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Clinical paper

Cardiac arrest patients in the emergency department—National Hospital Ambulatory Medical Care Survey, 2001–2007☆

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ABSTRACT

Aim of the study: Few studies have focused on the full complement of cardiac arrest cases seen in hospital emergency departments (ED). The aims of our study were to describe cardiac arrest visits in the ED by using a nationally representative sample of U.S. adults.
Methods: ED data from the 2001–2007 National Hospital Ambulatory Medical Care Survey (NHAMCS) were analyzed. Cardiac arrest visits were considered to be those with an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code of 427.5 as the primary diagnosis.
Results and conclusions: From 2001 to 2007, adults in the U.S. made an estimated 600,729,000 ED visits. Of those, 1,001,000 (0.17%) had a primary diagnosis of cardiac arrest. The majority of patients with such visits were dead on arrival or died in the ED (74.0%). The mean age for cardiac arrest visits was 66.7 years (95% confidence interval [CI], 64.6–68.8 years). Women had a lower rate of cardiac arrest visits than men (age-adjusted odds ratio [AOR], 0.6; 95% CI, 0.5–0.8), and the privately insured (AOR, 0.4; 95% CI, 0.2–0.7) and those with government insurance (AOR, 0.5; 95% CI, 0.3–0.9) had a lower proportion of cardiac arrest ED visits than uninsured persons. In addition, increasing age was a significant predictor of cardiac arrest visits. Cardiac arrest visits did not vary significantly by race, geographic region, or metropolitan statistical area. ED visits classified as cardiac arrest represent 1 in 600 visits and these visits differ by age, sex, payment source, and arrival time at the ED.

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1. Introduction

Cardiac arrest is the cessation of the heart's mechanical activity, which results in loss of blood flow to the brain and other vital organs. Each year in the U.S. approximately 300,000 out-of-hospital cardiac arrests are treated by emergency medical services (EMS).[1] Indeed, only about 60% of all out-of-hospital cardiac deaths are treated by EMS.[1] Many patients who suffer cardiac arrest are transported to hospitals for additional emergency care. Rates of survival to hospital discharge vary widely, but the median survival rate to discharge after EMS-treated out-of-hospital cardiac arrest is 7.9%.[1–3] Outcomes of cardiac arrest depend on many factors, particularly immediate recognition of cardiac arrest and rapid activation of EMS via 9-1-1, cardiopulmonary resuscitation started quickly, early defibrillation, effective advanced life support, and post-cardiac arrest care.[4,5]

Not surprisingly, the majority of the published literature has focused on out-of-hospital or in-hospital cardiac arrests; few studies have focused on the characteristics of all patients with cardiac arrest who are seen in the emergency department (ED).[6] Therefore, the purpose of this study was to examine the National Hospital Ambulatory Medical Care Survey (NHAMCS) for the years 2001–2007 to describe cardiac arrest visits in EDs in the U.S. and to examine variations in such visits (as a proportion of all ED visits) by demographic and other characteristics.

2. Methods

The NHAMCS, a national probability sample survey conducted by the Centers for Disease Control and Prevention (CDC)/National Center for Health Statistics (NCHS), uses a 4-stage probability design that begins with samples of primary sampling units (PSUs), hospitals within PSUs, clinics/EDs within the hospitals selected, and finally selecting patient visits within the clinics/EDs. Within the clinics or ED, patient visits are systematically selected over a randomly assigned 4-week reporting period. The survey is restricted to noninstitutional general and short-stay hospitals, excluding Federal, military, and Veterans Administration hospitals, located in the 50 states and the District of Columbia. Data were collected

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on a brief, 1-page patient record form by trained hospital staff or Census data collection agents and included the patient's age, sex, race/ethnicity, expected source of payment, mode of arrival (recorded for survey years 2003–2007 only), vital signs, diagnostic and therapeutic services provided, and the disposition of the visit (e.g., whether the patient was hospitalized, died, or discharged to home). In addition, the data included up to 3 physician's diagnoses, as many as 3 reasons for the visit as stated in the patient's own words if possible, and medications that were prescribed, provided, or continued at the visit. Physician's diagnoses were coded according to the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM).

The present analysis focuses on ED data for adults aged ≥18 years; cardiac arrest visits were defined as those having an ICD-9-CM code 427.5 as the primary diagnosis. The primary expected source of payment was categorized as private, government (Medicare, Medicaid), no insurance (self-pay), or other. Other payment sources, including unknown, missing, or no charge were combined because of the small number of sample records. Hospital location was identified by presence (yes, no) in a metropolitan statistical area (MSA) and by geographic region. MSA was based on the actual location of the hospital and the definition of the Bureau of the Census and the U.S. Office of Management and Budget. Four geographic regions, corresponding to those used by the Bureau of the Census, were employed. Arrival time was divided into 4 6-h intervals (12:01 am–6:00 am, 6:01 am–12:00 pm, 12:01 pm–6:00 pm, 6:01 pm–12:00 am) to match a recently published report.[7]

Percentages and their 95% confidence intervals (CIs) for cardiac arrest visits among all ED visits were determined by patient characteristics and are expressed per 1000 visits. Such percentages were determined by sex, age, race, payment source, geographic region, MSA status, and arrival time. Separate logistic regression models were used to assess the odds of a cardiac arrest visit (as a proportion of all ED visits) for the selected patient characteristics after adjusting for age. All analyses took into account the complex survey design and sampling weights. National estimates of visits made by all patients to EDs in the U.S. were obtained by aggregating the patient visit weight (inflation factor) assigned to each record. As required by NCHS, all estimates were based on at least 30 sample records and a relative standard error <30% to ensure their reliability.[8] Approximately 11 to 12 percent of the records each year were missing data on race; information on this variable was imputed by NCHS by randomly assigning a value from a patient record form with similar characteristics. Because of the sample size, data on ethnicity (Hispanic, non-Hispanic) could not be reliably calculated and are not presented. A P value of 0.05 was considered to be significant, and all analyses were completed using SAS, version 9.2, and SUDAAN, version 10.0.

