cost. Swedish hospitals register principal and contributory discharge diagnoses for all patients in the national hospital discharge register. For the purpose of the present study, data from the national hospital discharge and cause-specific death registers were linked through the personal identity number, which is unique for all Swedish citizens. The hospital discharge
register has been in operation since the 1960s and has operated on a nationwide basis since 1987. From 1984 to 1986, coverage was complete for 19 of 24 Swedish counties, which represents 85% of the population. The national cause-of-death register, based on diagnoses from death certificates, in its present form is complete from 1961.

Major Coronary Events and Related Case Fatality
The population for the present study includes all first cases of AMI or fatal CHD events among persons 35 to 84 years of age who were registered in Sweden from January 1, 1991, to December 31, 2006. We excluded persons 85 years and older because of the difficulty of determining the underlying cause of death among the very old with multiple comorbidities. Only first AMIs were included, to make all calendar years comparable. To ensure that the subjects did not have a previous admission with AMI, registrations from 1980 to 1990 were used to exclude patients with a prior diagnosis of AMI. We used a time frame of 7 years, during which a person with an AMI who had not been admitted within a minimum of 7 years previously was considered to have a first AMI. This was done to ensure that estimates for all years were performed in a standardized manner. The International Classification of Diseases (ICD) version 9 (ICD-9) was used from 1987 to 1996 and version 10 (ICD-10) from 1997 onward. A first event was defined as either hospitalization for a first AMI (a principal diagnosis of ICD-9 410 or ICD-10 I21) or death with CHD as an underlying diagnosis (ICD-9 410 to 414; ICD-10 120 to 125) in persons not admitted to the hospital and with no record of a prior AMI (within 7 years). Out-of-hospital death was defined as a death due to CHD in a person who was not hospitalized, as defined by not having a recorded admission on the day of death. Persons brought in with a cardiac arrest to the emergency department in whom resuscitation attempts were unsuccessful would be defined as an out-of-hospital death. Case fatality was defined as (1) all out-of-hospital deaths for which CHD was listed as the primary cause of death and the affected individual had not previously been hospitalized with AMI (n=111 319) and (2) fatalities that occurred within 28 days after a first hospitalization for AMI (36 552 of whom died within 28 days among 273 278 patients who were admitted).

Comorbidity was defined as any principal or concomitant diagnosis in a prior admission within 7 years before the index admission, categorized as diabetes (ICD-9 code 250; ICD-10 E10, E11, or E14), hypertension (ICD-9 401 to 405; ICD-10 I10-I15, stroke (ICD-9 430 to 438; ICD-10 I60 to I69), valvular disease (ICD-9 393 to 398, 424; ICD-10 I05 to I09, I34, or I35), heart failure (ICD-9 428; ICD-10 I50), unexplained chest pain (ICD-9 776F; ICD-10 R07.4), angina (ICD-9 413; ICD-10 I20), atrial fibrillation (ICD-9 427D; ICD-10 I48), cardiomyopathy (ICD-9 425; ICD-10 I42), pulmonary embolism (ICD-9 415B; ICD-10 I26), chronic obstructive lung disease (ICD-9 490 to 496; ICD-10 J44), asthma (ICD-9 493; ICD-10 J45), and cancer (ICD-9 140 to 239; ICD-10 C00 to D48). Diagnoses that refer to risk factors other than hypertension, such as dyslipidemia, obesity, and nicotine addiction, are very rarely recorded.

Validation of Registers
The coverage of the hospital discharge register from 1987 is 99% complete. A random sample of records from patients discharged with a diagnosis of either AMI or other coronary disease has been validated. The predefined criteria for a definite AMI were met in 86%, with possible AMI diagnosed in an additional 9%. In records with a diagnosis of CHD other than AMI (ICD-9 410 to 414), 3% met the criteria for AMI. A recent small Swedish 1-center study demonstrated that at least 95% of cases discharged with an AMI diagnosis fulfilled criteria; in the rest, there were insufficient data, but AMI could not be excluded. This uncertainty pertained particularly to patients older than 80 years and to those for whom AMI was a secondary diagnosis.

Swedish law requires an autopsy for persons who die outside the hospital if the cause of death is unknown. Autopsy rates for out-of-hospital deaths in the present study increased during 1991 to 2006 from 65% to 86% (overall 81%) for persons 35 to 54 years of age, from 48% to 75% for those 55 to 64 years of age (overall 68%), and from 37% to 53% for those 65 to 74 years of age (overall 49%) and remained approximately 26% throughout the period for those 75 to 84 years of age.

Statistical Analysis
Means and proportions for continuous and categorical variables were calculated for persons who died outside the hospital and were compared with those who died in the hospital within 28 days, with odds ratios (ORs), 95% confidence intervals (CIs), and P values calculated by the use of logistic regression. Differences in proportions were assessed with χ² tests, and t tests were used for continuous variables. The log-odds of mean annual change in 28-day mortality (total, in patients who died without being admitted, and in hospitalized patients), expressed as ORs with 95% CIs were modeled as a linear function of age, sex, and calendar year. When we tested potential deviations from linearity, there were only very minor effects, which were not relevant to the overall findings of the study. To evaluate the independent contribution of calendar year, age, sex, and relevant comorbidities were introduced into a multivariable logistic regression analysis. Only P values <0.0001 were considered significant. All analyses were performed with SAS version 9.2 and R version 2.6.

Ethics Approval
The study was approved by the Ethics Review Board at the University of Gothenburg. All personal identifiers were removed before analysis.

Results
Total Case Fatality
During the 16-year study period, a total of 384 597 persons 35 to 84 years of age (34.9% women, mean age 70.5 years) had a first recorded major coronary event. The demographic and clinical profile for the entire cohort and according to the timing of their first major coronary event is provided in Table 1.

Table 2 compares the profile of affected individuals according to their survival status to 28 days. In addition to the 111 319 out-of-hospital deaths (28.9% of the total cohort), a further 36 552 (9.5%) died within 28 days of being hospitalized with a first-ever AMI. The overall proportion of those surviving to 28 days after their first major coronary event was therefore 61.6%. On average, those who experienced an initial out-of-hospital death were 2 years younger than those who initially survived to reach a hospital but died within 28 days (mean age of 72.7 versus 74.9 years, P<0.0001; among persons surviving 29 days or more, mean age was 68.7 years, P<0.0001 compared with all fatal cases). Compared with individuals who initially survived to reach the hospital but died within 28 days, those who had an out-of-hospital death were less frequently female (OR 0.74) and had lower rates of diabetes (OR 0.41), hypertension (OR 0.59), stroke (OR 0.94), unexplained chest pain (OR 0.89), angina pectoris (OR 0.79), and malignancy (OR 0.69). Prior hospitalization for heart failure (OR 1.22) or atrial fibrillation (OR 1.32) was more common among those who died outside of the hospital (all P<0.0001). When all fatal cases were compared with survivors, with adjustment for age, fatal cases were slightly less likely to be female or to have a prior hospital diagnosis of diabetes or hypertension (conditions often managed on an outpatient basis) but were more likely to have a range of other comorbid conditions, most notably heart failure (OR 2.48) and cardiomyopathy (OR 3.06).

Gradients Across Age and Time Periods
A clear gradient according to age was observed with respect to both initial out-of-hospital deaths and subsequent case
fatality within 28 days (Table 3). For example, among those 35 to 54 years of age, 17.6% died outside the hospital and a further 2.8% died in the hospital, with 1 in 5 not surviving their first major coronary event beyond 28 days. These proportions rose to 34.8% and 13.5% in those 75 to 84 years of age, so that just more than 1 in 2 survived in the short term. Overall, 1 in 4 deaths (24.7%) occurred in a hospital. Once again, there was an age-related gradient, which ranged from 14.0% among those 35 to 54 years of age to 28.0% in the oldest age group.

Table 1. Demographic and Clinical Characteristics of 384,597 Men and Women With a First Major Coronary Event in Sweden (1991 to 2006) According to Timing of Event

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<thead>
<tr>
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<tbody>
<tr>
<td>No.</td>
<td>105,160</td>
<td>97,377</td>
<td>93,745</td>
<td>88,315</td>
<td>384,597</td>
</tr>
<tr>
<td>Women, n (%)</td>
<td>36,388 (34.6)</td>
<td>33,717 (34.6)</td>
<td>33,452 (35.7)</td>
<td>30,857 (34.9)</td>
<td>134,414 (34.9)</td>
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<tr>
<td>Mean age, y</td>
<td>70.5 (10.2)</td>
<td>70.5 (10.4)</td>
<td>70.6 (10.5)</td>
<td>70.4 (10.7)</td>
<td>70.5 (10.5)</td>
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<td>Diabetes, n (%)</td>
<td>12,704 (12.1)</td>
<td>12,949 (13.3)</td>
<td>13,815 (14.7)</td>
<td>14,103 (16.0)</td>
<td>53,571 (13.9)</td>
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<tr>
<td>Hypertension, n (%)</td>
<td>12,407 (11.8)</td>
<td>15,123 (15.5)</td>
<td>17,498 (18.7)</td>
<td>23,402 (26.5)</td>
<td>68,430 (17.8)</td>
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<tr>
<td>Stroke, n (%)</td>
<td>8,041 (7.6)</td>
<td>8,602 (8.8)</td>
<td>8,683 (9.3)</td>
<td>7,151 (8.1)</td>
<td>32,477 (8.4)</td>
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<td>Valvular disease, n (%)</td>
<td>2,035 (1.9)</td>
<td>2,164 (2.2)</td>
<td>2,293 (2.4)</td>
<td>2,081 (2.4)</td>
<td>8,573 (2.2)</td>
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<td>Heart failure, n (%)</td>
<td>11,400 (10.8)</td>
<td>12,084 (12.4)</td>
<td>11,278 (12.0)</td>
<td>9,735 (11.0)</td>
<td>44,497 (11.6)</td>
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<td>Unexplained chest pain, n (%)</td>
<td>9,998 (3.8)</td>
<td>14,567 (15.5)</td>
<td>17,498 (18.7)</td>
<td>23,402 (26.5)</td>
<td>85,732 (22.7)</td>
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</table>


<table>
<thead>
<tr>
<th>Comparison of Those Who Died Within 28 Days of First-Ever Major Coronary Event According to Timing of Death</th>
<th>Comparison of Survivors to 28 Days vs Deceased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out-of-Hospital Death &amp; Days of Admission*</td>
<td>Survived &gt; 28 d &amp; P</td>
</tr>
<tr>
<td>No. (% of total)</td>
<td>111,319 (28.9)</td>
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<tr>
<td>Mean age, y (SD)</td>
<td>72.7 (9.5)</td>
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<tr>
<td>Women, n (%)</td>
<td>37,864 (34.0)</td>
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<tr>
<td>Diabetes, n (%)</td>
<td>10,226 (9.2)</td>
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<td>Hypertension, n (%)</td>
<td>13,273 (11.9)</td>
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<td>Stroke, n (%)</td>
<td>12,867 (11.6)</td>
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<td>Valvular disease, n (%)</td>
<td>3,456 (3.1)</td>
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<td>Heart failure, n (%)</td>
<td>21,338 (19.2)</td>
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<td>Unexplained chest pain, n (%)</td>
<td>5,156 (4.6)</td>
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<tr>
<td>Angina, n (%)</td>
<td>14,555 (13.1)</td>
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<td>Atrial fibrillation, n (%)</td>
<td>14,662 (13.2)</td>
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<td>Cardiomyopathy, n (%)</td>
<td>1,107 (1.0)</td>
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<td>Pulmonary embolism, n (%)</td>
<td>1,392 (1.3)</td>
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<td>Chronic obstructive lung disease, n (%)</td>
<td>4,871 (4.4)</td>
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<tr>
<td>Asthma, n (%)</td>
<td>1,779 (1.6)</td>
</tr>
<tr>
<td>Cancer, n (%)</td>
<td>10,265 (9.2)</td>
</tr>
</tbody>
</table>

*Includes all case fatalities that occurred during the index AMI hospitalization and “secondary” out-of-hospital deaths (ie, after admission) that occurred within 28 days.
†OR for a fatal event occurring out of the hospital (with no prior admission for CHD).
‡OR for dying within 28 days.
In 1991 to 1994, total 28-day case fatality was 42.8% compared with 32.4% in 2003 to 2006 (mean annual decrease of 4.1%, 95% CI 3.9% to 4.2%). The proportion of all hospitalized individuals with AMI who died within 28 days decreased from 12.3% to 6.8% (mean annual decrease 5.8%, 95% CI 5.5% to 6.0%). Among those admitted, the corresponding decrease in case fatality was from 17.7% to 9.1%. The decline in out-of-hospital case fatality was from 30.5% to 25.6% (mean annual decrease 2.2%, 95% CI 2.1% to 2.4%). Among those <55 years old, 1.9% died in the hospital during the last period, with 15.7% dying outside the hospital, which brought the proportion of all deaths within 28 days that occurred in the hospital in this age group down to 10.8% (Figure 1). Even if substantially lower, compared with 1991 to 1994, total 28-day case fatality in the oldest age groups remained high, being 41.1% in 2003 to 2006, with only 1 in 4 deaths in patients admitted to a hospital. A lower proportion of deaths among men occurred in the hospital than did deaths among women (Figure 2); however, trends over time were roughly similar among men and women.

