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ABSTRACT

BACKGROUND

The incidence of ventricular fibrillation or pulseless ventricular tachycardia as the first recorded rhythm after out-of-hospital cardiac arrest has unexpectedly declined. The success of bystander-deployed automated external defibrillators (AEDs) in public settings suggests that this may be the more common initial rhythm when out-of-hospital cardiac arrest occurs in public. We conducted a study to determine whether the location of the arrest, the type of arrhythmia, and the probability of survival are associated.

METHODS

Between 2005 and 2007, we conducted a prospective cohort study of out-of-hospital cardiac arrest in adults in 10 North American communities. We assessed the frequencies of ventricular fibrillation or pulseless ventricular tachycardia and of survival to hospital discharge for arrests at home as compared with arrests in public.

RESULTS

Of 12,930 evaluated out-of-hospital cardiac arrests, 2042 occurred in public and 9564 at home. For cardiac arrests at home, the incidence of ventricular fibrillation or pulseless ventricular tachycardia was 25% when the arrest was witnessed by emergency-medical-services (EMS) personnel, 35% when it was witnessed by a bystander, and 36% when a bystander applied an AED. For cardiac arrests in public, the corresponding rates were 38%, 60%, and 79%. The adjusted odds ratio for initial ventricular fibrillation or pulseless ventricular tachycardia in public versus at home was 2.28 (95% confidence interval [CI], 1.96 to 2.66; P<0.001) for bystander-witnessed arrests and 4.48 (95% CI, 2.23 to 8.97; P<0.001) for arrests in which bystanders applied AEDs. The rate of survival to hospital discharge was 34% for arrests in public settings with AEDs applied by bystanders versus 12% for arrests at home (adjusted odds ratio, 2.49; 95% CI, 1.03 to 5.99; P=0.04).

CONCLUSIONS

Regardless of whether out-of-hospital cardiac arrests are witnessed by EMS personnel or bystanders and whether AEDs are applied by bystanders, the proportion of arrests with initial ventricular fibrillation or pulseless ventricular tachycardia is much greater in public settings than at home. The incremental value of resuscitation strategies, such as the ready availability of an AED, may be related to the place where the arrest occurs. (Funded by the National Heart, Lung, and Blood Institute and others.)

THE INCIDENCE OF VENTRICULAR FIBRILlation or pulseless ventricular tachycardia as the first recorded rhythm in out-of-hospital cardiac arrest has declined dramatically in the past several decades.[1,2] Thirty years ago, 70% of such arrests were characterized by initial ventricular fibrillation or pulseless ventricular tachycardia; today, the incidence is 23%.[3,4] This decline is of substantial importance for public health, since more than 300,000 Americans have an out-of-hospital arrest each year, with an estimated survival rate of 7.9% nationally,[5] and the majority of survivors are in the subgroup of persons whose initial rhythm is ventricular fibrillation or pulseless ventricular tachycardia.[3]

Controlled clinical trials have shown that "public access defibrillation" — that is, the use of automated external defibrillators (AEDs) in public settings by trained laypersons — improves survival after an out-of-hospital cardiac arrest.[6] In contrast, layperson use of AEDs in residential settings has not proved to be of benefit, possibly owing in part to a lower prevalence of ventricular fibrillation or pulseless ventricular tachycardia as the initial rhythm.[7] These observations suggest that the incremental value of certain resuscitation strategies, such as the ready availability of an AED, may be related to the setting in which the arrest occurs.

The purpose of this study was to assess the frequency of initially identified ventricular fibrillation or pulseless ventricular tachycardia and survival among patients whose cardiac arrest was witnessed in a public setting or at home and, in particular, when an AED was applied by a bystander.