3. Results

Of the 192,748 ED visits made by adults from 2001 to 2007 in this sample, 317 were due to cardiac arrest. After weighting, this represented a total of 601 million ED visits nationally, 264 million by men and 337 million by women (data not shown). Of the total visits, an estimated 1,001,000 (0.17%) carried a primary diagnosis of cardiac arrest (Table 1). Of these, 93.9% (95% CI, 88.5–96.9%) involved arrival by ambulance, 51.0% (95% CI, 42.9–59.0%) included cardiopulmonary resuscitation (CPR) performed in the ED, 74.0% (95% CI, 66.5–80.3%) involved patients who were dead on arrival (DOA) or died in the ED, and 16.4% (95% CI, 11.4–22.9%) included admission to the hospital (data not shown).

Men made 55.5% of the cardiac arrest visits (Table 1), and their rate of such visits as a percentage of all their ED visits was higher than that for women (2.1/1000 vs. 1.3/1000, Table 2). The mean age of patients making cardiac arrest visits was 66.7 years (95% CI, 64.6–68.8 years; data not shown); 60% of such visits were made by adults aged ≥65 years (Table 1). Among cardiac arrest visits, 76.5% were made by whites and 22.6% by blacks (Table 1), but the rate of such visits per 1000 ED visits was 1.7 for both groups (Table 2). For more than half of the cardiac arrest visits, government insurance was the payment source; in 13% of visits there was no insurance. In all, 45% of cardiac arrest visits were in the South, one-quarter were made in the Midwest, 17% were in the Northeast, and 13% were in the West. Most of the visits (81%) occurred in MSAs, and for 30% of the visits the patient arrived at the ED between 12:01 pm and 6:00 pm.

The age-adjusted proportion of ED visits that were considered cardiac arrest visits was lower among women than men (adjusted odds ratio [AOR] for women, 0.6; 95% CI, 0.5–0.8), and age was a significant predictor of cardiac arrest visits as a proportion of all ED visits (Table 2). For example, using persons aged 18–44 years as the referent, the AOR for cardiac arrest visits was significantly higher among all older age groups: for 45–54: AOR, 3.1, 95% CI, 1.8–5.4; 55–64: 8.1, CI, 4.6–14.0; 65–74: 13.5, CI, 8.8–20.8; ≥75: 14.4, CI, 9.2–22.6. Compared with the rate of cardiac arrest visits (as a proportion of all ED visits) for those with no insurance, rates for the privately insured (AOR, 0.4; CI, 0.2–0.7) and those with government insurance (AOR, 0.5; CI, 0.3–0.9) were significantly lower. In addition, the frequency of cardiac arrest visits as a share of all ED visits varied significantly across time blocks. Using the 12:01 am to

Table 1
Characteristics of cardiac arrest visits in the emergency department—National Hospital Ambulatory Medical Care Survey, 2001–2007.

Characteristic	Cardiac arrest as a primary diagnosis	
	No.	%[a] (95% CI)[b]
Total	1,001,000	0.17 (0.15–0.19)
Sex		
Male	555,000	55.5 (49.1–61.7)
Female	446,000	44.5 (38.3–50.9)
Age, y		
18–44	120,000	12.0 (8.4–16.7)
45–54	107,000	10.7 (7.4–15.1)
55–64	177,000	17.6 (12.0–25.2)
65–74	233,000	23.3 (17.5–30.2)
≥75	365,000	36.4 (30.0–43.4)
Race		
White	766,000	76.5 (68.9–82.7)
Black	226,000	22.6 (16.4–30.2)
Other	[c]	[c]
Payment source		
Private	180,000	17.9 (12.3–25.4)
Government	590,000	58.9 (51.9–65.6)
No insurance	134,000	13.4 (9.2–18.9)
Other	98,000	9.8 (6.3–15.0)
Geographic region[d]		
Northeast	166,000	16.6 (12.0–22.5)
Midwest	254,000	25.3 (18.5–33.7)
South	449,000	44.9 (37.1–52.9)
West	132,000	13.2 (9.3–18.4)
Located in metropolitan statistical area		
Yes	812,000	81.1 (71.7–87.9)
No	189,000	18.9 (12.1–28.3)
Arrival time		
12:01 am–6:00 am	188,000	19.0 (14.0–25.4)
6:01 am–12:00 pm	226,000	22.9 (17.1–29.8)
12:01 pm–6:00 pm	294,000	29.8 (23.8–36.6)
6:00 pm–12:00 am	280,000	28.3 (22.2–35.3)

[a] Weighted percentages.
[b] CI indicates confidence interval.
[c] Data for other not presented because estimates may be unreliable due to small samples.
[d] Northeast = CT, ME, MA, NH, NJ, NY, PA, RI, VT. Midwest = IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI. South = AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV. West = AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY.