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Effectiveness and Cost-Effectiveness of Automated External Defibrillators in Private Homes
A Report From the Cardiac Arrest Registry to Enhance Survival

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Invited Commentary

Supplemental content

IMPORTANCE Automated external defibrillators (AEDs) have the potential to save lives when used during cardiac arrest. While most cardiac arrests occur at home, there is limited evidence for AED use in private homes.

OBJECTIVE To determine whether AEDs in private homes are effective and cost-effective.

DESIGN, SETTING, AND PARTICIPANTS This cohort study used observational data from the Cardiac Arrest Registry to Enhance Survival in the US from January 2017 to December 2024 to determine the effectiveness of AEDs when used for cardiac arrests in private homes. A difference-in-difference approach was used to determine the causal relationship between AED application and survival to hospital discharge. A decision-analytic model was then created to evaluate the cost-effectiveness of purchasing an AED in a private home in the US.

EXPOSURE Application of an AED.

MAIN OUTCOMES AND MEASURES Survival to hospital discharge and cost-effectiveness.

RESULTS Of 582 536 included patients, 359 809 (61.8%) were male, and the median (IQR) age was 65 (52-76) years. Survival was better with AED application compared with no AED application in patients with a shockable rhythm (risk ratio, 1.26; 95% CI, 1.01-1.57) but not in those with a nonshockable rhythm (risk ratio, 1.00; 95% CI, 0.68-1.46). Results were consistent in the difference-in-difference analysis. The incremental cost-effectiveness ratio for an AED in a private home was $4 481 659 per quality-adjusted life-year. At a cost-effectiveness threshold of $200 000 per quality-adjusted life-year, AEDs in private homes would be considered cost-effective at a yearly cardiac arrest incidence per person above 1.3% or at an AED cost less than $65 (not including bystander training cost).

CONCLUSIONS AND RELEVANCE In this study, AEDs in private homes were effective at improving outcomes for patients with cardiac arrest and a shockable rhythm. Given the relative rarity of cardiac arrest at a given home, general purchase of AEDs for individual private homes cannot be considered cost-effective at the current pricing of AEDs.

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Key Points

Question Are automated external defibrillations (AEDs) in private homes effective and cost-effective?

Findings In this cohort study including 582 536 patients, survival was better with AED application compared with no AED application in patients with a shockable rhythm but not in those with a nonshockable rhythm. AEDs were not cost-effective.

Meaning AEDs in private homes are effective at improving outcomes for patients with cardiac arrest, but the indiscriminate purchase of AEDs for private homes is not cost-effective at the current pricing of AEDs.

Out-of-hospital cardiac arrest occurs more than 300 000 times each year in the US.[1] Outcomes are poor, especially for the approximately 70% of all cardiac arrests that occur in private homes.[1,2] Less than 10% survive to hospital discharge.[3,4]

Bystander interventions, including cardiopulmonary resuscitation (CPR) and the use of automated external defibrillators (AEDs), are increasingly performed. The use of AEDs has primarily been studied in the setting of cardiac arrests in public locations. A study using data from the Cardiac Arrest Registry to Enhance Survival (CARES) found that application of an AED is associated with improved outcomes in patients with out-of-hospital cardiac arrest with a shockable rhythm (ie, an initial rhythm of ventricular fibrillation or pulseless ventricular tachycardia) in a public location.[5] A subsequent cost-effectiveness analysis found that AEDs were cost-effective under many circumstances in public settings with a relatively high incidence of cardiac arrest.[6] There has been less focus on the large group of patients with cardiac arrest in a private home, and a previous randomized trial was inconclusive.[7] This group of patients has worse outcomes, are less likely to have a shockable rhythm, less likely to receive bystander CPR, and the response time from emergency medical services (EMS) is often longer compared with patients with cardiac arrest in a public location.[3,4] Furthermore, the cardiac arrest incidence is much lower in private locations compared with many public locations. Although the purchase of AEDs for private homes is increasingly being discussed in the media[8] and considered by many individuals, AEDs remain relatively expensive, and their effectiveness and cost-effectiveness in the private home setting remain unclear.

The objective of this study was to determine the effectiveness of AEDs to improve outcomes for patients with cardiac arrest at home and subsequently to determine whether placement of AEDs in individual private homes can be considered cost-effective. We further aimed to explore under which conditions purchase of an AED for a private home would be considered cost-effective.

Methods

Effectiveness of AEDs

Overview

To determine the effectiveness of AEDs for cardiac arrests in private homes, we conducted an observational study using data from CARES. Using a difference-in-difference approach, the causal effect of AED application was estimated in patients with cardiac arrest and an initial shockable rhythm. CARES was considered exempt from review by the Emory University Institutional Review Board. As CARES is a quality improvement registry, informed consent was not needed.

Data Source

CARES is an out-of-hospital cardiac arrest registry in the US currently covering approximately 186 million people. CARES prospectively includes all nontraumatic out-of-hospital cardiac arrests where resuscitation is attempted by a 911 responder. The registry also includes patients who received an AED shock from a bystander prior to the arrival of 911 responders. CARES data are geocoded to a US Census tract based on the address of the cardiac arrest. Census-level variables are then obtained from the American Community Survey. Additional details about the registry, including participating sites, data definitions, data registration, and data validity, have been provided in previous publications[9,10] and online.[11,12] We included data from January 1, 2017, to December 31, 2024.

Patient Population

We included patients 1 year and older with a nontraumatic out-of-hospital cardiac arrest in a private home. This did not include cardiac arrests in nursing homes or cardiac arrests witnessed by 911 responders.

Exposure and Other Variables

The exposure was the application of an AED (ie, attaching the AED to the person with cardiac arrest) by a bystander prior to the arrival of EMS. Patients were stratified according to the initial rhythm into shockable (ventricular fibrillation, ventricular tachycardia, and unknown shockable rhythm) and nonshockable (asystole, pulseless electrical activity, and unknown unshockable rhythm). Race and ethnicity were determined by EMS professionals and included in the current study, as race has been associated with both AED use and outcomes.[5]

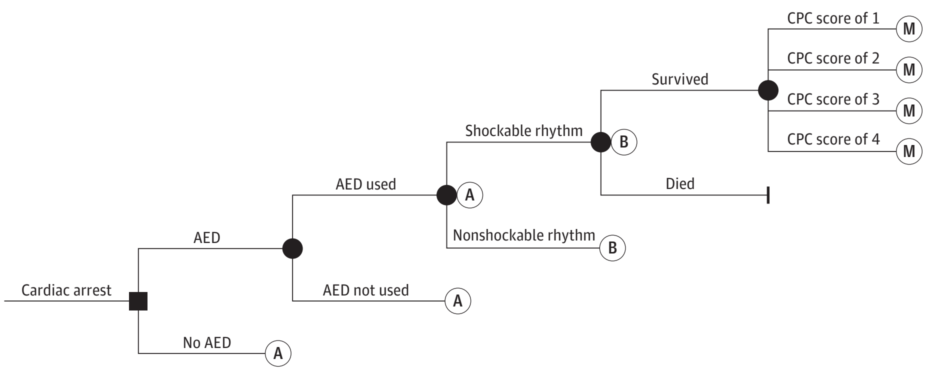
Outcomes

The primary outcome was survival to hospital discharge. Secondary outcomes included return of spontaneous circulation, admission to hospital, and favorable neurological outcome at hospital discharge. Favorable neurological outcome was defined as survival with a Cerebral Performance Category (CPC) score of 1 (mild or no neurological/functional deficit) or 2 (moderate cerebral disability but sufficient cerebral function for independent activities of daily life). The CPC score is determined by data abstractors reviewing the medical record.

Statistical Analysis

The statistical analysis plan, which includes detailed description of the statistical approach and the underlying assumptions, was published online prior to receipt of data.[13] Differences between the statistical analysis plan and the statistical approach used are described in eMethods 1 in Supplement 2.

Figure 1. Simplified Conceptual Overview of the Decision Model



The letters A and B represent clones of the tree structure. M signifies a Markov model. In the Markov model, individuals can either stay within the same Cerebral Performance Category (CPC) category or transition to death (not shown in figure for simplicity). A CPC score of 1 represents good cerebral performance; 2, moderate cerebral disability; 3, severe cerebral disability; and 4, coma or a vegetative state. Shockable and nonshockable refers to the initial rhythm of the cardiac arrest. AED indicates automated external defibrillator.

Multivariable generalized linear models were used to obtain risk ratios. All models were adjusted for sex, age, race and ethnicity, day of the week, time of year, year, witnessed status, presumed etiology, and who initiated CPR. The effect of AED application in those with a shockable rhythm was then estimated using a difference-in-difference approach by including an interaction term between AED application and the initial rhythm in the model. This approach leverages the assumption that AED application has no causal effect on outcomes in patients with an initial nonshockable rhythm, since no shock is given by an AED when it detects a nonshockable rhythm. Any residual association between AED application and outcomes in this group is assumed to be due to bias (ie, confounding). By using a difference-in-difference approach, this potential bias, which we assume is similar for those with a shockable and nonshockable rhythm, can then be removed from the analysis related to those with a shockable rhythm where a shock is given. The remaining association is assumed to reflect a causal effect of AED application on outcomes.

Potential clustering at the EMS agency level was accounted for, and missing data were imputed using multiple imputation. Predefined sensitivity and subgroup analyses were performed as described in the statistical analysis plan (Supplement 1).

Since our primary goal for this analysis was estimation and not null-hypothesis significance testing, *P* values are not reported. All confidence intervals have 95% coverage and were not adjusted for multiplicity. Analyses were conducted in SAS version 9.4 (SAS Institute). The statistical code is provided in the eAppendix in Supplement 2.

Cost-Effectiveness of AEDs

Overview

We developed a decision-analytic Markov model to evaluate the cost-effectiveness of having an AED in an individual private home compared with not having an AED in the US (eMethods 2 in Supplement 2). The analysis was conducted from a societal perspective and accounted for lifetime costs and health outcomes measured in quality-adjusted life-years (QALYs).[14] A secondary analysis was conducted from a health care payer perspective excluding the cost of the AED and bystander training. The cost-effectiveness analysis followed the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) reporting guideline.[15]

Costs are presented in 2024 US dollars. Costs and effects were discounted at a rate of 3% per year. Results are presented as incremental costs per QALY gained. A willingness-to-pay threshold of $200 000 per QALY gained was selected to signify the amount below which the strategy would be considered cost-effective.

A predefined analysis plan for the cost-effectiveness model was not published. There was no patient or public involvement. Analyses were performed in RStudio version 4.4.1 (Posit). The R code is provided in a GitHub repository.[16,17]

Model

The model structure was similar to our previously published model of AED use for public cardiac arrest.[6] The model combined a decision tree of initial treatment and a Markov model for postdischarge survival according to functional status at hospital discharge (**Figure 1**). The Markov model had a 1-year cycle length, with half-cycle corrections, and used a life-time horizon that was defined as a termination after 50 years.

Outcomes until hospital discharge were stratified according to the initial cardiac rhythm (shockable vs nonshockable) and AED use (used vs not used). Long-term outcomes after hospital discharge were stratified according to functional status at hospital discharge based on the CPC score.

Model Inputs

The model was populated with the results from our observational study and the remaining input parameters were informed by the best available evidence identified through new reviews and updates of previously published systematic reviews.[6,18] Key model inputs are provided in **Table 1**,[19] with additional parameters provided in eTable 1 in Supplement 2. Details including rationale for the estimates used can be found in eTables 1 to 12 and eFigures 1 and 2 in Supplement 2.

Additional Analyses

We performed a probabilistic analysis to understand the impact of multivariable parameter uncertainty on the model outcomes. We also conducted a series of 1-way sensitivity and scenario analyses to explore the robustness of our findings and

Table 1. Key Parameters for the Cost-Effectiveness Model[a]

Parameter	Value	Source
Yearly incidence of cardiac arrest per person in a private home	0.05%	CARES registry
Mean household size	2.5 Persons	US Census Bureau
Proportion with a shockable rhythm without AED use	16%	CARES registry
Effect of AED use on having an initial shockable rhythm	Risk ratio, 1.12	CARES registry
Survival to hospital discharge for cardiac arrests with shockable rhythms with no AED use	22%	CARES registry
Effect of AED use on survival to hospital discharge for cardiac arrests with shockable rhythms	Risk ratio, 1.26	CARES registry
Yearly AED cost[b]	$223	Listed cost of cheapest AED
Health-related quality of life after hospital discharge[c]	CPC score of 1, 0.77; CPC score of 2, 0.49; CPC score of 3, 0.32; CPC score of 4, 0	Stiell et al[19]

Abbreviations: AED, automated external defibrillator; CARES, Cardiac Arrest Registry to Enhance Survival; CPC, Cerebral Performance Category.

[a] Additional parameters are provided in eTable 1 in Supplement 2. Details related to all the model parameters are provided in eMethods 2 in Supplement 2.

[b] Yearly depreciated cost including the initial cost of the device and maintenance. The annual cost of $223 corresponds to an AED costing approximately $1620 and lasting for 8 years with no need for maintenance.

[c] Expressed as a utility ranging from 0 to 1, with 1 indicating perfect health-related quality of life.

to guide decision-making in various settings. In addition, a value of information analysis was performed. Additional details are provided in eMethods 2 in Supplement 2.

Results

AED Effectiveness

From the observational data, we included 582 536 patients with an out-of-hospital cardiac arrest in a private home. A total of 222 689 (38.2%) were female, 359 809 (61.8%) were male, and the median (IQR) age was 65 (52-76) years. A total of 15 672 (2.7%) were Asian, 123 046 (21.1%) were Black, 47 663 (8.2%) were Hispanic, 294 441 (50.5%) were White, 6515 (1.1%) were another race (including American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and multiracial), and 95 199 (16.3%) had missing data on race and ethnicity. An initial shockable rhythm was observed in 93 878 of 582 536 patients (16.1%). Descriptive data on patient, cardiac arrest, and Census characteristics are provided in eTable 13 in Supplement 2. Missing data were rare (less than 1%) except for race (95 199 [16.3%]), EMS response time (97 069 [16.7%]), medical history (131 983 [22.7%]), and Census variables (eTable 14 in Supplement 2).

An AED was applied in 777 patients (0.1%) (**Table 2**). Survival to hospital discharge was better with AED application compared with no AED application in patients with a shockable rhythm (risk ratio, 1.26; 95% CI, 1.01-1.57) but not in those with a nonshockable rhythm (risk ratio, 1.00; 95% CI, 0.68-1.46). In the adjusted difference-in-difference analysis, AED application was associated with an improvement in survival at hospital discharge (risk ratio, 1.26; 95% CI, 0.82-1.95; risk difference, 6.5%; 95% CI, −0.2% to 13%). Other outcomes are reported in Table 2. Results from additional analyses were generally consistent with the primary results and are reported in eTable 15 in Supplement 2. In patients with a shockable rhythm, results related to treatment effect heterogeneity according to sex, age, and EMS response time are presented in eTable 16 in Supplement 2.

AED Cost-Effectiveness

Main Results

In the base case analysis, having a cardiac arrest without a private AED resulted in 0.48 QALYs at a cost of $23 682. The presence of a private AED yielded an additional 0.04 QALYs for an increase in cost of $197 193. The incremental cost-effectiveness ratio was $4 481 659 per QALY gained. From a health care perspective, the incremental cost-effectiveness ratio was $37 705.

Model-derived survival at hospital discharge, 1 year, and 5 years were 7.2%, 5.4%, and 5.2%, respectively, for the no AED group, while survival probabilities were 7.9%, 6.0%, and 5.7% for the AED group (eFigure 3 in Supplement 2). The mean length of survival in the no AED group was 0.76 years, while it was 0.83 years in the AED group.

Sensitivity Analyses

When accounting for parameter uncertainty in the probabilistic analysis, having an AED was not cost-effective at a willingness-to-pay threshold of $200 000 per QALY gained (eFigures 4 and 5 in Supplement 2). The results of the expected value of perfect information analysis are presented in eFigure 6 in Supplement 2.

The relationship between cardiac arrest incidence and the incremental cost-effectiveness ratio is depicted in **Figure 2**A. At a yearly incidence above 1.3%, having an AED in a private home would be considered cost-effective at a willingness-to-pay threshold of $200 000. Figure 2B illustrates the relationship between the annual AED cost and the incremental cost-effectiveness ratio. The annual AED cost would have to be below approximately $9 to be considered cost-effective when not including cost of bystander training corresponding to an AED cost of $65 for an AED that works for 8 years with no need for maintenance

Sensitivity analyses related to other model parameters are provided in eFigures 7 to 17 in Supplement 2. **Table 3** provides 3 hypothetical scenarios where purchase of an AED could be considered cost-effective.

Discussion

Use of an AED for cardiac arrest in a private home improves outcomes for patients presenting with a shockable rhythm. Since cardiac arrests at home are common at a population level, the use of AEDs in private homes has an unrealized potential to save thousands of lives each year. Given the relative rarity of cardiac arrest at a given home and the current costs of AEDs,

Table 2. Automated External Defibrillator (AED) Application and Outcomes[a]

Outcome	Individuals, No./total No. (%)		Risk ratio (95% CI)
	AED used	No AED used	
Survival to hospital discharge			
Shockable rhythms	45/159 (28.3)	20 294/93 531 (21.7)	1.26 (1.01-1.57)
Nonshockable rhythms	29/618 (4.7)	21 496/487 303 (4.4)	1.00 (0.68-1.46)
Difference-in-difference analysis	NA	NA	1.26 (0.82-1.95)
Return of spontaneous circulation			
Shockable rhythms	74/159 (46.5)	39 412/93 690 (42.1)	1.06 (0.89-1.25)
Nonshockable rhythms	129/615 (21.0)	107 477/487 688 (22.0)	0.92 (0.78-1.08)
Difference-in-difference analysis	NA	NA	1.15 (0.91-1.46)
Admission to hospital			
Shockable rhythms	76/159 (47.8)	38 757/93 545 (41.4)	1.15 (0.98-1.34)
Nonshockable rhythms	94/618 (15.2)	91 851/487 326 (18.9)	0.80 (0.64-0.98)
Difference-in-difference analysis	NA	NA	1.44 (1.11-1.87)
Favorable neurological outcome at hospital discharge			
Shockable rhythms	40/159 (25.2)	17 125/93 478 (18.3)	1.33 (1.05-1.67)
Nonshockable rhythms	22/618 (3.6)	15 016/487 224 (3.1)	1.07 (0.69-1.65)
Difference-in-difference analysis	NA	NA	1.24 (0.77-2.01)

Abbreviation: NA, not applicable.

[a] Unadjusted numbers without imputation are provided for the outcomes according to AED application, whereas the risk ratios are after imputation and adjustment for sex, age, race and ethnicity, day of the week, time of year, year, witnessed status, presumed etiology, and who initiated cardiopulmonary resuscitation.

our cost-effectiveness analysis found that general purchase of AEDs for individual private homes cannot be considered cost-effective at the current pricing of AEDs.

While evidence from randomized clinical trials would be ideal, such trials are not feasible, as they would require randomization of millions of private homes, given the rarity of cardiac arrest at a specific home (eMethods 3 in Supplement 2). A previous clinical trial randomizing 7001 high-risk patients was inconclusive given the low rate of cardiac arrest at home.[7] AED use during cardiac arrest provides a unique opportunity to use observational data to estimate the causal effect of AEDs, as an AED is only useful for those with a shockable rhythm, but an AED is applied irrespective of the underlying rhythm.[5] To determine the effectiveness of AEDs, we used a large US-based registry of out-of-hospital cardiac arrest. Our findings of no association between AED use and survival in those with a nonshockable rhythm indicate no residual or unmeasured confounding and, hence, an unbiased estimate of effect in those with a shockable rhythm. The point estimates suggesting a relative increase in survival of 26% and in favorable neurological outcome of 24% with AED use in those with a shockable rhythm is similar to our previous study examining use of AEDs in public settings.[5] Our results, taken together with the public AED literature,[5,18] provides robust evidence that AEDs are effective for improving outcomes in patients with cardiac arrest with a shockable rhythm.

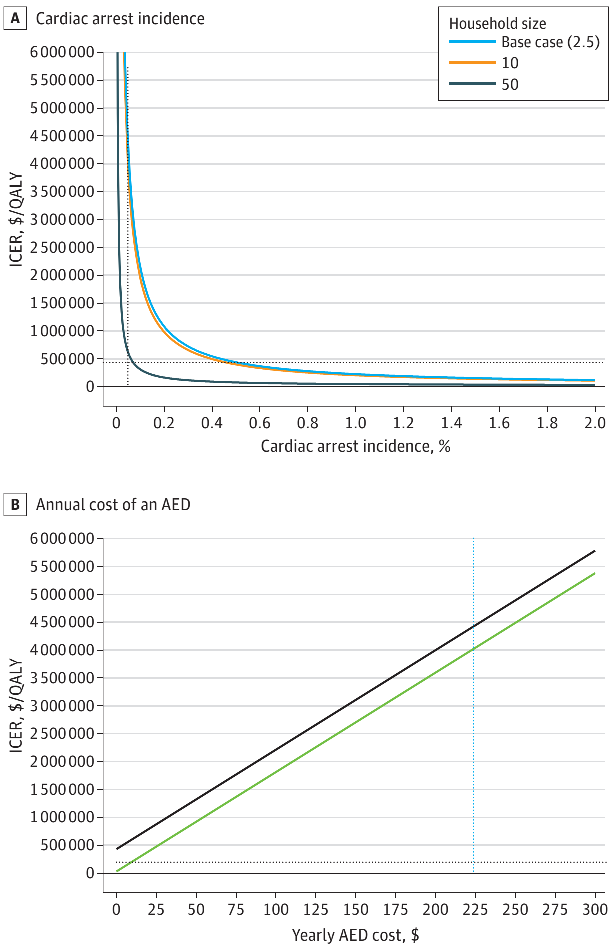
We found that indiscriminate purchase of AEDs for individual private homes would improve overall survival and quality of life but only in the minority of patients with a shockable rhythm and at an incremental cost of approximately $4.5 million per QALY gained. This cost is higher than commonly reported willingness-to-pay thresholds,[20] and the indiscriminate purchase of AEDs for private homes can therefore not be considered cost-effective. This contrasts with our previous cost-effectiveness analysis, which estimated a cost of approximately $62 000 per QALY gained, when an AED is placed in a public location with a relatively high incidence of cardiac arrest.[6]

We explored scenarios where the purchase of AEDs for private homes might be considered cost-effective. AEDs become increasingly cost-effective with higher incidence of cardiac arrest or when more people are likely to benefit from their use. However, identifying a very high-risk patient population (ie, with an annual cardiac arrest incidence at home of 1.3% or greater) might be challenging. There are settings, such as multiple high-risk patients living in near proximity, where purchase of AEDs may be considered cost-effective (Table 3). Making AEDs in individual private homes cost-effective in a broader sense will require a substantial decrease in AED cost. In our model, the cost of an AED would have to be below roughly $65 (when not including bystander training cost) for it to be considered cost-effective. This is much lower than current AED prices, with the cheapest AED currently costing approximately $1620. Evolving technology, and an incentive to produce cheaper AEDs for private homes, could make AEDs more cost-effective.

Limitations

This study has limitations. Our analysis of the effectiveness of AEDs was based on observational data and is contingent on several assumptions. While we believe these assumptions are reasonable, they cannot be definitively proven. Despite using one of the largest registries of cardiac arrest in the world, our sample size was limited, as AEDs are currently rarely used in private homes. Because of this and the use of a difference-in-difference approach, our primary results are imprecise with wide confidence intervals. While the inputs for the cost-effectiveness model were based on comprehensive reviews of the cardiac arrest literature, we were limited by the available data. More accurate and precise estimates of model inputs could further improve the cost-effectiveness model. Of note, only the point estimates of the results and not the uncer-

Figure 2. Relationship Between Cardiac Arrest Incidence and the Annual Cost of an Automated External Defibrillator (AED) and the Incremental Cost-Effectiveness Ratio (ICER)



A, The x-axis represents the yearly incidence of cardiac arrest in a private home for each household member. The base case incidence was 0.05% (vertical dotted line). At a yearly incidence above approximately 1.3%, having an AED in a private home would be considered cost-effective at a willingness-to-pay threshold of $200 000 (horizontal dotted line). At a yearly cardiac arrest incidence of 0.13% or 0.16%, corresponding to people 60 or 70 years or older (eMethods 2 in Supplement 2), the ICER was $1 739 318 and $1 388 705, respectively. Additional curves are presented for hypothetical household sizes of 10 and 50 to illustrate the potential cost-effectiveness of private AEDs when an AED might be shared between multiple individual households. In these scenarios, household size should be interpreted as the total number of people potentially benefiting from the AED. B, The x-axis represents the annual cost of an AED that includes the upfront device cost and subsequent maintenance (eMethods 2 in Supplement 2). The black line represents the base case. The green line represents the base case without the cost of AED training ($9 per person per year). The base case annual cost was $223 (vertical dotted line). At a willingness-to-pay threshold of $200 000 (horizontal dotted line), the annual AED cost would have to be below approximately $9 for AEDs to be cost-effective if cost of bystander training was not included. With bystander training included, AEDs would not be considered cost-effective at any AED cost. QALY indicates quality-adjusted life-year.

Table 3. Various Scenarios Where Purchase of an Automated External Defibrillator (AED) Might Be Considered Cost-Effective

Scenario	Changes to base case model inputs	Incremental cost-effectiveness ratio, $/QALY
Older couple with high risk of cardiac arrest	• Household size, 2 • Incidence of cardiac arrest, 5% • Lower baseline survival if a shockable rhythm (15%) • Higher postdischarge mortality (relative change, 150%)	156 636
Young family of 4 previously well-trained in AED use with a cheaper AED	• Household size, 4 • Incidence of cardiac arrest, 0.05% • Higher baseline survival if a shockable rhythm (30%) • Lower postdischarge mortality (relative change, 50%) • AED used when present, 90% • AED price per year, $20 • Bystander training cost, $0	92 056
Community with increased risk of cardiac arrest and shared AED	• Household size, 100[a] • Incidence of cardiac arrest, 0.16%[b]	205 182

Abbreviation: QALY, quality-adjusted life-year.

[a] Household size can be considered as the number of persons who might have the AED applied and could include members of multiple households if the AED is shared between households as is the case in this scenario.

[b] Corresponding to a cardiac arrest incidence in people 70 years and older.

tainty were considered for our primary cost-effectiveness analysis. However, many of the inputs with uncertain data (eg, long-term outcomes, costs) did not have a major impact on the incremental cost-effectiveness ratio. Furthermore, the probabilistic analysis and expected value of perfect information analysis indicated that parameter uncertainty is unlikely to affect our main conclusions. Our model was based on estimates primarily from the US. The main difference between the US and other high-income countries is health care costs,[21] while cardiac arrest incidence and outcomes are generally similar.[2] Our sensitivity analyses indicated that health care costs did not have a major influence on the incremental cost-effectiveness ratio. The results are therefore likely generalizable to other high-income countries. The generalizability to low- and middle-income countries is uncertain.

Conclusions

In this cohort study, we found that AEDs in private homes are effective at improving outcomes for patients with cardiac arrest with a shockable rhythm. The indiscriminate purchase of AEDs for individual private homes cannot be considered cost-effective at the current pricing of AEDs.

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Author Contributions: Dr Andersen had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Andersen, Holmberg, Krijkamp, Dijk, Caulley.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Andersen, Caulley.
Critical review of the manuscript for important intellectual content: All authors.
Statistical analysis: Andersen, Holmberg, Krijkamp, Caulley.
Administrative, technical, or material support: Andersen, Caulley.

Conflict of Interest Disclosures: Dr Krijkamp reported reimbursement from Aarhus University during the conduct of the study. Dr Kunst reported personal fees from Yale School of Medicine and RJW&Partners outside of the submitted work. Dr Granfeldt reported grants from PAION Pharma GmbH outside the submitted work. Dr Caulley reported grants from University of Ottawa Faculty of Medicine and grants from Aarhus University Research Foundation outside the submitted work. No other disclosures were reported.

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Data Sharing Statement: See Supplement 3.

Additional Contributions: We thank the Cardiac Arrest Registry to Enhance Survival (CARES) data sharing committee for providing access to the data and the sites for their participation in the registry. CARES participating sites can be located at https://mycares.net/sitepages/map.jsp.

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