METHODS

STUDY DESIGN AND PATIENTS

The Epidemiologic Cardiac Arrest Registry of the Resuscitation Outcomes Consortium (ROC Epistry–Cardiac Arrest) is a population-based emergency-medical-services (EMS) registry of out-of-hospital cardiac arrest.[3] We carried out a prospective, multicenter, population-based cohort study involving patients who were assessed or treated by one or more of 208 ROC EMS agencies and their receiving institutions at seven U.S. sites (Alabama, Dallas, Iowa, Milwaukee, Pittsburgh, Portland [OR], and Seattle–King County) and at three Canadian sites (Ottawa, Toronto, and British Co-lumbia). The study sites provided data for cardiac arrests that occurred between December 1, 2005, and March 31, 2007.[8]

Study patients included all persons 19 years of age or older with nontraumatic out-of-hospital cardiac arrest for whom external defibrillation was attempted (by lay bystanders or EMS personnel) or who were treated with chest compressions (by EMS personnel). The study was approved by the institutional review boards of the University of Washington (data coordinating center) and the participating U.S. and Canadian study sites. The requirement for informed consent was waived because the study was considered to meet the criteria for minimal risk.

DATA COLLECTION

Information about each subject was collected with the use of uniform definitions developed by the ROC investigators and included Utstein data elements.[9] The data elements included demographic characteristics of the patients, circumstances of the arrests, characteristics of care, and survival status. Data were collected by trained personnel who followed uniform procedures to ensure the validity and reproducibility of the data. All data recorded at study entry were subject to error, logic, and cross-form checks, which maximized the accuracy of the data. Routine, random, centralized review confirmed the initial rhythm as a stable, reproducible variable. Data were de-identified in compliance with the Health Insurance Portability and Accountability Act.

STUDY DEFINITIONS

A public location was defined as a street or highway, public building, place of recreation, industrial place, or other public property, excluding health care facilities (hospitals, medical clinics, and other health care institutions). A private location was defined as a home (the principal focus of this study), a residential institution (typically a nursing home), or some other nonpublic setting (usually a rural farmland location). Bystander-witnessed cardiac arrest was defined as an arrest observed by a person who was not part of the EMS system. AED application by a bystander was defined as AED placement (with or without delivery of a shock) by a person (or more than one person) outside the EMS system, including police on the scene before the arrival of EMS personnel. Bystander-administered AED shock was defined

as a shock that was delivered by non-EMS personnel before the arrival of EMS personnel. An EMS-witnessed arrest was defined as a cardiac arrest that occurred in the presence of a member of the EMS response team. In the few instances in which it could not be determined whether a bystander had witnessed the arrest or had applied an AED or administered a shock, we assumed that the event was not witnessed or that an AED was not applied. Survival to hospital discharge was determined from available records (hospital or EMS records in most cases and public or media sources in rare cases).

FIRST RECORDED RHYTHM

Ventricular fibrillation or pulseless ventricular tachycardia was presumed to be the initial cardiac-arrest rhythm if the shock was delivered by a bystander-applied AED. The initial rhythm as assessed by EMS personnel was determined from the electronic electrocardiographic (ECG) recordings (in 25% of cases) or paper rhythm tracings (in 24%) derived from defibrillators or from descriptions of the initial rhythm in the EMS record (in 51%).

To confirm the accuracy of the reported initial rhythm, 30 arrests were randomly selected from each of four strata, defined by the location of the arrest (home vs. public location) and the first recorded rhythm (shockable [ventricular fibrillation or pulseless ventricular tachycardia] vs. nonshockable), and these 120 arrests were independently reevaluated by three of the authors on the basis of the EMS record, defibrillator ECG recordings, or both. The 13 arrests for which source documents could not be obtained were excluded from the reevaluation study. Rhythm diagnoses were completely concordant among the reviewers, who disagreed with a site interpretation of the reported rhythm in only 3 of 107 cases, for an estimated error rate of 3.1% (95% confidence interval [CI], 0.0 to 7.8) (taking into account the sampling rates for the four strata).

STATISTICAL ANALYSIS

Statistical analyses were conducted with the use of R software, version 2.1.1 (R Foundation for Statistical Computing). All statistical tests were two-sided, with a significance level of 0.05.