### Broad Population Trends

These broad changes in the survival profile of individuals experiencing a first-ever coronary event translated to important trends at the population level. Overall, population mortality rates associated with a first-ever major coronary event in Sweden declined from 245 to 131 per 100 000 population during the period 1991 to 2006. This decline was attributable to an overall decrease in the rates of both out-of-hospital deaths (from 169 to 106 per 100 000) and death within 28 days of hospitalization for AMI (from 76 to 25 per 100 000 population). Figure 3 shows the relative contribution of out-of-hospital deaths versus those that occurred in hospital-
Correlates of Out-of-Hospital Versus 28-Day Case Fatality

To evaluate the respective contribution of the various factors associated with death that occurred outside a hospital among all fatal cases, a multivariable analysis was performed (Table 4). Increasing age (adjusted OR 0.97 for each year) and female sex (OR 0.85) were associated with a lower probability of dying out of the hospital, as were hypertension, diabetes, angina, and prior malignancy (OR range of 0.40 to 0.82). In contrast, heart failure (adjusted OR 1.46) and atrial fibrillation (OR 1.35) were associated with an increased probability of dying out of the hospital. Overall, the probability of dying out of the hospital increased by 4% per calendar year, independently of other factors (all \( P < 0.0001 \)).

Discussion

We examined the pattern of first-ever major coronary events (comprising out-of-hospital deaths due to CHD and 28-day case fatality after a first-ever admission for AMI) in almost 400,000 individuals in Sweden over a 16-year period. Overall, 3 in 4 fatalities represented out-of-hospital deaths. Even though case fatality declined overall, observed trends were strongest in relation to 28-day case fatality after AMI hospitalization. As a result, the proportional contribution of out-of-hospital deaths to overall fatal events increased over the study period. Clear age-related gradients were observed for all trends. For example, in those <65 years of age, nearly 9 of 10 fatal events during the period 2003 to 2006 occurred in those who did not survive to reach the hospital. On an adjusted basis, male sex and younger age were associated with higher risk of out-of-hospital death, with each successive calendar year being associated with a 4% increased risk for such an event.

Findings in the Context of the Literature

It is well known that the majority of coronary deaths occur outside the hospital. In a United Kingdom study dating from the mid 1990s, 74% of 1589 deaths due to AMI in people <75 years old occurred outside the hospital; the proportion of out-of-hospital to total deaths varied inversely with age from 91% at age <55 years to 67% at age 70 to 74 years. In a large registry study conducted from 1986 to 1995, which included >200,000 cases of first fatal and nonfatal AMI, population-based out-of-hospital death rates declined. Studies from the United States have shown that the decline in case fatality in subjects hospitalized for CHD was greater than observed declines in out-of-hospital CHD deaths. Although confirming the results of prior studies, the present study provides an important contribution to our understanding of the contemporary balance between short-term case fatality in hospital cases versus out-of-hospital deaths related to CHD. Moreover, it highlights some important differences in the profile of those affected, with the potential to target high-risk groups (particularly younger men, cases of heart failure without a documented AMI, and patients with atrial fibrillation).

Methodological Considerations

A critical factor in the study of fatal coronary events is the denominator for the calculations. In the general population, both out-of-hospital deaths and short-term case fatality in those surviving to hospital with a coronary event are decreasing, chiefly owing to declining event rates overall. However, changes in event rates have become increasingly difficult to measure, not only because of changes in the definition of AMI but also because of decreasing severity. Accordingly, we explicitly acknowledge that the use of the denominator for the hospitalized cohort of individuals with AMI is problematic for a like-for-like comparison over an extended period of time. As a result, the relative decline in associated case fatality may be inflated by the inclusion of milder cases. This obviously will not apply to fatal cases, which is the denominator for the comparison between patients dying with or without reaching the hospital.

To represent out-of-hospital coronary deaths, we selected the wider group of deaths due to any coronary diagnosis, rather than restricted to AMI, because a developing AMI may not be recognized at autopsy. Accordingly, out-of-hospital deaths in the present study represent a broad spectrum of...
cases from ST-elevation AMI with acute thrombus to ventricular arrhythmia in a failing myocardium with scars from prior silent AMIs. The underlying pathology of sudden coronary death is complicated. In a study of 168 consecutive cases of sudden coronary death, three quarters were demonstrated at autopsy to have had a recent coronary thrombotic lesion, and the rest were thought to have had a primary arrhythmia on the basis of preexisting myocardial hypertrophy or scarring.25 Another series from the United States showed fresh or organized thrombi in 74%, and the rest had stable plaques, with or without healed AMI.26

Importantly, we excluded patients with prior hospital registrations for AMI but not angina pectoris. The reason why people who died out of the hospital had less diabetes and hypertension could be because they, like angina patients, were more likely to have been prescribed aspirin, β-blockers, and statin drugs; however, because there was no available information on drugs, we were unable to address this. The slightly startling finding of an overall lower risk of death in subjects with diabetes is probably due to misclassification in the use of prior hospital diagnoses as a method to classify a condition that to a large extent is treated on an outpatient basis. Conversely, the increased risk of out-of-hospital death for patients with prior heart failure or atrial fibrillation is likely due to myocardial or arrhythmogenic factors associated with those conditions, either because of acute ischemia or because of misclassification. Even so, the contribution of CHD to the cause of heart failure is significant.

Out-of-hospital death is sometimes used as a proxy for sudden coronary death, for which, in turn, different definitions exist based on death occurring either within 1 or within 24 hours of the person last having been seen well. In the present study, details of death were not available, other than that it occurred without hospital admission. In a recent study from the United Kingdom of 1290 out-of-hospital CHD deaths or cases of cardiac arrest, fewer than half were witnessed,27 which indicates that a 1-hour definition, even if the data were available, would decrease the proportion with sudden cardiac death considerably.

There is a need for more knowledge about CHD deaths that occur out of the hospital. The linking of the national hospital discharge register and the national cause of death register made it possible to identify all first cases in a well-defined large population, whereas other studies have been restricted to smaller samples.13,21 Reports, however, appear consistent in that many fatal events still occur out of the hospital in spite of the improvement in CHD mortality and advances in CHD medical treatment, prevention, and emergency transport systems.12,15,28–30

In addition to those highlighted above, there are some limitations to the present study; one is its reliance on an administrative register, with the quality of the statistics obviously of fundamental importance. In the Framingham Heart Study, death certificates for deaths due to out-of-hospital CHD were compared with physician-adjudicated sudden cardiac deaths, which showed that these deaths were overestimated by 47%.31 However, because there was a limit of symptoms lasting <1 hour to define a sudden death, those results are not strictly comparable to the present study. Other validation studies have shown much greater validity for a death certificate diagnosis of CHD in out-of-hospital deaths. In the study by Norris et al,33 in which the results bear a striking resemblance to the present findings, with 91% of fatalities among those younger than 55 years occurring out of the hospital, 86% of the 1589 cases identified as having died out of the hospital underwent an autopsy, with the rest being carefully validated clinically. A recent US series of unselected cases who died unexpectedly found severe subclinical CHD in >80%.34 The most striking finding from the present study was that nearly 9 of 10 deaths among younger victims from the most recent period occurred out of the hospital. Bearing in mind that the autopsy rates for the present study population were quite high among persons with out-of-hospital deaths who were less than 65 years old, misclassification of noncoronary deaths as CHD deaths is probably relatively minor but may obviously be higher among older persons, for whom autopsy rates were low. The accuracy of death certificate diagnosis of CHD for patients who died in the hospital was not determined in the present study; however, given that more detail was known about the decedent, it was presumably less subject to misclassification than out-of-hospital death.

Conclusions

Of all deaths related to a first-ever manifestation of a major coronary event in Sweden over the longer term, almost 80% occurred as an out-of-hospital death in 2003 to 2006. An increasing proportion of fatal coronary events occur in the out-of-hospital setting and beyond the reach of advanced hospital care. It is therefore of concern that the time from onset of chest pain to arrival at the hospital has not improved despite community education efforts.33 Furthermore, modeling studies have shown that lifestyle-related changes in risk factors are quantitatively more important than interventions in acute coronary syndromes,7–9 although lower estimates for primary prevention have also been found.34 At least in younger persons, case fatality associated with hospital care for an AMI is now very low. To achieve further reduction in CHD-related case fatality, primary prevention is increasingly more important, as are efforts to persuade individuals to seek hospital treatment as soon as symptoms of a major coronary event occur.

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Disclosures

None.

References

One of the most frightening aspects of coronary heart disease is that many people die suddenly, out of the hospital, and with little or no warning. With modern treatment and with decreasing case severity in hospitalized cases, hospital mortality, morbidity, and medical care from 1985 through 1997: the FINAMI study. Circulation. 2003;108:691–696.


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