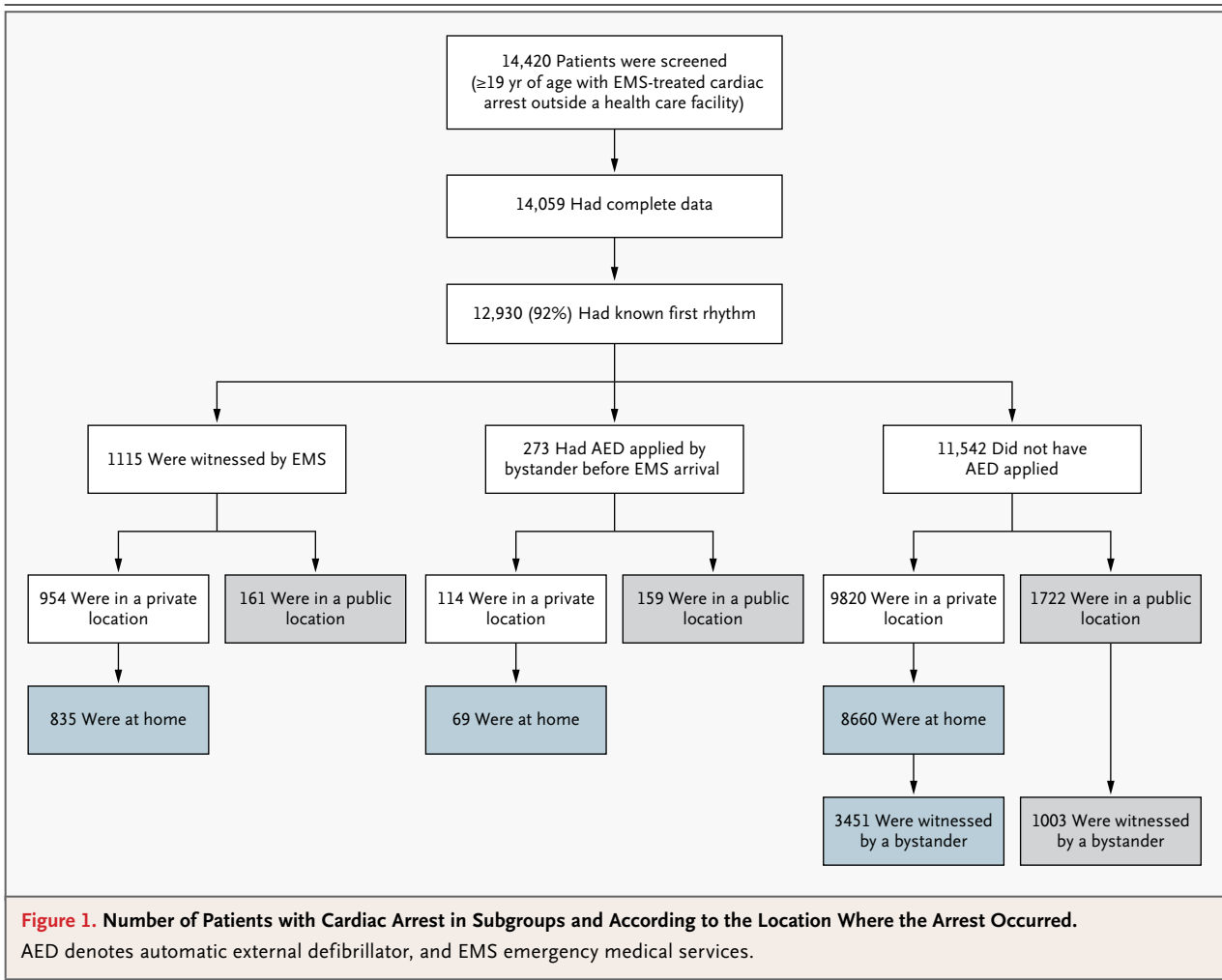The frequencies of ventricular fibrillation or pulseless ventricular tachycardia and of survival to hospital discharge were calculated as simple proportions. Multiple logistic-regression analyses were used to assess the independent association between location and initially recorded ventricular fibrillation or pulseless ventricular tachycardia or survival to hospital discharge after adjustment for age, sex, bystander-witnessed cardiac arrest, the delivery of bystander-initiated cardiopulmonary resuscitation (CPR), and EMS response time from the 911 call until the arrival of the EMS vehicle, as appropriate.

RESULTS

STUDY POPULATION

Between December 2005 and April 2007, a total of 14,420 adult patients were treated by EMS personnel for a cardiac arrest occurring outside a health care facility (Fig. 1); complete data were available for 14,059 of these patients. The initial cardiac-arrest rhythm was known or was deemed shockable (i.e., ventricular fibrillation or pulseless ventricular tachycardia) as indicated by receipt of a bystander-administered AED shock in 12,930 patients (92%). Of this group, 5034 patients (39%) had cardiac arrests that were witnessed by a bystander in a home or public location, 273 (2%) had an AED applied by a bystander before the arrival of EMS personnel, and 1115 (9%) had arrests that were witnessed by EMS personnel.

Table 1 shows the key demographic characteristics and resuscitation status of the patients, including the frequency of ventricular fibrillation or pulseless ventricular tachycardia as the initial recorded rhythm and of survival, according to the location of the arrest. When cardiac arrest occurred in a nonpublic location, it was further characterized as taking place at home, in a residential facility (e.g., nursing home), or in some other private (nonhome) setting. Of 1324 patients in whom the cardiac arrest occurred in a residential institution or other private (nonhome) location, only 41 (3%) survived. This group was excluded from further analysis, so that the principal focus of our study was a comparison of cardiac arrests that occurred in public locations with those that occurred at home. For cardiac arrests that were witnessed by bystanders in public locations, the median time from the 911 call to the arrival of the EMS vehicle at the scene was 5.0 minutes (interquartile range, 3.8 to 6.6);

Figure 1. Number of Patients with Cardiac Arrest in Subgroups and According to the Location Where the Arrest Occurred.
AED denotes automatic external defibrillator, and EMS emergency medical services.

for bystander-witnessed arrests in the home, the median time was 5.6 minutes (interquartile range, 4.3 to 7.1).

INITIAL RHYTHM

The initial ascertainable rhythm was ventricular fibrillation or pulseless ventricular tachycardia (and, in rare cases, a hypotensive supraventricular tachycardia) in 3336 of the 12,930 arrests, for an overall frequency of 26% (Table 1). Of the 3451 patients with bystander-witnessed cardiac arrest that occurred in the home, 1193 (35%) had initial ventricular fibrillation or pulseless ventricular tachycardia on the arrival of EMS personnel, as compared with 600 of 1003 patients (60%) in whom cardiac arrest occurred in a public location (Table 2 and Fig. 2). The multivariable odds ratio for initial ventricular fibrillation or pulseless ventricular tachycardia after a

bystander-witnessed arrest in a public location versus an arrest at home (adjusted for age, sex, bystander-administered CPR, and time from the 911 call to the arrival of EMS personnel at the scene) was 2.28 (95% CI, 1.96 to 2.66; P<0.001) (Table 3).

An AED was applied by a bystander before EMS arrival in 69 patients with cardiac arrests that occurred at home (Table 2 and Fig. 1). Of these patients, 25 (36%) had an initial shockable rhythm, as compared with 125 of 159 patients (79%) in whom an AED was applied by a bystander in a public location. The multivariate odds ratio for shockable rhythm in public versus at home (adjusted for sex, age, bystander-witnessed arrest, bystander-administered CPR, and time from the 911 call to EMS arrival) was 4.48 (95% CI, 2.23 to 8.97; P<0.001) (Table 3). Among the 835 cardiac arrests in the home that were witnessed by

Table 1. Demographic Characteristics, Resuscitation Status, and Outcomes for Patients with Cardiac Arrest, According to the Location of the Arrest.*

Variable	Total Arrests (N=12,930)	Arrests in Private Location		Arrests in Public Location (N=2042)
		Home (N=9564)	Residential or Other Private Facility (N=1324)	
Mean age — yr	66.3±16.8	66.3±16.6	75.5±14.9	60.2±15.7
Male sex — no. (%)†	8227 (64)	5946 (62)	617 (47)	1664 (81)
Bystander witnessed arrest — no. (%)‡	5034 (39)	3485 (36)	424 (32)	1125 (55)
Bystander performed CPR — no. (%)§	4077 (32)	2463 (26)	689 (52)	925 (45)
Bystander applied AED — no. (%)¶	273 (2)	69 (1)	45 (3)	159 (8)
Bystander delivered AED shock — no. (%)	163 (1)	25 (<1)	14 (1)	124 (6)
EMS witnessed arrest — no. (%)	1115 (9)	835 (9)	119 (9)	161 (8)
Initial VF or pulseless VT — no. (%)‖	3336 (26)	2134 (22)	167 (13)	1035 (51)
Survival to hospital discharge — no. (%)	946 (7)	549 (6)	41 (3)	356 (17)

* Plus–minus values are means ±SD. AED denotes automated external defibrillator, CPR cardiopulmonary resuscitation, EMS emergency medical services, VF ventricular fibrillation, and VT ventricular tachycardia.
† Data were missing in 0.1% of cases.
‡ Data were missing and the arrest was presumed not to have been witnessed in 15.8% of cases.
§ Data were missing and CPR was presumed not to have been given in 8.5% of cases.
¶ Data were missing and the AED was presumed not to have been applied in 8.5% of cases.
‖ The initial cardiac-arrest rhythm (as determined by EMS personnel) was not known in 8% of cases, and these patients were therefore excluded from the analysis.

EMS personnel, the initial rhythm was ventricular fibrillation or pulseless ventricular tachycardia in 207 cases (25%), as compared with 61 of 161 EMS-witnessed cardiac arrests (38%) that occurred in a public location (Table 2 and Fig. 2). For EMS-witnessed cardiac arrests, the odds ratio for initial ventricular fibrillation or pulseless ventricular tachycardia in public versus at home (adjusted for age and sex) was 1.63 (95% CI, 1.13 to 2.35; P=0.009) (Table 3).

SURVIVAL TO HOSPITAL DISCHARGE

Survival outcomes are shown in Tables 1 and 2. Overall survival among the 12,930 patients whose initial cardiac-arrest rhythm was known was 7%. Survival rates after a cardiac arrest at home were 2% among the 5209 patients whose arrests were not witnessed by a bystander or EMS personnel or who did not have an AED applied by a bystander, 8% among the 3451 patients whose arrests were witnessed by a bystander, and 10% among the 1219 patients who were then given CPR by a bystander.

Among patients who had a cardiac arrest at home before the arrival of EMS personnel and for whom an AED was not applied by a bystander, the likelihood of survival to discharge was significantly increased if the arrest was witnessed by a bystander (odds ratio, 3.76; 95% CI, 3.01 to 4.70; P=0.004) and if the bystander administered CPR (odds ratio, 1.37; 95% CI, 1.10 to 1.70; P=0.004).

The survival rate among 1003 patients with bystander-witnessed cardiac arrests that occurred in a public setting was 20%; in 159 instances in which an AED was applied by a bystander, the survival rate was 34%, and in 124 instances in which an AED shock was administered by a bystander, the rate was 42%. The adjusted odds ratio for survival when an AED was applied by a bystander after a cardiac arrest in a public location versus an arrest at home was 2.49 (95% CI, 1.03 to 5.99; P=0.04). Among those who received a shock from an AED applied by a bystander, survival rates did not differ significantly according to the place where the cardiac arrest occurred (odds ratio for survival after an arrest in a public location vs. an arrest at home, 1.68; 95% CI, 0.58 to 4.88; P=0.34).

Table 2. Demographic Characteristics, Resuscitation Status, and Outcomes of Patients with Cardiac Arrest at Home or in Public, According to Circumstances of the Event.*

Variable	Bystander Witnessed Cardiac Arrest		EMS Witnessed Cardiac Arrest		Bystander Applied AED	
	Home (N=3451)	Public (N=1003)	Home (N=835)	Public (N=161)	Home (N=69)†	Public (N=159)‡
Mean age — yr	67.8±15.5	61.7±15.7	67.7±15.7	59.6±17.6	61.8±16.5	60.0±14.2
Male sex — no. (%)	2257 (65)	805 (80)	491 (59)	112 (70)	43 (62)	138 (87)
Bystander carried out CPR — no. (%)	1219 (35)	555 (55)	9 (1)	0	61 (88)	150 (94)
Bystander delivered AED shock — no. (%)	—	—	—	—	25 (36)	124 (78)
Initial VF or pulseless VT — no. (%)	1193 (35)	600 (60)	207 (25)	61 (38)	25 (36)	125 (79)
Time from 911 call to EMS arrival — min						
Median	5.6	5.0				
Interquartile range	4.3–7.1	3.8–6.6				
Survival to hospital discharge — no. (%)	276 (8)	202 (20)	138 (17)	44 (27)	8 (12)	54 (34)

* Plus–minus values are means ±SD. AED denotes automated external defibrillator, CPR cardiopulmonary resuscitation, EMS emergency medical services, VF ventricular fibrillation, and VT ventricular tachycardia.
† Of the 69 arrests that occurred at home, 34 (49%) were witnessed by a bystander.
‡ Of the 159 arrests that occurred in public, 122 (77%) were witnessed by a bystander.

DISCUSSION

This study shows that shockable arrhythmias (ventricular fibrillation or pulseless ventricular tachycardia) are a relatively infrequent presentation of out-of-hospital cardiac arrest (with an overall incidence of 26%) and account for a remarkably low proportion of both EMS-witnessed arrests (25%) and bystander-witnessed arrests (35%) in the home. The frequency of shockable arrhythmias was higher for bystander-witnessed cardiac arrests in a public location (60%), particularly those in which an AED was applied by a bystander in a public location (79%) (Fig. 2). Therefore, as might be expected, the rate of survival to hospital discharge was significantly higher when an AED was applied by a bystander after a cardiac arrest in a public location (34%, vs. 12% for arrests at home; adjusted model P=0.04).

The limitations of this study should be acknowledged before we consider its implications and possible explanations for the findings. First, we did not have access to the ECG recordings from bystander-applied AED and cannot confirm independently that all shocked rhythms were ventricular fibrillation or pulseless ventricular tachycardia. However, AED rhythm-detection algorithms are considered to be highly sensitive and specific for a shockable arrhythmia, since a shock advisory is strongly correlated with its presence and a no-shock advisory with its absence.[10,11]

Second, it is possible that delays in calling for EMS help were responsible for the low frequency of ventricular fibrillation or pulseless ventricular tachycardia as the initial rhythm among cardiac arrests at home, including those witnessed by a bystander and those for which a bystander applied an AED. Ascertaining the delay between the time of the witnessed collapse and the call to EMS can be challenging in both the public setting and the home setting, since one must rely on accurate recollections by witnesses. Nevertheless, it is unlikely that such a delay would be greater today than it was in an earlier era, when ventricular fibrillation or pulseless ventricular tachycardia was the initial rhythm in 70% of all cardiac arrests.[1,2]
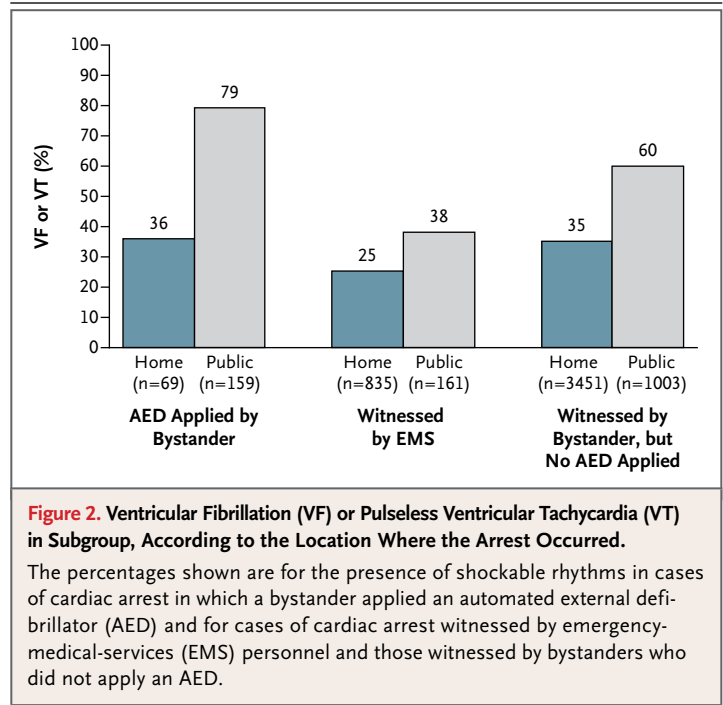
With respect to EMS delays, although the median time from the 911 call to EMS arrival was modestly longer for bystander-witnessed cardiac arrests at home than for those in public

(Table 2), the EMS response times were less than 7 minutes for more than 75% of the patients in both locations.

A spline-fit analysis (data not shown) relating the incidence of initial ventricular fibrillation or pulseless ventricular tachycardia to EMS response time in the case of bystander-witnessed cardiac arrests in public indicated that the frequency of this arrhythmia diminished from 60% to no less than 50% as the EMS response time increased from zero to 7 minutes. Therefore, it does not seem likely that the much lower frequency of ventricular fibrillation or pulseless ventricular tachycardia observed after cardiac arrest in the home would be accounted for by differences in EMS response time or other delays in the case of home-witnessed arrests. EMS response time was also not significantly related to the incidence of initial ventricular fibrillation or pulseless ventricular tachycardia in the multivariate analysis (Table 3). Furthermore, the frequency of these arrhythmias was similar (25%) for cardiac arrests in the home that were witnessed by EMS personnel, and in such cases, one would expect that the first rhythm was documented promptly after the event.

Survival data reported for the population groups in this study are consistent with previous reports on successful bystander-applied AED shocks and witnessed cardiac arrests in both public and nonpublic locations.[12-14] Among the patients in our study who received AED shocks from bystanders in public locations, the survival rate was 42%. This compares favorably with results from a study of cardiac arrests in casinos in which the approximate survival rate was 53% among patients who received AED shocks after the arrests were promptly recognized by means of video cameras on the gaming floor.[12] Similarly, in a study of cardiac arrests that occurred in Chicago airports, the survival rate was 60% among patients who received AED shocks delivered by bystanders.[14]

Studies in Osaka, Japan,[15] and in Copenhagen[16] came to similar conclusions regarding the incidence of ventricular fibrillation or pulseless ventricular tachycardia in public or workplace settings versus nonpublic ones. However, these studies did not specifically address arrests involving bystander-applied AEDs, nor did they exclude unwitnessed cardiac arrests, for which the interval between the arrest and the initial ECG is likely to be prolonged.

Figure 2. Ventricular Fibrillation (VF) or Pulseless Ventricular Tachycardia (VT) in Subgroup, According to the Location Where the Arrest Occurred.

The percentages shown are for the presence of shockable rhythms in cases of cardiac arrest in which a bystander applied an automated external defibrillator (AED) and for cases of cardiac arrest witnessed by emergency-medical-services (EMS) personnel and those witnessed by bystanders who did not apply an AED.

The results of this study have a number of important implications for public health and community strategies to improve survival after cardiac arrest. First, because only 20 to 30% of cardiac arrests in the United States and Canada occur in public settings, our findings suggest that AED programs and education in AED use by lay responders should be focused on these sites.[17,18]

Second, our findings suggest that the incremental benefit in survival from the use of AEDs in the home, as compared with a strategy that increases the frequency and quality of CPR by bystanders in the home, is likely to be small. The rate of survival after cardiac arrest in the home for the 1219 cases in which a bystander witnessed the event and performed CPR was 10%, which is similar to the 12% survival rate associated with use of a bystander-applied AED in the home. Increasing the rate of CPR by bystanders in the home, perhaps with dispatch assistance, might yield a benefit similar to that achieved with the use of home AEDs.[19-21]

Another strategy to improve survival is initial continuous chest compression without rescue breathing, which may also be more effective in cardiac arrest with ventricular fibrillation or pulseless ventricular tachycardia than in arrest with other initial rhythms. In experimental stud-

Table 3. Odds Ratios for Initial Ventricular Fibrillation or Pulseless Ventricular Tachycardia (or Shockable Rhythm) in Cardiac Arrests Occurring in Public versus Arrests at Home, According to Circumstances of the Event.*

Variable	Bystander Witnessed Arrest			EMS Witnessed Arrest			Bystander Applied AED		
	VF or VT no./total no. of arrests (%)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	VF or VT no./total no. of arrests (%)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	VF or VT no./total no. of arrests (%)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Location of arrest									
Home	1193/3451 (35)			207/835 (25)			25/69 (36)		
Public	600/1003 (60)	2.82 (2.44–3.26)	2.28 (1.96–2.66)†	61/161 (38)	1.85 (1.30–2.64)	1.63 (1.13–2.35)‡	125/159 (79)	6.47 (3.48–12.03)	4.48 (2.23–8.97)†
Male sex		2.15 (1.87–2.46)	1.88 (1.63–2.17)†		1.95 (1.44–2.64)	1.83 (1.34–2.48)†		3.07 (1.59–5.94)	2.08 (0.94–4.58)
Age (per 5-yr increase)		0.92 (0.90–0.93)	0.94 (0.92–0.96)†		0.93 (0.90–0.98)	0.99 (0.98–1.00)		1.00 (0.91–1.10)	1.02 (0.91–1.13)
Bystander witnessed arrest								4.67 (2.56–8.49)	3.50 (1.76–6.97)†
Bystander performed CPR		1.98 (1.75–2.24)	1.76 (1.55–2.01)†					1.96 (1.79–2.15)	2.09 (0.64–6.84)
Time from 911 call to EMS arrival		1.00 (1.00–1.00)	1.00 (1.00–1.00)					1.00 (0.99–1.02)	1.00 (0.98–1.03)

* AED denotes automated external defibrillator, CPR cardiopulmonary resuscitation, EMS emergency medical services, VF ventricular fibrillation, and VT pulseless ventricular tachycardia.
† P<0.001.
‡ P=0.009.

ies that propose continuous compression, ventricular fibrillation or pulseless ventricular tachycardia models of cardiac arrest are used.[22] Two recently published studies in humans showed no significant difference in survival between patients who were randomly assigned, on the basis of dispatchers' instructions to bystanders, to receive continuous compression without rescue breathing and those assigned to receive standard CPR with rescue breathing.[20,21] In one of the two studies, continuous compression without rescue breathing was associated with increased survival among patients with arrests due to cardiac causes[20]; in the other study, there was a trend toward increased survival with continuous compression and no rescue breathing among patients with arrests characterized by ventricular fibrillation or pulseless ventricular tachycardia.[21] If arrests characterized by ventricular fibrillation or pulseless ventricular tachycardia have better outcomes with continuous compression alone, this could be the more effective resuscitation strategy in the public setting, whereas rescue breathing along with compression might be of greater importance in the home, where the frequency of ventricular fibrillation or pulseless ventricular tachycardia is lower.[23]

Why is the initial recorded cardiac-arrest rhythm different when cardiac arrest occurs in a public location rather than in the home? One explanation is that the person who has a cardiac arrest in the home is typically older and more likely to have one or more chronic diseases that limit or preclude participation in activities outside the home. Thus, the location of an out-of-hospital cardiac arrest may be a surrogate variable for underlying disease or disease severity and the corresponding risk of ventricular fibrillation or pulseless ventricular tachycardia. For example, treatment with an implanted defibrillator is known to have a smaller effect on survival among patients with more severe heart failure than among those with less severe heart failure, suggesting that the incidence of shockable arrhythmias (ventricular fibrillation or pulseless ventricular tachycardia) differs between these two groups.[24]

In conclusion, our study shows that the frequency of ventricular fibrillation or pulseless ventricular tachycardia as the initial recorded rhythm is lower among patients with witnessed cardiac arrests in the home than among those

with witnessed arrests in a public setting. This finding adds strength to the argument for putting AEDs in public locations. Although the role of AEDs in cardiac arrests that occur in the home will probably continue to evolve, the relatively low incidence of shockable arrhythmias in this setting suggests that a treatment strategy that emphasizes prompt, bystander-delivered CPR of high quality (e.g., with the assistance of a dispatcher) should be as effective in saving lives as the widespread deployment of AEDs in homes.

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